5725 Highway 290 West,
Suite 200-B
Austin, Texas 78735
(512) 494-0333 • FAX (512) 494-0334

GEOMATRIX

February 24, 2004
Project No. 7168

Ms. Mirtha Capiro
Project Coordinator
U.S. Environmental Protection Agency (USEPA)
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3507

Subject: Addendum 01, Supplemental Facility Investigation (FI) Work Plan (December 2003),
RCRA 3013 Administrative Order
EPA ID No. OHD. 000 724 138
Morton International, Inc. Facility
Reading, Ohio

Dear Ms. Capiro:

On behalf of the Rohm and Haas Co. (Rohm and Haas), Geomatrix Consultants, Inc. (Geomatrix) is submitting this letter to address the U.S. Environmental Protection Agency's (USEPA) conditional approval of the Supplemental FI Work Plan (Geomatrix, December 2003). In the February 6, 2004 letter, one of the conditions of USEPA's approval requested the following:

> *Boreholes for the installation of the proposed monitoring wells UAW26, UAW27 and UAW28 shall be advanced and continuously sampled for lithology to a depth where the lower aquifer is encountered.*

As we discussed on February 12 and 13, Rohm and Haas is reluctant to proceed with drilling in this manner. Given that the Lower Aquifer is known to be contaminated in this area by historical activities at the Pristine Superfund Site, Rohm and Haas has always conducted drilling at the Reading, Ohio facility with a high degree of conservatism. The objective of this conservation has been to avoid any reasonable potential for cross contamination between the Upper and Lower Aquifers. For example, all boreholes advanced to the Lower Aquifer by Rohm and Haas were drilled using sonic methods, which maintain a continuously cased borehole during drilling. All stratigraphic borings advanced to the Lower Aquifer were grouted to the surface after reaching total depth, even when these boreholes could have potentially been used for construction of an Upper Aquifer well at that location.

In summary, Rohm and Haas has expended a significant amount of effort and cost to date to reduce the possibility of cross contamination to or from the Lower Aquifer, and would strongly prefer to stay consistent with this approach in the upcoming drilling. This would mean that the three planned UAW borings would not be drilled to the Lower Aquifer prior to well construction. Based on our discussions, it is Geomatrix's understanding that this position on the issue is acceptable to USEPA, on the condition that Rohm and Haas advance an additional stratigraphic boring to the Lower Aquifer. Rohm and Haas agrees to this approach, and proposes to advance one stratigraphic boring (STR12) in the area that USEPA indicated, as shown on the attached drawings (Revision 01 of Figures 2 and 3). Procedures for the drilling, logging, and grouting of this boring will be consistent with those specified in the Quality Assurance Project Plan (Geomatrix, 2000) and relevant Field Operating Procedures. Because the purpose of this boring is to acquire stratigraphic information, soil samples will not be collected for geochemical or geotechnical analysis.

Please consider this letter to be Addendum 01 to the Supplemental FI Work Plan and substitute these figures for Figure 2 and 3 in that Work Plan.. Geomatrix's understanding is that Rohm and Haas may proceed with the field work with your approval. For your information, we currently anticipate field activities to begin on March 8, and to continue until the end of March or early April.

Mirtha, thank you for working with us on this issue, and feel free to contact me with any questions.

Sincerely,
GEOMATRIX CONSULTANTS, INC.

Mark P. Hemingway, P.G.
Principal Hydrogeologist

Attachments

USEPA (2 additional copies)
cc: Carl Coker, The Rohm and Haas Company
Eric Walker, The Rohm and Haas Company (2 copies)

Base Map Source: Abercrombie & Associates, Inc.
May 2001

0 60 120
APPROXIMATE SCALE (FEET)

N

EXPLANATION

- UAW28 — PROPOSED DEEP UPPER AQUIFER MONITORING WELL LOCATION
- UAW11-40 — DEEP UPPER AQUIFER MONITORING WELL LOCATION
- STR12 — PROPOSED STRATAGRAPHIC BORING LOCATION
- UAW11-10 — SHALLOW UPPER AQUIFER MONITORING WELL LOCATION
- LAW12-60 — LOWER AQUIFER MONITORING WELL LOCATION
- RECOVERY WELL LOCATION
- STR09 — SOIL BORING LOCATION AND IDENTIFICATION NUMBER
- T-3 — TRENCH LOCATION
- MW-EPA-1 — UPPER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
- SW — FRENCH DRAIN AND SLURRY WALL LOCATION SOIL BORING SERIES
- MORTON FACILITY PROPERTY BOUNDARY
- SS-2 — STREAM STATION LOCATION
- B-05 — BACKGROUND SAMPLE LOCATION
- GW50 — PRISTINE SHALLOW AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- MW71 — PRISTINE LOWER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- IMPOUNDMENT – (FROM 1960 AERIAL PHOTO)
- LOCATION OF REPORTED WASTE BURIAL

REVISION 01, FEBRUARY 2004
ADDENDUM 01

DEEP UPPER AQUIFER MONITORING SYSTEM

PREPARED FOR
SUPPLEMENTAL FACILITY INVESTIGATION WORK PLAN
MORTON INTERNATIONAL
READING, OHIO

GEOMATRIX

Project No.	Figure
7168	3

7168B24.DWG

Supplemental Facility Investigation Work Plan
RCRA §3013 Administrative Order

EPA ID No. OHD. 000 724 138

Morton International, Inc. Facility
Reading, Ohio

Prepared for:

The Rohm and Haas Co.
Route 413 and State Road
Bristol, Pennsylvania 19007

Prepared by:

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

December 2003

Project No. 7168

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5725 Highway 290 West Suite 200B
Austin, Texas 78735

December 2003

Project No. 7168

100 INDEPENDENCE MALL WEST, PHILADELPHIA, PA 19106-2399 USA TELEPHONE (215) 592-3000

REPLY TO:
ENGINEERING DIVISION
[illegible] STATE ROAD
CROYDON, PA 19021
(215) 785-7000 FAX (215) 785-7458

ROHM AND HAAS

4 December 2003

Ms. Mirtha Capiro
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
U.S. Environmental Protection Agency
Region 5 (DE-9F)
77 West Jackson Street
Chicago, Illinois 60604-3590

Re: Morton International, Inc.
Reading, Ohio Facility
RCRA Docket No. R3013-5-00-001

Via: Overnight mail

For your review, please find enclosed three copies of the *Revised Supplemental Facility Investigation Work Plan* prepared by Geomatrix Consultants for the above referenced project. Please note that we have included our formal responses to your comments, based on our previous meeting and discussions, on this Work Plan as Appendix E of the document. This document provides responses to comments provided by USEPA to Morton in October 2003.

Morton anticipates that field activities will commence in March 2004. This is based on the assumption that the USEPA has reviewed and approved the revised work plan by the end of January 2004. Table 4 of the Work Plan provides a draft schedule for the project. Morton also anticipates conducting the T-1 Area Interim Measure in conjunction with the supplemental investigation.

Morton will conduct the additional field activities in accordance with the existing field procedures in the Facility Investigation Work Plan and the Quality Assurance Project Plan expect where modified by the Revised Supplemental Investigation Work Plan.

Thank you for your cooperation during this project. We look forward to continuing to work with you in a timely and efficient manner in addressing the issues at the facility. If you have any questions, please do not hesitate to contact me at (215) 785-7079 or Mark Hemingway at (512) 494-0333.

Sincerely,

Peter V. Palena Jr.
Rohm and Haas Company
Corporate Remediation Manager

Supplemental Facility Investigation Work Plan
RCRA §3013 Administrative Order
Morton International, Inc. Facility
[EPA ID No. OHD. 000 724 138]
Reading, Ohio
Dated November 2000

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1.0 INTRODUCTION AND BACKGROUND INFORMATION

On August 18, 2000, the U.S. Environmental Protection Agency (USEPA) Region 5 issued a Resource Conservation and Recovery Act (RCRA) §3013 Administrative Order (AO) to Morton International, Inc. (Morton) [EPA ID No. OHD 000 724 138]. Morton is a wholly-owned subsidiary of the Rohm and Haas Co. (Rohm and Haas) and the owner and operator of a facility at 2000 West Street, Reading, Ohio (Figure 1). This facility is herein referred to as the Morton Facility and is the subject of the AO. Geomatrix Consultants, Inc. (Geomatrix) has been retained by Rohm and Haas to implement the scope of work required by the AO, and to assist their Project Coordinator.

The stated basic objective of the AO is 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." Specific areas of suspected environmental impact (i.e., study areas) are identified in the AO; these and additional areas are referenced in the Current Conditions Report (Geomatrix, 2000a) and the Facility Investigation (FI) Work Plan (Geomatrix, 2000b).

On March 2, 2001, the USEPA conditionally approved the FI Work Plan. On March 31, 2001, Rohm and Haas submitted Revision 01 of the FI Work Plan, which primarily addressed USEPA questions and comments on field procedures and approach. On August 15, 2001, Rohm and Haas submitted Revision 02 of the FI Work Plan, which addressed USEPA questions and comments on ecological and human health risk assessment.

Mobilization for the FI commenced on March 6, 2001. The FI Report (Geomatrix, 2002a), which describes the implementation and findings of the investigation activities described in the USEPA-approved FI Work Plan, was submitted to the USEPA in May of 2002. The Baseline Risk Assessment (BRA) (Geomatrix, 2002b) was submitted to USEPA concurrently with the FI Report.

The USEPA provided Rohm and Haas with comments on the FI Report and BRA in November 2002. Thereafter, there was a dialogue between USEPA and Rohm and Haas to address USEPA's comments. Rohm and Haas and the USEPA have agreed that additional investigation would be performed to supplement the data gathered and reported in both the FI Report and BRA. The purpose of the Supplemental FI Work Plan, which was submitted to the USEPA in May 2003, is to outline the rationale and scope of all additional investigation items required to fill known or suspected data gaps. In October of 2003, USEPA provided Rohm and

Haas with comments on this Supplemental FI Work Plan and a meeting was held at the Morton Facility to review the scope of the supplemental investigation in more detail. This revision, Revision 01 of the Supplemental FI Work Plan, has been prepared to address the USEPA comments and the decisions discussed in the October 28, 2003 Morton Facility meeting and subsequent correspondence relating to the scope of work. A copy of the USEPA comments on Revision 00 of the Supplemental FI Work Plan, and the responses to these comments, have been included for reference as an appendix to this Work Plan.

After the Supplemental FI activities described in this document are completed, Rohm and Haas will revise and resubmit a supplement to or revision of the FI Report to USEPA for approval. After the USEPA has approved the revised FI Report as substantially complete, Rohm and Haas will revise and resubmit the BRA using the appropriate new and existing FI data.

2.0 SCOPE OF WORK AND OBJECTIVES

The current goals and information needs for the Supplemental FI activities are generally consistent with those established in the FI Work Plan and restated in the FI Report:

Goal 1 - Evaluate whether the migration of impacted groundwater is under control. Primary information needs identified to address this Goal were:

- The character and extent of impact to the Upper Aquifer.
- The presence of impact to those areas of the Lower Aquifer most likely to have been impacted by Morton Facility constituents. [Note – This information goal was identified during the course of FI field activities, subsequent to submittal of the FI Work Plan.]
- The effectiveness of the French drain and the slurry wall.
- The nature of horizontal and vertical groundwater flow within the Upper Aquifer system.
- The nature of flow between the Upper Aquifer and the Lower Aquifer.
- The identification of any past or continuing releases to groundwater and soils from Morton Facility sources identified in the AO or the Current Conditions Report.

Goal 2 - Evaluate whether current risks to human health and the environment are within acceptable limits. Primary information needs identified to address this Goal were:

- The character and extent of impact to seeps in the east bank of Mill Creek, and to sediments within the creek.
- The character and extent of impact to on-site shallow (<15 ft.) soils.
- The character and extent of any buried wastes.
- The presence, location, and character of human and ecological receptors.

The Supplemental FI will focus on addressing data gaps identified by the USEPA as part of their review of the FI Report. Specifically, there are eight identified data gaps to be addressed:

- Characterize tin in the surface soils in the southeast portion of the facility.
- Delineate lead in subsurface soils in the vicinity of soil sample UAW17-40-5'.
- Delineate toluene in subsurface soils in the vicinity of soil sample UAW04-20-10'.
- More fully characterize subsurface soil impact beneath and near the former surface impoundments.

- Confirm the species of chromium (i.e., trivalent vs. hexavalent) present in soil, groundwater, sediment, and surface water.
- Characterize groundwater directly beneath the T-1 location with respect to possible impact from tin, arsenic, lead, and chromium.
- Provide additional capability to monitor potential pathways for contaminant movement from the Upper Aquifer to the Lower Aquifer by adding monitoring wells screened in the Deep Upper Aquifer Sands.
- Characterize the nature and impact of groundwater transport from the Upper Aquifer to Mill Creek.
- Characterize sediments and surface water found in Mill Creek adjacent to the Rohm and Haas plant.

The data acquired to address these gaps is intended to supplement the existing information in these specific areas; this information has been provided in the FI Report. Given this, sampling and analysis at specific locations may not strictly follow the original guidelines stated in the FI Work Plan with respect to sample depths or analytes. Specific sample depths and analytes for each media and study area are discussed in the following sections. As appropriate given the data gap and objective at each sampling location, samples will be analyzed for selected compounds at specific depths. A summary of the sample locations and analytical requirements is provided in Tables 1, 2, and 3 and Figures 2 and 3. The Supplemental FI will be performed in accordance with the recently finalized Data Management Plan (CH2M Hill, 2003). Appendix A contains the relevant Field Operating Procedures (FOPs). Appendix B contains the Target Analyte Lists, analytical method requirements, and a summary of sample container and preservation requirements. Appendix C contains the Sample Location Nomenclature and the Rohm and Haas Protocol for Labeling Field Samples (CRG-026). Appendix D contains a copy of a Cincinnati Milacron (prior property owner) memo, circa 1979, describing soil sampling and removal related to tin contamination. Appendix E contains USEPA comments on Revision 00 of the Supplemental FI Work Plan, the responses to these comments, and related correspondence.

3.0 SUPPLEMENTAL SOIL INVESTIGATION

Other than exceptions discussed below, soil sampling will be performed in accordance with the FI Work Plan, Quality Assurance Project Plan (QAPP) and applicable FOPs, including:

FOP Number	Title
B-2	Direct-Push Technique (DPT) Procedures
B-5	Sealing of Boreholes
D-1	Split-Spoon Sampling
D-2	Soil Sample Field Screening Using an Organic Vapor Meter
D-3	Soil Sample Handling for Volatile Organic Constituent (VOC) Analysis

The FOPs listed above have been included as Appendix A of this document, to enable ease of use by the field team. The complete set of FOPs is found in the QAPP. Appendix B contains information on Target Analyte Lists. Appendix C should be consulted for sample location nomenclature and details regarding changes to the Sample Labeling and Identification protocols.

The following sections summarize the rationale and specific sampling programs for supplemental soil sampling. Figure 2 shows the approximate sample locations and general sample distribution for the Supplemental FI. The exact locations and scope of work may change based on conditions encountered in the field. Any such variance will be documented in Progress Reports or other applicable reporting.

3.1 SOUTHEAST PORTION OF THE FACILITY
(Tin, Chromium Speciation)

A Cincinnati Milacron memo from 1979 (Appendix D) discussed soil contamination resulting from processes using tin.

> "The sources of contaminations are run-off wastes from leaks developing on the aqueous tin chloride transfer pipes feeding into the tin tank farms; these pipes run mainly along the east fence line. Other sources are storage drums piled between Buildings 12 and 26, washings from replaced tin lines during maintenance operations, spills from kettles at Building 27 when rupture discs break and hosing down of contaminated building floors in cases of accidental spills."

Most of the top soil in these areas was replaced after 1976, and sampling in 1978 characterized remaining tin concentrations as being well below applicable human health risk-based screening levels. Additional evaluation for tin was not performed on soils in this area as part of the FI. Supplemental FI activities will characterize current tin concentrations in shallow soils in this area.

In the vicinity of Buildings 12, 19, 26, and 27 in the southeast portion of the facility, eleven shallow soil samples (depth: 1.0 to 1.5 feet below ground surface (bgs)) will be collected using a hand auger. These samples, which roughly correlate to locations with elevated tin concentrations in the 1970s sampling, will be analyzed for tin. Since they lie within the area of interest, the three soil samples collected at a depth of 5 feet bgs to assess lead levels in soils near UAW17-40 (see Section 3.2) will also be analyzed for tin. Two of the fourteen soil samples will be selected for chromium speciation (Section 3.5), at locations indicated on Figure 2.

One of the proposed Deep Upper Aquifer Wells will be located in this general area. One soil sample from the 1.0 to 1.5 foot sample interval in this boring will be collected and analyzed for tin. As the borehole is advanced, additional soil samples will be collected from depths of approximately 3, 5, 7, 10, 12 and 15 feet; these samples will be held by the laboratory until such time as it is determined by Rohm and Haas that tin analysis (or analysis for the other target metals chromium or lead) from any of these samples would provide useful vertical characterization details.

Figure 2 shows the approximate sample locations and general sample distribution for the southeast portion of the facility. Table 1 summarizes the scope of sampling and analysis.

3.2 UAW17-40 AREA

(Lead and Tin, Chromium Speciation)

The concentration of lead reported in the 5-foot sample at the UAW17-40 boring was 128 milligrams per kilogram (mg/kg), and the USEPA has requested that additional sampling be performed at this location to determine if this level was a localized anomaly or evidence of a more extensive lead distribution. Three soil borings will be advanced using direct push technology (DPT) at locations evenly spaced around, and spaced approximately 25 feet from, UAW17-40 (Figure 2). At each of the three sampling points, the DPT boring will be advanced

to the shallower of the water table or a depth of 15 feet bgs. Based on routine measurements in UAW17-40, the depth to water in this location is approximately 12 feet bgs.

- If field evidence of impact (i.e., waste, staining, significant odor, or vapor detector readings) is observed in any boring, a sample will be analyzed from that interval.
- In the absence of field evidence of impact, samples will be selected for analysis as follows:
  - One sample from the 5-foot depth in each boring will be analyzed for lead (three samples total).
  - One sample will be collected from each location at 10 feet bgs. These will be held by the laboratory pending analytical results from the samples at 5-foot depth.
  - The sample from 10 feet bgs in the boring with the highest lead concentration at the 5-foot depth will also be analyzed for lead (one additional sample, making a total of four).

These four samples will also be analyzed for tin, as discussed in Section 3.1. Table 1 summarizes the scope of sampling and analysis.

One of these four samples will also be selected for chromium speciation analysis, as explained in Section 3.5 and shown on Figure 2.

3.3 UAW04-20 AREA
(Toluene, Chromium Speciation)

The concentration of toluene reported in the 10-foot sample at UAW04-20 was 160 mg/kg, and the USEPA suggested additional sampling to delineate toluene in this area. Three DPT soil borings will be advanced at locations evenly spaced around, and approximately 25 feet from, UAW04-20 (Figure 2). At each DPT location, soil will be continuously sampled for lithology to the depth of the water table – estimated to be approximately 15 feet bgs. The field team will record field indications of impact, measuring organic vapors with a portable ionization detector (PID), and noting staining and odors. Biased towards samples with field indications of impact, a single sample will be retained from each of the three borings for laboratory analysis. If field screening does not indicate the presence of impact in a boring, the default sampling depth for that boring will be 10 feet bgs. These three soil samples will be analyzed for toluene. Table 1 summarizes the scope of sampling and analysis.

One soil sample will also be collected from the 1.0 to 1.5 foot bgs interval at the southwest location for chromium speciation analysis, as explained in Section 3.5 and shown on Figure 2.

3.4 FORMER SURFACE IMPOUNDMENTS

(CLP – TAL VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin, Chromium Speciation)

USEPA has expressed concern that the potential variability of soil impact at the former surface impoundments may not be adequately represented by the samples collected during the FI. Currently, 16 FI soil samples have been collected within and immediately adjacent to the former surface impoundments, at depths typically biased towards the strongest field indications of impact (i.e., staining, odors, and measurable organic vapors). To supplement this data set, Rohm and Haas will use DPT borings to sample soils on a 30-foot grid across the area of the surface impoundment system. The 30-foot sample grid will add 24 borings within the former impoundments. At each DPT location, soil will be continuously sampled for lithology to a total depth of 15 feet bgs or the water table, whichever is deeper. The field team will collect and hold approximately five soil samples from each DPT boring for a total of 120 soil samples; these samples will be biased towards field indications of impact. All samples will then be tested for head space vapor levels using a PID. Twelve of the 120 soil samples will be retained for laboratory analysis. The twelve samples will be selected from locations distributed across the surface impoundment system. Based on the field screening, nine of the samples will be biased towards field indications of impact – elevated organic vapor readings or obvious staining and/or odors. In the absence of field indications of impact, these nine samples will be selected from between the former bottom of the surface impoundment (five to six ft bgs according to the Current Conditions Report) and the total boring depth. In addition, in the absence of field indications of impact, the sampling depths should be varied from boring to boring to ensure a more complete vertical delineation of contamination over the entire soil profile. The balance of the samples (3 samples) will consist of soils with lower or no obvious field indications of impact.

As summarized in Table 1, these soil samples will be analyzed for a comprehensive target analyte list based on the Contract Laboratory Program Target Analyte List (CLP-TAL) provided in Table A1-1 of the QAPP (Appendix A of the FI Work Plan). The samples will be analyzed for the volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals from the CLP-TAL with the addition of analysis for aniline and tin. The complete compound list is provided in Appendix B. As indicated on Figure 2, one soil sample from the northwest portion of the sample grid will be collected from 15 feet bgs for chromium speciation (Section 3.5).

3.5 FACILITY-WIDE CHROMIUM SPECIATION
(Total Chromium and Hexavalent Chromium)

All chromium analyses performed during the FI were for total chromium, as specified in the FI Work Plan. For the purposes of risk assessment, all chromium observed was presumed to be trivalent. The USEPA has raised a concern regarding the uncertainty as to the actual speciation. Although hexavalent chromium use is not consistent with historical plant operations, and there is no record of its use, additional sampling and analysis will be performed to confirm that the chromium measured in prior samples represents only trivalent chromium. To achieve this goal, sample locations have been selected at areas with a range of total chromium concentrations, with a bias towards higher concentrations. These samples will be analyzed for hexavalent chromium (SW 846 Method 7196A) and total chromium (SW 846 Method 6010B). Consistent with standard analytical procedures, the trivalent chromium concentration will be calculated as the difference between total and hexavalent chromium.

Six soil sample locations for chromium analysis will be distributed across the site to gather a representative data set. The proposed locations are shown on Figure 2, and consist of previous sample locations where total chromium concentrations were elevated, and locations proposed for other characterization objectives in this Supplemental FI Work Plan (Sections 3.1 to 3.4). The proposed sample depths are summarized in Table 1.

Similarly, six groundwater, one surface water, and two sediment samples will be collected for chromium speciation analysis, as discussed in Sections 4.3, 5.1, and 5.2 and as shown on Figure 2. Tables 2 and 3 summarize the scope of groundwater and Mill Creek sampling, respectively.

The holding time for aqueous (groundwater and surface water) samples for hexavalent chromium analysis is 24 hours, so coordination between the field team and laboratory will be critical to ensure this short holding time is met.

4.0 SUPPLEMENTAL GROUNDWATER INVESTIGATION

Supplemental investigation of the groundwater at the Morton Facility will include the installation of wells screened in the Deep Upper Aquifer Sands, the collection of a one-time grab sample, and the completion of a facility-wide groundwater sampling event. Except as noted, the supplemental groundwater investigation will be performed in accordance with the FI Work Plan, QAPP and applicable FOPs, including:

FOP Number	Title
B-2	Direct-Push Technique Procedures
B-3	Sonic Drilling and Soil Sampling Procedures
B-5	Sealing of Boreholes and DPT penetrations
C-2	Monitoring Well Construction for Sonic Boreholes
C-3	Monitoring Well Development
E-1	Low-Flow (Minimal Drawdown) Groundwater Purging Procedures
E-2	Groundwater Sample Collection

The FOPs listed above have been included as Appendix A of this document, to enable ease of use by the field team. The complete set of FOPs is found in the QAPP. Appendix B contains information on Target Analyte Lists. Appendix C should be consulted for sample location nomenclature and details regarding changes to the Sample Labeling and Identification protocols.

The following sections summarize the rationale and specific sampling programs for supplemental groundwater sampling. Figure 2 shows the approximate sample locations and general sample distribution for the Supplemental FI. The exact locations and scope of work may change based on conditions encountered in the field. Any such variance will be documented in Progress Reports or other pertinent reporting.

4.1 DRILLING AND MONITORING WELL INSTALLATION

(CLP – TAL VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin, Chromium Speciation)

The USEPA has previously expressed concerns that impact in shallow Upper Aquifer groundwater suspected to be derived from the Morton Facility may potentially migrate in the future to the Lower Aquifer. The FI included the installation of 12 wells in the deeper portions of the Upper Aquifer (Figure 3). The USEPA has directed Rohm and Haas to review the

locations of the wells vis-à-vis potential pathways between the Shallow Upper Aquifer Sand and the Lower Aquifer, and to install any wells required to fill these gaps.

A review of the site hydrogeology identified a contact stretching from the southwest to the east-central parts of the Morton Facility. Along this contact, Deep Upper Aquifer Sands (south and southeast of the contact) are suspected to be in direct hydraulic communication with the Lower Aquifer (north and northwest). In order to enhance the Morton Facility's groundwater monitoring capabilities upgradient (south) of this area of communication, Rohm and Haas will install three additional Deep Upper Aquifer Sand wells at locations shown on Figure 2. A similar area of communication is believed to exist in the northeast portion of the Morton Facility and at the Pristine Superfund Site, but this area is believed to be adequately monitored by both Morton and Pristine wells.

The wells will be installed using a rotasonic drilling rig. The locations will be continuously sampled for lithology, in accordance with the FOPs. Samples will not be retained for chemical analysis.

Wells with 10-foot nominal length well screens will be installed in the targeted Deep Upper Aquifer Sand. The anticipated well construction details and depth have been projected on FI hydrogeologic cross sections, as shown on Figures 4, 5, and 6. Note that the targeted depths shown on these figures assume that a transmissive zone correlatable to the deep UA Sands is present at the proposed location. Actual well construction depths may be shifted a maximum of 10 feet above or below the shown targeted depth, at the discretion of the Field Team Leader based on the actual depth to observed transmissive zones. If no transmissive zone is present in this interval, however, this will confirm that no deep Upper Aquifer Sand pathway is present at the proposed location, and a well will not be installed.

As summarized in Table 2, the groundwater samples will be analyzed for a comprehensive target analyte list of the CLP-TAL VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin. The complete compound list is provided in Appendix B.

4.2 GROUNDWATER SAMPLING AT T-1 LOCATION
(Tin, Arsenic, Lead, Chromium Speciation,)

Soil samples collected at the trench identified as T-1 contained elevated concentrations of tin, arsenic, chromium, and lead. USEPA requested that sampling be performed directly beneath

these soils to evaluate the possibility that soil impact may extend to groundwater. The results of a groundwater sample at this location would supplement the existing groundwater data from nearby downgradient monitoring well UAW06-20. A one-time groundwater sample will be collected using DPT methods from the Shallow Upper Aquifer Sand at the T-1 location (Figure 2). This sample will be analyzed for tin, arsenic, chromium speciation, and lead.

4.3 GROUNDWATER MONITORING

(CLP – TAL VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin, Chromium Speciation)

As summarized in Table 2, all existing Upper Aquifer wells will be sampled during the Supplemental FI and analyzed for the CLP-TAL VOCs, SVOCs + Aniline, Pesticides, PCBs, and Metals + Tin. A subset of these wells will also be analyzed for chromium speciation, as indicated in Figure 2 and summarized on Table 2.

5.0 MILL CREEK

Supplemental investigation of Mill Creek will focus on addressing USEPA's request for characterization of creek bed sediments and surface water at locations adjacent to the Rohm and Haas Plant. Prior investigation of Mill Creek included the sampling of seeps, creek bank sediments and creek bed sediments. Based on discussions with USEPA, it was decided that additional sampling of the creek banks and seeps would not provide useful data, and therefore is not be performed. Additional investigation, therefore, will focus on sampling the creek bed and surface water.

The bottom of Mill Creek is comprised of rip rap and other man-made materials, and there are limited areas of sediment deposition. To the extent possible, Rohm and Haas will collect creek bed sediments from locations adjacent to the Morton Facility and the park area to the south. One sample will be biased toward the north property boundary and another sample will be biased toward the south property boundary. The creek bed sediment data collected will supplement the previous creek bed sampling data.

The data collected for surface water and sediments will be utilized in the quantitative assessment of risks related to Mill Creek receptors. Compounds in Mill Creek that are not derived from releases at the Morton Facility may be considered by the USEPA for the purposes of Risk Management decisions; however, Rohm and Haas will not be required to assess the extent of these compounds, or to remediate them.

The supplemental Mill Creek investigation will be performed in accordance with the FI Work Plan, QAPP and the following applicable FOPs, including:

FOP Number	Title
F-2	Sediment Sampling From Creek/River Banks or Creek/River Beds
F-3	Surface Water Sampling

The FOPs listed above have been included as Appendix A of this document, to enable ease of use by the field team. The complete set of FOPs is found in the QAPP. Appendix B contains information on Target Analyte Lists. Appendix C should be consulted for sample location nomenclature and details regarding changes to the Sample Labeling and Identification protocols.

5.1 SEDIMENT SAMPLING

(Chromium Speciation; App IX– TAL VOCs, SVOCs, Pesticides, PCBs, Metals + Tin)

Six creek bed samples will be collected from locations adjacent to the Morton Facility. One sample will be biased toward the north property boundary and other will be biased toward the south property boundary. The remaining four samples will be collected adjacent to previous sampling locations CS-1, CS-2, CS-4 and CS-5, subject to the presence of sediment in these areas. As indicated on Figure 3, two of the sediment samples will be analyzed for chromium speciation analysis (Section 3.5). All samples will be analyzed for the App IX-TAL VOCs, SVOCs, Pesticides, PCBs, and Metals including tin.

5.2 SURFACE WATER SAMPLING

(Chromium Speciation; App IX– TAL VOCs, SVOCs, Pesticides, PCBs, Dissolved Metals + Tin)

At each of the sediment sampling locations discussed in Section 5.1, a surface water sample will be collected. The surface water samples will be analyzed for the same target analytes as the sediments. The samples will be analyzed for dissolved metals only as proposed by the USEPA (Appendix E). For the dissolved metals analysis, the samples will be field filtered in accordance with Method 1669 – Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (USEPA, 1996).

6.0 PROJECT SCHEDULE AND REPORTING

It is estimated that the field work for the Supplemental FI will begin in March 2004. An estimated schedule is provided in Table 4 and includes estimated times for USEPA reviews and approvals. The exact schedule will reflect actual review times. Also note that this schedule is subject to revision based on force majeure events such as bad weather, and based on other delays outside of Rohm and Haas control.

Rohm and Haas will continue submittal of quarterly progress reports to USEPA through the conclusion of field and reporting activities, summarizing field and project related activities and providing copies of the pertinent field documentation. Data management of Supplemental FI field and analytical information will be ongoing, as described in the Data Management Plan.

Following the completion of the Supplemental FI, the additional data will be evaluated and reported to the USEPA in one of two forms:

- A revised (Revision 01) FI Report; or
- A Supplemental FI Report, primarily documenting just the newly acquired data.

As required by the Data Management Plan, Rohm and Haas will also provide USEPA with EQUIS-compliant electronic data deliverables (EDDs).

Following USEPA approval of this FI Report documentation, the baseline risk assessments, human health and ecological, will be revised and submitted to the USEPA.

7.0 REFERENCES

CH2M Hill, 2003, Site Investigation and Remediation, Data Management Plan for Morton International, Inc. Facility, Reading Ohio, March.

Geomatrix Consultants, Inc., (Geomatrix), 2000a, Current Conditions Report, Morton International, Inc. Facility, Reading, Ohio, September.

Geomatrix Consultants, Inc., (Geomatrix), 2000b, Facility Investigation Work Plan, Morton International, Inc. Facility, Reading, Ohio, November.

Geomatrix Consultants, Inc. (Geomatrix), 2002a, Facility Investigation Report, Morton International, Inc. Facility, Reading, Ohio, June 2002.

Geomatrix Consultants, Inc., (Geomatrix), 2002b, Baseline Risk Assessment, Morton International, Inc. Facility, Reading, Ohio, June 2002.

The Rohm and Haas Company, (Rohm and Haas), Corporate Remediation Group (CRG), Document No. CRG-026, Protocol for Labeling Field Samples, Revision 003, Issue Date: 3/11/2003.

U.S. Environmental Protection Agency (USEPA) Office of Water Engineering and Analysis Division (4303), 1996, Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels, July.

U.S. Environmental Protection Agency (USEPA), 2000, Administrative Order Requiring Monitoring, Analysis, and Reporting, Region 5, Docket No. R3013-5-00-001, August 18.

U.S. Environmental Protection Agency (USEPA), 2000, Contract Laboratory Program Target Analyte List Developed from the USEPA Superfund Contract Laboratory Program, On line: http://www.epa.gov/superfund/programs/clp/target.htm.

U.S. Environmental Protection Agency (USEPA), 2000, Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs February 2000. http://www.epa.gov/ost/cs/biotesting/.

TABLES

Table 1
Scope of Soil Sampling and Analysis
Supplemental Investigation Work Plan
Morton International, Inc.
Reading, Ohio

Symbol	Purpose	Estimated Number of Samples	Sample Collection Technique	Sample Depth	Analytical Requirements
A	Tin characterization in the southeast portion of the facility	12	Hand Auger (except for the soil sample collected during the drilling of UAW27)	1.0 to 1.5 feet bgs	Tin One sample will be analyzed for Chromium Speciation
B	Lead characterization in the vicinity of UAW17-40	4	DPT	Various – See Work Plan	Lead and Tin One sample will be analyzed for Chromium Speciation
C	Toluene characterization in the vicinity of UAW04-20	3	DPT	Various – See Work Plan	Toluene One sample will be analyzed for Chromium Speciation
D	Characterization of former surface impoundment system	1) 120 samples for field screening 2) 12 samples for laboratory analysis	DPT	Various – See Work Plan	1) FIELD SCREENING Photoionization detector (PID) 2) LAB ANALYSIS CLP-TAL VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin One sample will be analyzed for Chromium Speciation

Table 1
Scope of Soil Sampling and Analysis
Supplemental Investigation Work Plan
Morton International, Inc.
Reading, Ohio

Symbol	Purpose	Estimated Number of Samples	Sample Collection Technique	Sample Depth	Analytical Requirements
Cr	Chromium speciation analysis	6	DPT	Cr 1 – 9 feet bgs. Cr 2 – 1 foot bgs Cr 3 – 5 feet bgs. Cr 4 – 1.5 feet bgs. Cr 5 – 1 foot bgs. Cr 6 – 15 feet bgs.	Hexavalent Chromium and Total Chromium

Table 2
Scope of Groundwater Sampling and Analysis
Supplemental Investigation Work Plan
Morton International, Inc.
Reading, Ohio

Symbol	Purpose	Estimated Number of Samples	Sample Collection Technique	Location	Groundwater Analytical Requirements
	Characterize Shallow Upper Aquifer groundwater directly beneath the T-1 location	1	DPT: one-time grab sample	Trench 1 (T-1); Shallow Upper Aquifer Sands (estimated: 10 ft. bgs)	Tin, Arsenic, Lead, and Chromium Speciation
	Monitor Deep Upper Aquifer Sands	3	Rotasonic Drilling for Monitoring Well Installation. Low-Flow Groundwater Purging and Sampling Procedures	See Figure 2 for the three proposed locations: UAW26 UAW27 UAW28 Deep Upper Aquifer Sands	CLP-TAL VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin
NA	Site-wide groundwater monitoring	36 existing monitoring wells	Low-Flow Groundwater Purging and Sampling Procedures	Shallow Upper Aquifer (24) and Deep Upper Aquifer (12)	CLP-TAL VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin Five samples will be analyzed for chromium speciation.
Cr	Chromium speciation analysis	6	Low-Flow Groundwater Purging and Sampling Procedures	MWEPA-2 MWEPA-4 UAW06-20 UAW11-40 Recovery Well DPT at T-1	Chromium Speciation

Table 3
Scope of Mill Creek Sampling and Analysis
Supplemental Investigation Work Plan
Morton International, Inc.
Reading, Ohio

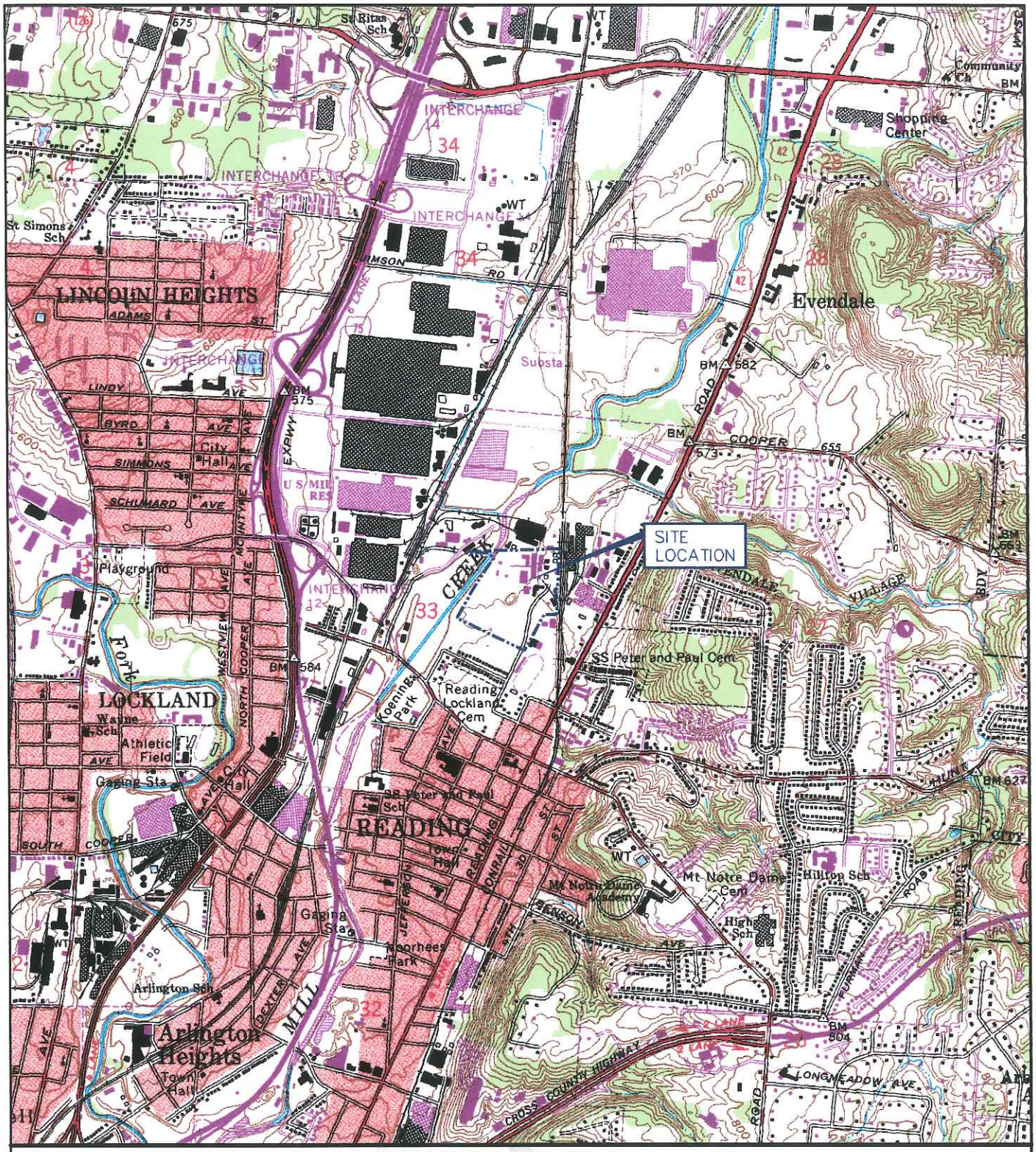
Symbol	Purpose	Estimated Number of Samples	Sample Collection Technique	Location	Analytical Requirements
	Surface water sampling in creek	6	See Field Operating Procedure	WS-1A WS-2 WS-3 WS-4 WS-5 WS-6A	Appendix IX – TAL VOCs SVOCs, Pesticides, PCBs, Dissolved Metals + Tin One sample will be analyzed for dissolved chromium speciation.
	Sediment sampling of the creek bed	6	See Field Operating Procedure	CS-1A CS-2 CS-3 CS-4 CS-5 CS-6A	Appendix IX – TAL VOCs, SVOCs, Pesticides, PCBs, Metals + Tin Two samples will be analyzed for chromium speciation.
Cr Cr	Chromium speciation analysis	2 Sediment 1 Surface Water	See Field Operating Procedures	CS-5 (Creek Bed Sediment) CS-6A (Creek Bed Sediment) WS-6A (Surface Water)	Chromium Speciation

Table 4
Supplemental Investigation Schedule
Morton International, Inc.
Reading, Ohio

Supplemental Work Plan Schedule	Date
Final Supplemental Work Plan (Revision 00) to USEPA - due 5/19/2003	Monday, May 12, 2003
USEPA review complete	Tuesday, October 14, 2003
Revise & Resubmit Supplemental Work Plan (Revision 01)	Friday, December 5, 2003
USEPA approve Final Supplemental Work Plan (Revision 01)	TBD

Field Investigation	Date
Estimated Field Mobilization Date	Monday, March 01, 2004
Complete Monitoring Well Installation, and Soil Sampling (one 10-day shift)	Monday, March 08, 2004
Complete Groundwater Monitoring and Sediment Sampling at Mill Creek, and T-1 Excavation (one 10-day shift)	Monday, March 22, 2004
Receive Final and Complete Analytical Data from Severn Trent Laboratories (estimate 30 days)	Friday, April 23, 2004
Complete Data Validation (estimate 30 days)	Sunday, May 23, 2004
Submit Report to USEPA (estimate 30 days)	Friday, June 25, 2004
Submit Revised Baseline Risk Assessment	90 days after Final FI Report Approved

FIGURES



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

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APPROXIMATE SCALE (FEET)

QUADRANGLE LOCATION

GEOMATRIX

SITE LOCATION MAP
SUPPLEMENTAL FACILITY INVESTIGATION
WORK PLAN
PREPARED FOR
MORTON INTERNATIONAL – READING, OHIO

Project No. 7168

Figure No. 1

7168A02.DWG

Base Map Source: Abercrombie & Associates, Inc.
May 2001

0 60 120
APPROXIMATE SCALE (FEET)

N

EXPLANATION

- UAW28 — PROPOSED DEEP UPPER AQUIFER MONITORING WELL LOCATION
- UAW11-40 — DEEP UPPER AQUIFER MONITORING WELL LOCATION
- UAW11-10 — SHALLOW UPPER AQUIFER MONITORING WELL LOCATION
- LAW12-60 — LOWER AQUIFER MONITORING WELL LOCATION
- RECOVERY WELL LOCATION
- STR09 — SOIL BORING LOCATION AND IDENTIFICATION NUMBER
- T-3 — TRENCH LOCATION
- MW-EPA-1 — UPPER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
- SW — FRENCH DRAIN AND SLURRY WALL LOCATION SOIL BORING SERIES
- MORTON FACILITY PROPERTY BOUNDARY
- SS-2 — STREAM STATION LOCATION
- B-05 — BACKGROUND SAMPLE LOCATION
- GW50 — PRISTINE SHALLOW AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- MW71 — PRISTINE LOWER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- IMPOUNDMENT – (FROM 1960 AERIAL PHOTO)
- LOCATION OF REPORTED WASTE BURIAL

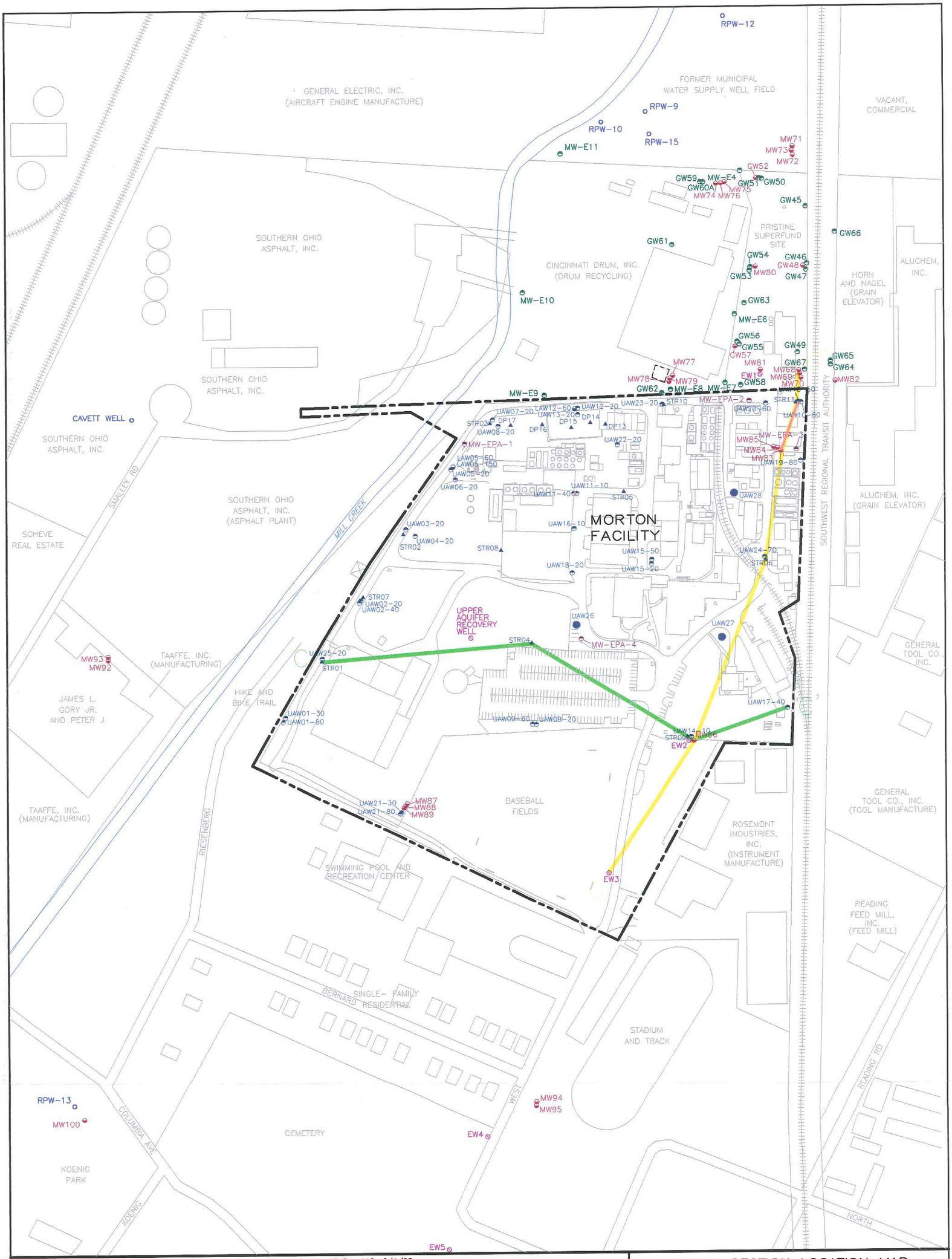
DEEP UPPER AQUIFER MONITORING SYSTEM

PREPARED FOR
SUPPLEMENTAL FACILITY INVESTIGATION WORK PLAN
MORTON INTERNATIONAL
READING, OHIO

GEOMATRIX

Project No.	Figure
7168	3

7168P20.DWG



Base Map Source: American Process Design, Inc., Cincinnati, OH., Proj. No. 16151, 410, 6/4/98.

EXPLANATION

- STR03 ▲ MORTON FACILITY SOIL BORING LOCATION
- UAW03-20 MORTON FACILITY UPPER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- LAW12-60 MORTON FACILITY LOWER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- CAVETT WELL ○ NON-MUNICIPAL SUPPLY WELL LOCATION
- MW-EPA-1 MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- GW50 PRISTINE SHALLOW AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- MW71 PRISTINE LOWER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- EW1 PRISTINE EXTRACTION WELL LOCATION AND IDENTIFICATION NUMBER
- MORTON FACILITY PROPERTY BOUNDARY

N

0 240

APPROXIMATE SCALE (FEET)

CROSS-SECTION LOCATION MAP
SUPPLEMENTAL FACILITY INVESTIGATION WORK PLAN

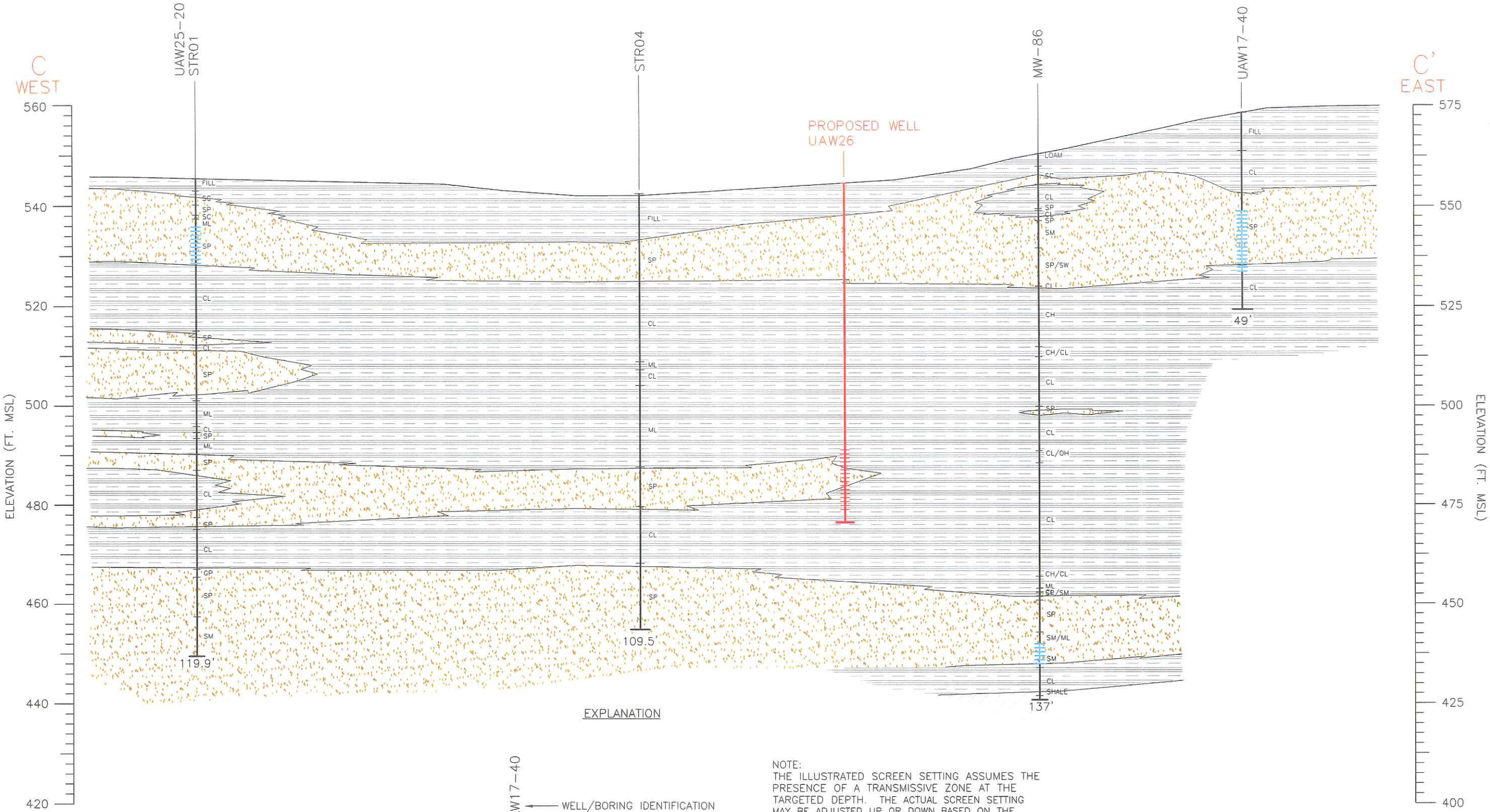
PREPARED FOR

MORTON INTERNATIONAL
READING, OHIO

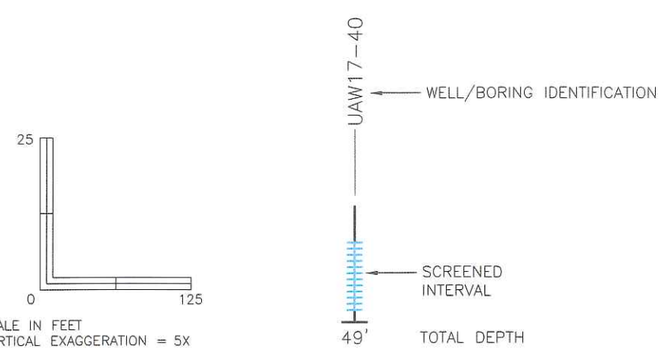
GEOMATRIX

Project No.	Figure
7168	4

7168B21.DWG



EXPLANATION



SCALE IN FEET
VERTICAL EXAGGERATION = 5X

NOTE:
THE ILLUSTRATED SCREEN SETTING ASSUMES THE PRESENCE OF A TRANSMISSIVE ZONE AT THE TARGETED DEPTH. THE ACTUAL SCREEN SETTING MAY BE ADJUSTED UP OR DOWN BASED ON THE DEPTH AND PRESENCE OF THE TARGETED ZONE, AS DISCUSSED IN THE TEXT.

CROSS SECTION C–C'
SUPPLEMENTAL FACILITY INVESTIGATION
WORK PLAN
PREPARED FOR
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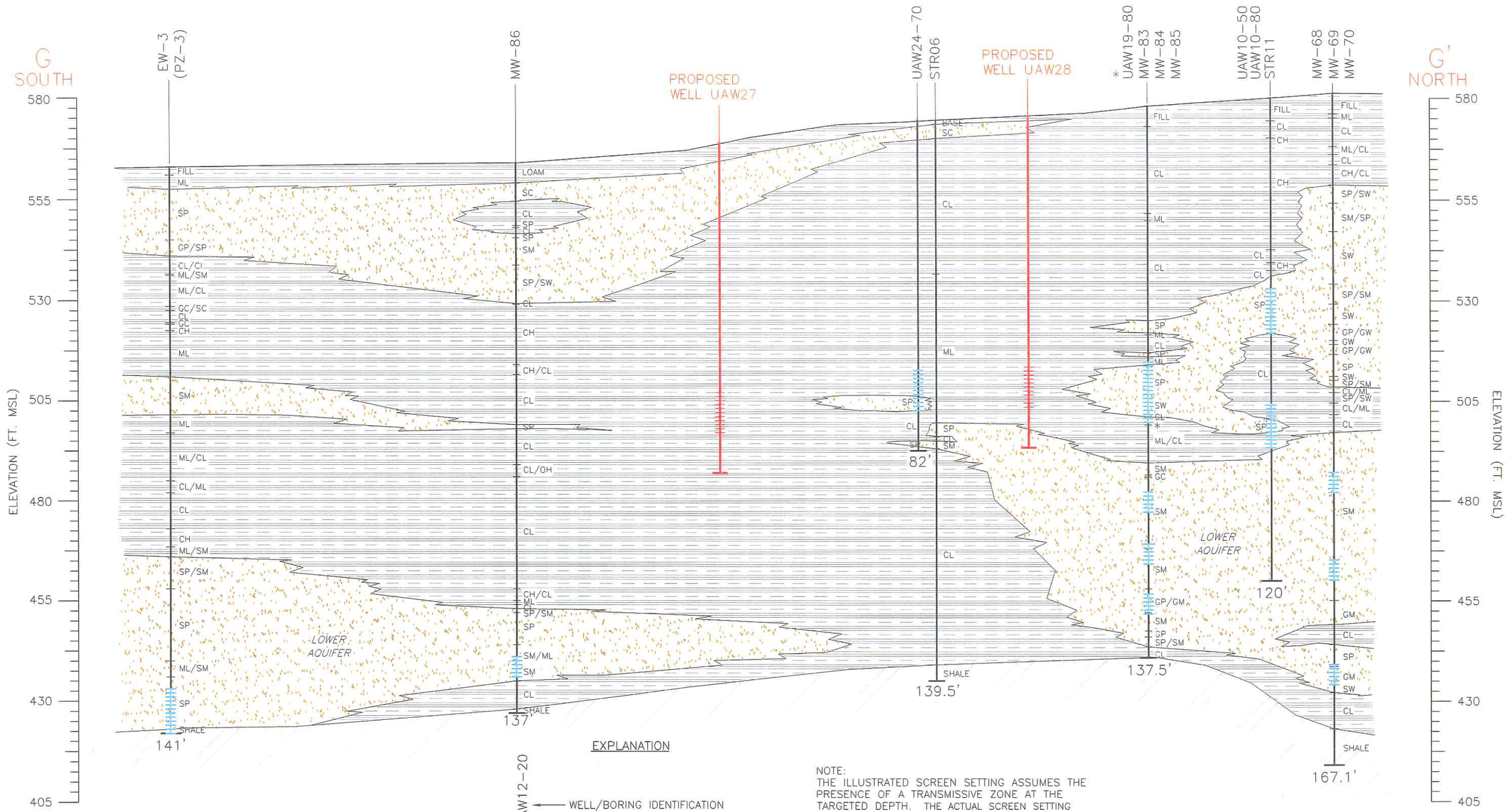
READING, OHIO

GEOMATRIX	Project No.	Figure	7168822.DWG
	7168	5	



EXPLANATION

UAW12-20 — WELL/BORING IDENTIFICATION

SCREENED INTERVAL

18' TOTAL DEPTH

NOTE:
THE ILLUSTRATED SCREEN SETTING ASSUMES THE PRESENCE OF A TRANSMISSIVE ZONE AT THE TARGETED DEPTH. THE ACTUAL SCREEN SETTING MAY BE ADJUSTED UP OR DOWN BASED ON THE DEPTH AND PRESENCE OF THE TARGETED ZONE, AS DISCUSSED IN THE TEXT.

25 0 125
SCALE IN FEET
VERTICAL EXAGGERATION = 5X

* UAW19-80 STRATIGRAPHY 0-79'
MW-85 STRATIGRAPHY 79-139.5'

STRATIGRAPHY IS TAKEN FROM THE DEEPEST BORING OR MONITORING WELL UNLESS OTHERWISE NOTED

CROSS SECTION G-G'
SUPPLEMENTAL FACILITY INVESTIGATION
WORK PLAN
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READING, OHIO

GEOMATRIX

Project No.	Figure
7168	6

7168B23.DWG

APPENDIX A

FIELD OPERATING PROCEDURES (FOPs)

Field Operating Procedures
Table of Contents

B-2	Direct Push Technique Procedures
B-3	Sonic Drilling and Soil Sampling Procedures
B-5	Sealing of Boreholes
C-2	Monitoring Well Construction for Sonic Boreholes
C-3	Monitoring Well Development
D-1	Split-Spoon Sampling
D-2	Soil Sample Field Screening Using and Organic Vapor Meter
D-3	Soil Sample Handling for Volatile Organic Constituent (VOC) Analysis
E-1	Low Flow (Minimal Drawdown) Groundwater Purging Procedures
E-2	Groundwater Sample Collection
F-2	Sediment Sampling From Creek/River Banks or Creek/River Beds (Revised November 2003)
F-3	Surface Water Sampling

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
Morton International, Inc.
RCRA Facility Investigation of Reading, Ohio, Facility

DIRECT PUSH TECHNIQUE PROCEDURES

PURPOSE

This guideline presents a method for advancing a borehole while sampling soils through unconsolidated materials, including soils or overburden.

PROCEDURE

The following procedure will be used to advance a borehole for sampling using direct push methods and equipment.

1. Mobilize the direct push rig to the site and position over the borehole.
2. Level and stabilize the rig using the rig jacks, and recheck the rig location against the planned boring location. If necessary, raise the jacks and adjust the rig position.
3. Advance the direct push sampling tool into the subsurface. The direct push tool typically will be configured to sample continuously as the tool advances. The Geomatrix field supervisor will verify this configuration with the operator, to ensure sampling is performed through the targeted intervals.
4. Check the drive string periodically during drilling to ensure the boring is plumb. Adjust rig position as necessary to maintain plumb.
5. Collect soil samples by withdrawing the retrievable sample tool from the drive string and the intervals dictated by the equipment's sample length capacity. The Geomatrix field supervisor will verify the appropriate intervals with the operator.
6. Continue advancing the drive string until reaching the total depth assigned by Geomatrix.
7. Manage all unused sample/core and other solids as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.
8. All boreholes not used for well installation will be promptly sealed as described in the Geomatrix Field Operating Procedure for Sealing of Boreholes. In the case of direct push borings, grout will be emplaced either through the drive string as that string is withdrawn, or through a grouting string or tremie driven or pushed into the boring after the drive/sampling string is removed. The grouting string or tremie will be driven or pushed to within five feet of the borings total depth prior to grouting.

DIRECT PUSH TECHNIQUE PROCEDURES

Other Procedural Issues:

- Borings will not be advanced past the assigned total depth (rat holed) without the express permission of the Geomatrix field supervisor.
- All depth measurements should be accurate to the nearest 0.1 foot, to the extent practicable.

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
Morton International, Inc.
RCRA Facility Investigation of Reading, Ohio, Facility

SONIC DRILLING AND SOIL SAMPLING PROCEDURES

PURPOSE

This guideline presents a method for drilling a borehole through unconsolidated materials, including soils or overburden, and consolidated materials, including bedrock.

PROCEDURE

The following procedure will be used to drill a borehole for sampling and/or well installation, using sonic methods and equipment.

1. Mobilize the sonic drilling rig to the site and position over the borehole.

2. Level and stabilize the rig using the rig jacks, and recheck the rig location against the planned drilling location. If necessary, raise the jacks and adjust the rig position.

3. Advance drive casing into the subsurface. For well installation, nominal 10- or 12-inch ID outer casing should be used. The boring diameter will be approved by the Geomatrix field supervisor.

4. Check casing periodically during drilling to ensure the boring is plumb. Adjust rig position as necessary to maintain plumb.

5. Water will be used only if critically necessary for hole control during the drilling process, and with the concurrence of the Geomatrix field supervisor. All water used must be of potable quality, transported in a clean container, and sampled for verification of water quality. The Geomatrix field supervisor, with support from the driller, will track volumes of water used/lost.

6. Collect soil samples by withdrawing the inner drive casing and removing the sample liner at nominal intervals of 10 feet.

7. Continue drilling until reaching the assigned total depth.

8. Manage all drill cuttings, excess waters, unused sample/core, and entrained solids as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

9. If constructing a monitoring well, follow the Geomatrix Field Operating Procedure for Monitoring Well Construction for Sonic Boreholes.

SONIC DRILLING AND SOIL SAMPLING PROCEDURES

10. All boreholes not used for well installation will be promptly sealed as described in the Geomatrix Field Operating Procedure for Sealing of Boreholes.

Other Procedural Issues:

- Borings will not be overdrilled (rat holed) without the express permission of the Geomatrix field supervisor.
- All depth measurements should be accurate to the nearest 0.1 foot, to the extent practicable.

SEALING OF BOREHOLES

PURPOSE

This guideline presents a method for sealing a borehole that will not be used for well construction, after the conclusion of drilling, sampling, and logging. This is performed to remove, to the extent practicable, the formation of preferential vertical flow paths.

PROCEDURE

The following procedure will be used to seal a borehole using hollow-stem auger or sonic methods and equipment.

1. Begin with the augers or casing at total depth.

2. Mix grout to a smooth consistency using a centrifugal or reciprocating pump. Do not hand mix. All water used must be potable quality. Record the volume of cement, additives (e.g. bentonite), and water used. Measure the field density of each batch of grout using a mud scale or equivalent method.

3. Fill the auger stem or casing with grout. Filling will be performed using tremie pipe if more than approximately 1 foot of water is present in the annular space. Otherwise, the space may be filled by surface pouring or pumping from the surface. If the tremie method is used, measure the field density of grout returns using a mud scale or equivalent method.

4. With grout standing within the auger stem or casing, begin withdrawal of the augers or casing string. Periodically top the auger stem or casing off with additional grout. Collect representative samples of each batch of grout in labeled cups or jars, and set aside to verify grout set. Document later checking of these samples in field notes.

5. When the auger stem or casing string is completely withdrawn from the borehole, place drums or barricades around the well for protection while the grout cures.

6. Leave the borehole undisturbed for at least 24 hours to allow the grout to cure. If excessive grout fallback occurs, top off as necessary with bentonite chips or additional grout.

Manage all drill cuttings, drilling mud, wash waters, and entrained solids as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

MONITORING WELL CONSTRUCTION FOR SONIC BOREHOLES

PURPOSE

Wells will be installed within selected boreholes for the purpose of evaluating groundwater characteristics. Well installation procedures depend upon the drilling method. This procedure describes well construction and installation for boreholes drilled using the sonic method. Refer to the Geomatrix Field Operating Procedure for Sonic Drilling Procedures. Nominal dimensions and materials for the well are shown in the Monitoring Well Construction Diagram included with this FOP section.

PROCEDURE

1. Advance borehole in accordance with the Geomatrix Field Operating Procedure for Sonic Drilling Procedures to the required depth. The nominal inside diameter (ID) of the outer drive casing used should be approximately 4 inches or more larger than the outside diameter (OD) of the riser and screen selected for the well installation. Record the monitoring well construction on the Log of Well Boring form (see Field Operating Procedures for Documentation Requirements of Drilling and Well Installation).

2. Remove the inner drive casing or sampling tools from the outer casing and verify borehole depth using weighted measuring tape.

3. In the event of an overdrill (i.e. borehole depth is more than one foot greater than desired base of screen depth), use bentonite chips poured through the auger stem to seal the overdrilled portion of the borehole.

4. Add a maximum of 6 inches of filter pack material through the auger stem to the base of the borehole. (Note: This step may be avoided if dense non-aqueous phase liquids are suspected to be present and it is desirable to have the screen at the base of the borehole.)

5. Measure the length of the well string (i.e. riser and screen), and lower the well string into the well assembly to the desired depth. All measurements during the well installation process will be accurate to 0.1 foot.

6. Surface pour filter pack material into the annulus between the well and the outer casing as the casing is gradually withdrawn from the borehole. Use a weighted tape to confirm that the level of sand is maintained within the casing at all times. Record material volumes used.

MONITORING WELL CONSTRUCTION FOR SONIC BOREHOLES

7. After filter pack materials are brought to the required level, surface pour bentonite chips or pellets into the annulus between the well and the casing to form the filter pack seal. If necessary to avoid bridging, delayed hydration (coated) pellets may be used. Record the volume of material used.

8. Allow the bentonite to adequately hydrate, preferably through absorption of natural (formation) waters. Add potable water if necessary to promote hydration. Track any volumes of water used. Cap or cover the upper end of the well.

9. Mix grout to a smooth consistency using a centrifugal or reciprocating pump. Do not hand mix. All water used must be potable quality. Record the volume of cement, additives (e.g. bentonite), and water used. Measure the field density of each batch of grout using a mud scale or equivalent method.

10. Fill the remaining annulus between the well and the casing with grout. Filling will be performed using tremie pipe if more than approximately 1 foot of water is present in the annular space. Otherwise, the space may be filled by surface pouring or pumping from the surface. If the tremie method is used, measure the field density of grout returns using a mud scale or equivalent method.

11. With grout standing within the annular space, begin withdrawal of the casing string. Periodically top the casing off with additional grout.

12. When the casing string is withdrawn either to its final position or from the borehole, center the upper portion of the well riser within the borehole or casing, and place drums or barricades around the well for protection while the grout cures. Place and lock a security cap in the opening of the well riser.

13. Leave the well undisturbed for at least 24 hours to allow the grout to cure. If excessive grout fallback occurs, top off as necessary with bentonite chips or additional grout.

14. Construct the surface completion as shown in the Monitoring Well Construction Diagram included with this FOP section. Select flush completions for all locations in active operational or high traffic areas, or in other areas where an above grade completion would be undesirable. Use aboveground completions in all other areas.

15. Place a dedicated lock on the well or protective casing, and keep well locked when not actively attended.

16. Permanently mark a survey location on the north side at the top of the casing with a cut. Survey all wells for horizontal location and elevation, using a surveyor licensed by the State

of Ohio. Coordinates and elevations will be provided in a coordinate system consistent with previous well surveys at the Morton Plant. Information obtained will include location (x and y) of the well, and elevation (z) of the ground surface, the pad, and the top of riser.

17. Develop the well as described in the Geomatrix Field Operating Procedure for Monitoring Well Development.

18. Manage all waste materials generated during well installation and development as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
Morton International, Inc.
RCRA Facility Investigation of Reading, Ohio, Facility

MONITORING WELL DEVELOPMENT

PURPOSE

This procedure describes the methods for the development of wells. Wells are developed after installation in order to remove introduced water and drilling fluids, reduce the turbidity of the water, and improve the hydraulic communication between the well and the water-bearing formation. Well development will not commence until the annular grout seal has cured, but will be performed within ten calendar days of well installation.

PROCEDURE

1. All well development will include surge blocking or false bailing with one or more of the following fluid removal methods. Well development activities may include:

   - Bailing
   - Air Lifting
   - Submersible Pumping
   - Other methods as approved by the Geomatrix Field Team Leader.

   The appropriate water removal method will be selected based on water level depth and anticipated well productivity.

2. Assemble and decontaminate equipment (if necessary), and place it in the well. Reference the Geomatrix Field Operating Procedure for Drilling and Excavation Equipment Decontamination.

3. Alternate the use of agitation methods with water removal methods, using the former to suspend solids in the well water, and the latter to remove the turbid water. For example, use a vented surge block to agitate the well, moving up and down within the screened interval, then use a pump to clear the well. A bailer may be used for both purposes, by surging with the bailer (false bailing) for a period within the screened interval, then bailing a volume of water from the well.

4. When using surging methods, initiate this activity gradually, with short (2 to 3 feet) strokes. After several passes across the screened interval, increase the speed and length of the surge strokes.

MONITORING WELL DEVELOPMENT

5. Continue development until the following objectives are achieved:

    - Field parameters (pH, specific conductance, temperature) stabilize. Fluctuations beyond 10 percent above or below a mean value will not be considered stable.

    - The well will generate non-turbid water during continued pumping. A turbidity level of 5 nephelometric turbidity units (NTU) will be used as a general target, but will not be considered a rigid standard, since many wells cannot achieve that level of clarity.

    - In the case of mud-rotary drilled wells, the volume of water removed exceeds twice the volume of water lost to the formation during the drilling process, as indicated by the water balance. For all wells, a volume of water equivalent to at least two well volumes (casing plus filter pack porosity volume) will be removed, provided the well has adequate yield to support this removal volume.

6. Document the development methods, volumes, field parameter measurements, and other observations on the attached Geomatrix Well Development Record form (see Field Operating Procedures for Documentation Requirements of Drilling and Well Installation).

GEOMATRIX CONSULTANTS, INC.
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SPLIT-SPOON SAMPLING

PURPOSE

This guideline presents the methods for using a split-spoon sampler for collecting soil samples from a boring and for estimating the relative in-situ compressive strength of subsurface materials (ASTM D 1586). Representative samples for lithologic description, geochemical analysis, and geotechnical testing will be collected from the subsurface materials using the split-spoon sampler.

PROCEDURE

1. Place plastic sheeting on a sturdy surface to prevent the split-spoon and its contents from coming in contact with the surface (several layers of sheeting may be placed on the surface so that they may be removed between each sample or as needed).

2. Line the split-spoon sampler with brass or stainless steel liners, unless otherwise specified by the Geomatrix field supervisor.

3. Lower the sampling string to the base of the borehole. Measure the portion of the sampling string that extends above surrounding grade (i.e. the stickup). The depth of sampling will equal the total length of the string (sampler plus rods) minus the stickup length.

4. Measure sampling depths to an accuracy of 0.1 feet. If field measurements indicate the presence of more than 0.3 feet of disturbed materials in the base of the borehole (i.e. slough), the sampler will be used to remove this material, after which a second sampling trip will be made.

5. Select additional sampler components as required (i.e., leaf spring core retainer for clays or a sand trap for non-cohesive sands). If a retainer or trap is not used, a spacer ring will be used to hold the liners in position inside the sampler.

6. For driving samples, attach the drive head sub and hammer to the drill rods without the weight resting on the rods. For pushing samples using the rig hydraulics, skip to Step 10.

7. Mark four 6-inch intervals on the drill rods relative to a reference point on the drill rig. With the sampler resting on the bottom of the hole, drive the sampler with the 140 lb. hammer falling freely over a 30-inch fall until 24 inches have been penetrated or 50 blows applied.

SPLIT-SPOON SAMPLING

8. Record the number of blows per 6 inches. Determine the "N" value by adding the blows for the 6 to 12-inch and 12 to 18-inch intervals of each sample drive.

9. After penetration is complete, remove the sampling string. If sample retention has been poor, let the sampling string rest in place for at least 3 minutes, then rotate clockwise at least 3 times before removing from the borehole.

10. For pushed samples, mark four 6-inch intervals on the drill rods relative to a reference point on the rig. Use the rig pulldown to press the sampler downward until 24 inches have been penetrated or no further progress can be made with the full weight of the rig on the sampler.

11. Remove the split-spoon sampler from the sampling string and place on the plastic-covered surface.

12. Open the split-spoon sampler only when the Geomatrix field geologist is prepared to describe and manage the sample.

13. Describe the sample in accordance with the Unified Soil Classification System, using the Geomatrix Boring Log (see Field Operating Procedures for Documentation Requirements for Drilling and Well Installation).

14. Collect a portion of the sample for field screening as described in the Geomatrix Field Operating Procedure for Soil Sample Field Screening Using an Organic Vapor Meter.

15. If applicable, collect soil samples for volatile organic constituents (VOCs) from the end of a selected metal liner using the EnCore Sampler (reference Geomatrix Field Operating Procedure for Handling Soils for Volatile Organic Analysis). If applicable, select metal liners for semivolatile, metals, geotechnical, or other off-site analysis. Seal and manage these liners as specified in the pertinent Geomatrix Field Operating Procedure.

16. Label, store, and manage the sample as described in the Geomatrix Field Operating Procedure for Sample Management.

17. Manage the unused portion of the sample as described in Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

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SOIL SAMPLE FIELD SCREENING USING AN ORGANIC VAPOR METER

PURPOSE

This procedure is used to screen soil samples for the presence of volatile organic constituents (VOCs) using a field organic vapor meter. These meters will be either photoionization detector (PID) or flame-ionization detector (FID) type. This screening is performed at the drilling and sampling location as a procedure for ensuring the health and safety of personnel at the site and to identify potentially contaminated soil samples for laboratory analysis. All soil samples will be field screened.

PROCEDURE

1. When the split-spoon or other sampler is opened or accessed, shave a thin layer of material from the entire length of the core. Scan the core visually and with the PID or FID noting stratification, visible staining, or other evidence of contamination. Based on this initial scan of the sample, collect approximately 100 milliliters (ml) of soil using a decontaminated stainless steel spatula, scoop, or equivalent. Place this soil into a clean, re-sealable plastic bag and seal the bag.

2. Place field screening sample bag in a location where the ambient temperature is at least 70° Fahrenheit.

3. Leave the field screening sample bag for at least 30 minutes, but no more than 60 minutes.

4. Carefully unseal a portion of the plastic bag just big enough to insert the probe of a calibrated FID or PID.

5. Record the maximum reading in parts per million by volume (ppmv) on the Boring Log form (Field Operation Procedures for Documentation Requirements for Drilling and Well Installation), at the depth interval corresponding to the depth of sample collection.

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SOIL SAMPLE HANDLING FOR VOLATILE ORGANIC CONSTITUENT (VOC) ANALYSIS

PURPOSE

This procedure describes the methods for collecting soil samples for VOC analysis to ensure that the sample adequately represents the VOC concentrations in the soil. These compounds tend to volatilize from the soil after disturbance or introduction to the atmosphere. Therefore, care must be exercised to ensure that the sample collected is not altered during the collection and storage procedures.

PROCEDURE

1. The preferred method for collecting and storing a soil sample for VOC analysis is using the EnCore™ method. The manufacturers' directions are attached.

2. Ensure that the EnCore™ Sampler is present at the sampling location before collecting the sample from the borehole or surface sample location. The necessary parts of the EnCore™ Sampler will consist of three disposable coring bodies, three disposable caps, and a reusable stainless steel tee handle.

3. Retrieve the sampling tool from the borehole or sample location.

4. Expose a surface of the soil sample. For Shelby tube samples, this would require the extrusion of the sample. For split spoon samples, this would require the spoon be disassembled and opened. If liners are being used in conjunction with a split spoon or solid barrel sampler, this would require the removal of the liners from the sampler, so that the soil at the liner's end is exposed.

5. Following the manufacturer's directions for the use of the EnCore™ Sampler (attached), collect three aliquots of soil from the exposed soil surface, using the three coring bodies. After the collection of each aliquot, cap and label each aliquot. The manufacturer's direction for use of the EnCore™ Sampler are attached

6. If the use of the EnCore™ Sampler is not possible due to soil texture (e.g. gravels) the sample must be field preserved with acid and methanol. The procedure for field preservation of soil samples is attached.

7. If the soil material is too coarse for sampling with the EnCore™ Sampler <u>and</u> contains excessive calcium carbonate material that reacts with the acid preservative, the sample will

SOIL SAMPLE HANDLING FOR VOLATILE ORGANIC CONSTITUENT (VOC) ANALYSIS

be retained in the brass or stainless steel liner of the split-spoon sampler or similar device. The ends of these liners will be covered with Teflon™ rounds, capped and sealed with tape.

8. Label, store, and ship all samples in accordance with the Geomatrix Field Operations Procedures.

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FIELD OPERATING PROCEDURE
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LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER PURGING PROCEDURES

PURPOSE

This procedure describes the methods used for performing low flow purging, also referred to as micro-purging, at a well prior to groundwater sampling to obtain a representative sample from the water-bearing zone. This method of purging is used to minimize the turbidity of the produced water. This may increase the representativeness of the groundwater samples by avoiding the necessity of filtering suspended solids in the field prior to preservation of the sample.

Well purging is typically performed immediately preceding groundwater sampling. The sample should be collected as soon as the parameters measured in the field (i.e., pH, specific conductance, dissolved oxygen, temperature, and turbidity) have stabilized.

PROCEDURE

1. Unlock and remove the protective cap or cover and place on clean plastic.

2. Monitor the top of the well casing for organic vapors using a photoionization detector or flame ionization detector. If a reading of greater than 5 parts per million by volume (ppmv) is recorded, the well should be allowed to vent until levels drop below 5 ppmv before proceeding with purging.

3. Decontaminate all equipment (Reference the Geomatrix Field Operating Procedure for Sampling Equipment Decontamination).

4. Measure the static water level (Reference the Geomatrix Field Operating Procedure for Groundwater Level Measurement). Refer to the construction diagram for the well to identify the screened depth.

5. Lower the purge pump (typically a low-flow electrical submersible) <u>slowly</u> into the well until the pump intake is approximately in the middle of the screened interval. Rapid insertion of the pump will increase the turbidity of well water, and can increase the required purge time.

LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER PURGING PROCEDURES

6. Begin pumping to purge the well. The pumping rate should be bellow 1000 milliliters (ml) per minute. Periodically check the well water level with the e-line. If the well level appears to be more than 2 feet below static and declining, slow the purge rate until the water level generally stabilizes.

7. Measure field parameters (pH, specific conductance, dissolved oxygen (DO), temperature, and turbidity). In lieu of measuring all of the parameters, a minimum subset could be limited to pH, specific conductance, and turbidity or DO. An in-line flow through cell to continuously measure the above parameters may be used. The in-line device should be disconnected or bypassed during sample collection.

8. Record well purging and sampling data in the Project Field Book or on the attached "Well Development/Purging Log" and "Well Sampling Field Data Sheet" forms. Measurements should be taken approximately every three to five minutes, or as merited given the rapidity of change.

9. Purging is complete when field parameters stabilize. Stabilization is achieved after all field parameters have stabilized for three successive readings. Three successive readings should be within ± 0.2 units for pH, ±10% for specific conductance, and ±10% for turbidity and dissolved oxygen.

10. Sample the well as discussed in the Geomatrix Field Operating Procedure for Groundwater Sampling of Monitoring Wells.

11. Restore the well to its capped/covered and locked condition.

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FIELD OPERATING PROCEDURE
Morton International, Inc.
RCRA Facility Investigation of Reading, Ohio, Facility

GROUNDWATER SAMPLE COLLECTION

PURPOSE

This procedure describes the methods for collecting water samples from monitoring wells. It also includes the order in which water samples are collected based on the suite of analytical parameters required.

PROCEDURE

1. Purge the monitoring well in accordance with the Geomatrix Field Operation Procedures for Low Flow Groundwater Purging Procedures.

2. Sampling equipment that is not disposable or dedicated to the well will be decontaminated in accordance with the Geomatrix Field Operating Procedures.

3. Groundwater samples will be collected directly from the sampling valve on the flow through cell. In low-yielding wells at which the flow through cell is not used, the samples may be collected using a disposable bailer.

4. Sampling data will be recorded on a Well Sampling Form (example attached).

5. Samples will be collected in the order designated below and in the sample containers supplied by the laboratory for the specified analytes.

6. The samples will be labeled, stored and shipped in accordance with the Geomatrix Field Operating Procedures for Sample Labeling, Storage, and Shipment.

All groundwater samples, from monitoring wells and domestic supply wells, will be collected in accordance with the following.

1. Samples will be collected preferentially in recognition of volatilization sensitivity. The preferred order of sampling is:

   - Volatile organics
   - Total Organic Carbon (TOC)
   - Extractable organics
   - Total metals
   - Phenols

GROUNDWATER SAMPLE COLLECTION

- Cyanide
- Sulfate and chloride
- Turbidity
- Nitrate and ammonia

2. Document the sampling procedures on the attached Well Sampling and Development Record.

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FIELD OPERATING PROCEDURE
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SEDIMENT SAMPLING FROM CREEK/RIVER BANKS OR CREEK/RIVER BEDS (Revised November 2003)

PURPOSE

This guideline presents methods for collection of two types of sediment samples:

Creek/river bank samples from along the margins of the water edge.

Creek/river bed samples from sediments from the floor of the water body.

PROCEDURE - CREEK/RIVER BANK SEDIMENTS

1. Decontaminate sampling tools - stainless steel trowels and bowls.
2. Scrape off the top few inches of sediment from the sample location to expose undisturbed sediments.
3. Collect a grab sample using a freshly decontaminated stainless steel trowel.
4. Transfer contents to a clean stainless steel bowl or directly into the pre-cleaned sample jars using a stainless steel trowel.
5. Follow procedures for EnCore™ sample collection consistent with the Field Operating Procedure for Soil Sampling Handling for Volatile Organic Constituent analysis. For sediment samples, it may be necessary to manually pack a portion of the sample aliquot into the Encore™ sample vials.
6. Continue the sample procedure as necessary immediately adjacent to the previous sampling point until adequate sample volume is obtained to fill all of the necessary sample jars.
7. All manual contact with sediments will be performed using new disposable nitrile loves.
8. Follow Geomatrix Field Operating Procedures for Non-Disposable and Non-Dedicated Equipment Decontamination and Sample, Labeling, Storage and Shipment

SEDIMENT SAMPLING FROM CREEK/RIVER BANKS OR CREEK/RIVER BEDS (Revised November 2003)

PROCEDURE - CREEK/RIVER BED SEDIMENTS

1. This procedure will require two or three personnel. Personnel entering the water body must be properly attired with appropriate safety equipment. Refer to the project Health and Safety Plan for specific requirements. At least one person will remain out of the water to provide support and handle the samples as they are collected by the entry personnel.

2. Assemble the decontaminated sampler(s), which will consist of a polyethylene scoop with an extension handle. The design of the sample can be modified as deemed necessary based on field conditions.

3. To the extent practicable, collect samples from downstream locations first and work upstream, to minimize impacts of sampling on downstream water quality.

4. Slowly scoop a sample from the sediment bed and bring to the surface. Transfer the sample to a stainless steel bowl and continue collection within the same area until sufficient sediment has been collected for laboratory analysis.

5. Personnel on the creek bank will use decontaminated stainless steel trowels and tools to transfer the sediment into the appropriate pre-cleaned sample jars.

6. Follow procedures for EnCore™ sample collection consistent with the Field Operating Procedure for Soil Sampling Handling for Volatile Organic Constituent analysis. For sediment samples, it may be necessary to manually pack a portion of the sample aliquot into the EnCore™ sample vials.

7. All manual contact with sediments will be performed using new disposable nitrile gloves.

8. Follow Geomatrix Field Operating Procedures for Non-disposable and Non-Dedicated Equipment Decontamination and Sample, Labeling, Storage and Shipment.

Record pertinent information for the sample in the Project Field Notebook in accordance with the Geomatrix Field Operating Procedures for Documentation Requirements. Documented information should include a description of sediment physical characteristics, such as soil type (e.g., clay, silt, gravel), consistency, and color. If the sediment sampling is performed at the location of a pertinent feature, such as a spring, seep, channel, or outfall, include a drawing showing the size, position, etc. of this feature, and the relative location of the sample.

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
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RCRA Facility Investigation of Reading, Ohio, Facility

SURFACE WATER SAMPLING

This procedure describes a method for collecting surface water samples from creeks, streams, rivers or other water bodies. Sediment samples will be collected in conjunction with surface water samples if site-specific work plan requires. The method for collecting surface water samples uses dedicated sample containers for grab sample collection and transfer.

PROCEDURE

1. This procedure will require two or three personnel. Personnel entering the water body must be properly attired with appropriate safety equipment. Refer to the project Health and Safety Plan for specific requirements. At least one person will remain out of the water to provide support and handle the samples as they are collected by the entry personnel.

2. To the extent practicable, collect samples from downstream locations first and work upstream, to minimize impacts of sampling on downstream water quality. Whenever possible, samples will be collected facing upstream and upwind to minimize introduction of contaminant.

3. Surface water samples will be collected using either a grab sampling technique, or by pumping using a peristaltic or submersible pump. Rapidly immerse sample collection bottle(s) into water and cap to minimize exposure to airborne particulate matter. The volume of sample to be collected will be determined by the analytical requirements.

4. Carefully transfer surface water sample for laboratory analysis into the appropriate pre-cleaned sample bottles. All manual contact with surface water samples will be performed using new disposable nitrile gloves.

5. Fill the sample bottles for VOCs first in an effort to minimize sample volatilization.

6. Fill the sample bottles for metals. For dissolved metals, the sample will be field-filtered through a 0.4-micron, 47 mm polycarbonate Nucleopore (or equivalent) filter, as discussed in Section 6.17.2 of Method 1660, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels, July 1996. For grab samples, a vacuum filtration flask will be used for field filtration. For samples collected using a pump, the filter will be placed in line on the pump discharge sampling line.

7. Fill and securely cap the remaining sample bottles.

SURFACE WATER SAMPLING

8. Measure field parameters (i.e., pH, specific conductance, dissolved oxygen (DO), temperature, and turbidity) of the surface water. Record in the Project Field Book.

9. Label, store, and ship sample in accordance with Geomatrix Field Operating Procedures and Rohm and Haas protocols.

10. The use of dedicated sampling equipment is preferable. However, for re-usable sampling and field equipment, follow the Geomatrix Field Operating Procedures for proper decontamination.

Record available information for the surface water that was sampled, such as location, immersion depth of sampling equipment/sample bottles, physical description, field parameters in the Project Field Book in accordance with the Geomatrix Field Operating Procedures for Documentation Requirements. Approximate sampling points should be identified on a sketch of the water body.

APPENDIX B

TARGET ANALYTE LISTS, ANALYTICAL METHOD, AND SAMPLE PRESERVATION AND BOTTLE REQUIREMENTS

CONTRACT LABORATORY PROGRAM TARGET ANALYTE LIST (CLP-TAL)
VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin
TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Inorganic Constituents		
Aluminum	(Total)	6010B
Antimony	(Total)	6010B
Arsenic	(Total)	6010B
Barium	(Total)	6010B
Beryllium	(Total)	6010B
Cadmium	(Total)	6010B
Calcium	(Total)	6010B
Chromium	(Total)	6010B
Cobalt	(Total)	6010B
Copper	(Total)	6010B
Cyanide	57-12-5	9012A
Iron	(Total)	6010B
Lead	(Total)	6010B
Magnesium	(Total)	6010B
Manganese	(Total)	6010B
Mercury	(Total)	7471A/7470A
Nickel	(Total)	6010B
Potassium	(Total)	6010B
Selenium	(Total)	6010B
Silver	(Total)	6010B
Sodium	(Total)	6010B
Sulfide	18496-25-8	376.1
Tin	(Total)	6010B
Thallium	(Total)	6010B
Vanadium	(Total)	6010B
Zinc	(Total)	6010B
Volatile Organic Constituents		
Acetone	67-64-1	8260B
Benzene	71-43-2	8260B
Bromochloromethane	74-97-5	8260B
Bromodichloromethane	75-27-4	8260B
Bromoform; Tribromomethane	75-25-2	8260B
Bromomethane; Methyl bromide	74-83-9	8260B
Carbon disulfide	75-15-0	8260B
Carbon tetrachloride	56-23-5	8260B
Chlorobenzene	108-90-7	8260B
Chloroethane; Ethyl chloride	75-00-3	8260B
Chloroform	67-66-3	8260B
Cyclohexane	110-82-7	8260B
Dibromochloromethane; Chlorodibromomethane	124-48-1	8260B
1,2-Dibromo-3-chloropropane; DBCP	96-12-8	8260B
1,2-Dibromoethane; Ethylene dibromide (EDB)	106-93-4	8260B
Dichlorodifluoromethane	75-71-8	8260B
1,1-Dichloroethane (1,1-DCA)	75-34-3	8260B
1,2-Dichloroethane; Ethylene dichloride	107-06-2	8260B
1,1-Dichloroethene; 1,1-Dichloroethylene; Vinylidene chloride	75-35-4	8260B
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2	8260B
trans-1,2-Dichloroethene; trans-1,2-Dichloroethylene	156-60-5	8260B
1,2-Dichloropropane	78-87-5	8260B
cis-1,3-Dichloropropene	10061-01-5	8260B

CONTRACT LABORATORY PROGRAM TARGET ANALYTE LIST (CLP-TAL)
VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin
TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
trans-1,3-Dichloropropene	10061-02-6	8260B
Ethylbenzene	100-41-4	8260B
2-Hexanone	591-78-6	8260B
Isopropylbenzene; cumene	98-82-8	8260B
Methyl acetate	79-20-9	8260B
Methyl chloride; Chloromethane	74-87-3	8260B
Methyl cyclohexane	108-87-2	8260B
Methylene chloride; Dichloromethane	75-09-2	8260B
Methyl ethyl ketone; 2-Butanone; MEK	78-93-3	8260B
4-Methyl-2-pentanone; Methyl isobutyl ketone (MIBK)	108-10-1	8260B
Methyl tert-butyl ether	1634-04-4	8260B
Styrene	100-42-5	8260B
1,1,2,2-Tetrachloroethane	79-34-5	8260B
Tetrachloroethylene; Perchloroethylene; Tetrachlorethene (PCE)	127-18-4	8260B
Toluene	108-88-3	8260B
1,1,1-Trichloroethane; Methylchloroform	71-55-6	8260B
1,1,2-Trichloroethane	79-00-5	8260B
Trichloroethylene; Trichloroethene	79-01-6	8260B
Trichlorofluoromethane	75-69-4	8260B
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	8260B
Vinyl chloride	75-01-4	8260B
Xylene (total)	1330-20-7	8260B
Semivolatile Organic Constituents		
Acenaphthene	83-32-9	8270C
Acenaphthylene	208-96-8	8270C
Acetophenone	98-86-2	8270C
Aniline	62-53-3	8270C
Anthracene	120-12-7	8270C
Atrazine	1912-24-9	8270C
Benzaldehyde	100-52-7	8270C
Benzo[a]anthracene; Benzanthracene	56-55-3	8270C
Benzo[b]fluoranthene	205-99-2	8270C
Benzo[k]fluoranthene	207-08-9	8270C
Benzo[ghi]perylene	191-24-2	8270C
Benzo[a]pyrene	50-32-8	8270C
1,1'-Biphenyl	92-52-4	8270C
Bis(2-chloroethoxy)methane	111-91-1	8270C
Bis(2-chloroethyl)ether	111-44-4	8270C
Bis(2-ethylhexyl) phthalate	117-81-7	8270C
4-Bromophenyl phenyl ether	101-55-3	8270C
Butyl benzyl phthalate; Benzyl butyl phthalate	85-68-7	8270C
Caprolactam	105-60-2	8270C
Carbazole	86-74-8	8270C
4-Chloroaniline; p-Chloroaniline	106-47-8	8270C
4-Chloro-3-methylphenol; p-Chloro-m-cresol	59-50-7	8270C
2-Chloronaphthalene	91-58-7	8270C
2-Chlorophenol	95-57-8	8270C
4-Chlorophenyl phenyl ether	7005-72-3	8270C
Chrysene	218-01-9	8270C
o-Cresol; 2-Methylphenol	95-48-7	8270C
p-Cresol; 4-Methylphenol	106-44-5	8270C

CONTRACT LABORATORY PROGRAM TARGET ANALYTE LIST (CLP-TAL)
VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin
TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Dibenz[a,h]anthracene	53-70-3	8270C
Dibenzofuran	132-64-9	8270C
Di-n-butyl phthalate	84-74-2	8270C
1,2-Dichlorobenzene; o-Dichlorobenzene	95-50-1	8270C
1,3-Dichlorobenzene; m-Dichlorobenzene	541-73-1	8270C
1,4-Dichlorobenzene; p-Dichlorobenzene	106-46-7	8270C
3,3'-Dichlorobenzidine	91-94-1	8270C
2,4-Dichlorophenol	120-83-2	8270C
Diethyl phthalate	84-66-2	8270C
2,4-Dimethylphenol	105-67-9	8270C
Dimethyl phthalate	131-11-3	8270C
4,6-Dinitro-2-methylphenol; 4,6-Dinitro-o-cresol	534-52-1	8270C
2,4-Dinitrophenol	51-28-5	8270C
2,4-Dinitrotoluene	121-14-2	8270C
2,6-Dinitrotoluene	606-20-2	8270C
Di-n-octyl phthalate	117-84-0	8270C
Fluoranthene	206-44-0	8270C
Fluorene	86-73-7	8270C
Hexachlorobenzene	118-74-1	8270C
Hexachlorobutadiene	87-68-3	8270C
Hexachlorocyclopentadiene	77-47-4	8270C
Hexachloroethane	67-72-1	8270C
Indeno(1,2,3-cd)pyrene	193-39-5	8270C
Isophorone	78-59-1	8270C
2-Methylnaphthalene	91-57-6	8270C
Naphthalene	91-20-3	8270C
2-Nitroaniline; o-Nitroaniline	88-74-4	8270C
3-Nitroaniline; m-Nitroaniline	99-09-2	8270C
4-Nitroaniline; p-Nitroaniline	100-01-6	8270C
Nitrobenzene	98-95-3	8270C
2-Nitrophenol; o-Nitrophenol	88-75-5	8270C
4-Nitrophenol; p-Nitrophenol	100-02-7	8270C
N-Nitrosodiphenylamine	86-30-6	8270C
N-Nitrosodi-n-propylamine; N-Nitrosodipropylamine; Di-n-propylnitrosamine	621-64-7	8270C
2,2'-Oxybis(1-chloropropane)	108-60-1	8270C
Pentachlorophenol	87-86-5	8270C
Phenanthrene	85-01-8	8270C
Phenol	108-95-2	8270C
Pyrene	129-00-0	8270C
1,2,4-Trichlorobenzene	120-82-1	8270C
2,4,5-Trichlorophenol	95-95-4	8270C
2,4,6-Trichlorophenol	88-06-2	8270C
Polychlorinated Biphenyl Aroclors		
Aroclor 1016	12674-11-2	8082
Aroclor 1221	11104-28-2	8082
Aroclor 1232	11141-16-5	8082
Aroclor 1242	53469-21-9	8082
Aroclor 1248	12672-29-6	8082
Aroclor 1254	11097-69-1	8082
Aroclor 1260	11096-82-5	8082
Organochlorine Pesticides		

CONTRACT LABORATORY PROGRAM TARGET ANALYTE LIST (CLP-TAL)
VOCs, SVOCs + Aniline, Pesticides, PCBs, Metals + Tin
TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Aldrin	309-00-2	8081A
alpha-BHC	319-84-6	8081A
beta-BHC	319-85-7	8081A
delta-BHC	319-86-8	8081A
gamma-BHC (Lindane)	58-89-9	8081A
alpha-Chlordane	5103-71-9	8081A
gamma-Chlordane	5103-74-2	8081A
4,4'-DDD	72-54-8	8081A
4,4'-DDE	72-55-9	8081A
4,4'-DDT	50-29-3	8081A
Dieldrin	60-57-1	8081A
Endosulfan I	959-98-8	8081A
Endosulfan II	33213-65-9	8081A
Endosulfan sulfate	1031-07-8	8081A
Endrin	72-20-8	8081A
Endrin aldehyde	7421-93-4	8081A
Endrin ketone	53494-70-5	8081A
Heptachlor	76-44-8	8081A
Heptachlor epoxide	1024-57-3	8081A
Methoxychlor	72-43-5	8081A
Toxaphene	8001-35-2	8081A

Notes:

1 Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2 Chemical Abstracts Service registry number (CAS RN). Where "Total" is entered, all species that contain this element are included.

3 Analytical methods refer to analytical procedure numbers used in the U.S. Environmental Protection Agency (USEPA) publication, SW-846, "Test Methods for Evaluating Solid Waste," Current Edition.

Contract Laboratory Program Target Analyte List developed from the USEPA Superfund Contract Laboratory Program. Available from Internet url: http://www.epa.gov/superfund/programs/clp/target.htm

APPENDIX IX TARGET ANALYTE LIST (APP IX-TAL)
VOCs, SVOCs, Pesticides, PCBs, Metals + Tin
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Inorganic Constituents		
Antimony	(Total)	6010B
Arsenic	(Total)	6010B
Barium	(Total)	6010B
Beryllium	(Total)	6010B
Cadmium	(Total)	6010B
Chromium	(Total)	6010B
Cobalt	(Total)	6010B
Copper	(Total)	6010B
Cyanide	57-12-5	9012A
Lead	(Total)	6010B
Mercury	(Total)	7471A/7470A
Nickel	(Total)	6010B
Selenium	(Total)	6010B
Silver	(Total)	6010B
Sulfide	18496-25-8	376.1
Tin	(Total)	6010B
Thallium	(Total)	6010B
Vanadium	(Total)	6010B
Zinc	(Total)	6010B
Volatile Organic Constituents		
Acetone	67-64-1	8260B
Acetonitrile; Methyl cyanide	75-05-8	8260B
Acrolein	107-02-8	8260B
Acrylonitrile	107-13-1	8260B
Benzene	71-43-2	8260B
Bromodichloromethane	75-27-4	8260B
Bromoform; Tribromomethane	75-25-2	8260B
Bromomethane; Methyl bromide	74-83-9	8260B
Carbon disulfide	75-15-0	8260B
Carbon tetrachloride	56-23-5	8260B
Chlorobenzene	108-90-7	8260B
Chloroethane; Ethyl chloride	75-00-3	8260B
Chloroform	67-66-3	8260B
Chloroprene	126-99-8	8260B
3-Chloropropene; 3-Chloro-1-propene; Allyl chloride	107-05-1	8260B
Dibromochloromethane; Chlorodibromomethane	124-48-1	8260B
1,2-Dibromo-3-chloropropane; DBCP	96-12-8	8260B
1,2-Dibromoethane; Ethylene dibromide (EDB)	106-93-4	8260B
Dibromomethane; Methylene bromide	74-95-3	8260B
trans-1,4-Dichloro-2-butene	110-57-6	8260B
Dichlorodifluoromethane	75-71-8	8260B
1,1-Dichloroethane (1,1-DCA)	75-34-3	8260B
1,2-Dichloroethane; Ethylene dichloride	107-06-2	8260B
1,1-Dichloroethene; 1,1-Dichloroethylene; Vinylidene chloride	75-35-4	8260B
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2	8260B
trans-1,2-Dichloroethene; trans-1,2-Dichloroethylene	156-60-5	8260B
1,2-Dichloropropane	78-87-5	8260B
cis-1,3-Dichloropropene	10061-01-5	8260B
trans-1,3-Dichloropropene	10061-02-6	8260B
Ethylbenzene	100-41-4	8260B

APPENDIX IX TARGET ANALYTE LIST (APP IX-TAL)
VOCs, SVOCs, Pesticides, PCBs, Metals + Tin
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Ethyl methacrylate	97-63-2	8260B
2-Hexanone	591-78-6	8260B
Isobutyl alcohol	78-83-1	8260B
Methacrylonitrile	126-98-7	8260B
Methyl chloride; Chloromethane	74-87-3	8260B
Methylene chloride; Dichloromethane	75-09-2	8260B
Methyl ethyl ketone; 2-Butanone; MEK	78-93-3	8260B
Methyl iodide; Iodomethane	74-88-4	8260B
Methyl methacrylate	80-62-6	8260B
4-Methyl-2-pentanone; Methyl isobutyl ketone (MIBK)	108-10-1	8260B
Propionitrile; Ethyl cyanide	107-12-0	8260B
Styrene	100-42-5	8260B
1,1,1,2-Tetrachloroethane	630-20-6	8260B
Tetrachloroethylene; Perchloroethylene; Tetrachlorethene (PCE)	127-18-4	8260B
Toluene	108-88-3	8260B
1,1,1-Trichloroethane; Methylchloroform	71-55-6	8260B
1,1,2-Trichloroethane	79-00-5	8260B
Trichloroethylene; Trichloroethene	79-01-6	8260B
Trichlorofluoromethane	75-69-4	8260B
1,2,3-Trichloropropane	96-18-4	8260B
Vinyl acetate	108-05-4	8260B
Vinyl chloride	75-01-4	8260B
Xylene (total)	1330-20-7	8260B
Semivolatile Organic Constituents		
Acenaphthene	83-32-9	8270C
Acenaphthylene	208-96-8	8270C
Acetophenone	98-86-2	8270C
2-Acetylaminofluorene; 2-AAF	53-96-3	8270C
4-Aminobiphenyl	92-67-1	8270C
Aniline	62-53-3	8270C
Anthracene	120-12-7	8270C
Aramite	140-57-8	8270C
Benzo[a]anthracene; Benzanthracene	56-55-3	8270C
Benzo[b]fluoranthene	205-99-2	8270C
Benzo[k]fluoranthene	207-08-9	8270C
Benzo[ghi]perylene	191-24-2	8270C
Benzo[a]pyrene	50-32-8	8270C
Benzyl alcohol	100-51-6	8270C
Bis(2-chloroethoxy)methane	111-91-1	8270C
Bis(2-chloroethyl)ether	111-44-4	8270C
Bis(2-chloro-1-methylethyl) ether; 2,2-Di-chlorodiisopropyl ether	108-60-1	8270C
Bis(2-ethylhexyl) phthalate	117-81-7	8270C
4-Bromophenyl phenyl ether	101-55-3	8270C
Butyl benzyl phthalate; Benzyl butyl phthalate	85-68-7	8270C
4-Chloroaniline; p-Chloroaniline	106-47-8	8270C
Chlorobenzilate	510-15-6	8270C
4-Chloro-3-methylphenol; p-Chloro-m-cresol	59-50-7	8270C
2-Chloronaphthalene	91-58-7	8270C
2-Chlorophenol	95-57-8	8270C
4-Chlorophenyl phenyl ether	7005-72-3	8270C
Chrysene	218-01-9	8270C

APPENDIX IX TARGET ANALYTE LIST (APP IX-TAL)
VOCs, SVOCs, Pesticides, PCBs, Metals + Tin
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
m-Cresol; 3-Methylphenol	108-39-4	8270C
o-Cresol; 2-Methylphenol	95-48-7	8270C
p-Cresol; 4-Methylphenol	106-44-5	8270C
Dibenz[a,h]anthracene	53-70-3	8270C
Dibenzofuran	132-64-9	8270C
Di-n-butyl phthalate	84-74-2	8270C
1,2-Dichlorobenzene; o-Dichlorobenzene	95-50-1	8270C
1,3-Dichlorobenzene; m-Dichlorobenzene	541-73-1	8270C
1,4-Dichlorobenzene; p-Dichlorobenzene	106-46-7	8270C
3,3'-Dichlorobenzidine	91-94-1	8270C
2,4-Dichlorophenol	120-83-2	8270C
2,6-Dichlorophenol	87-65-0	8270C
Diethyl phthalate	84-66-2	8270C
O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	297-97-2	8270C
Dimethoate	60-51-5	8270C
p-(Dimethylamino)azobenzene	60-11-7	8270C
7,12-Dimethylbenz[a]anthracene	57-97-6	8270C
3,3-Dimethylbenzidine	119-93-7	8270C
alpha, alpha-Dimethylphenethylamine	122-09-8	8270C
2,4-Dimethylphenol	105-67-9	8270C
Dimethyl phthalate	131-11-3	8270C
1,2-Dinitrobenzene; o-Dinitrobenzene	528-29-0	8270C
m-Dinitrobenzene; 1,3-Dinitrobenzene	99-65-0	8270C
4,6-Dinitro-2-methylphenol; 4,6-Dinitro-o-cresol	534-52-1	8270C
2,4-Dinitrophenol	51-28-5	8270C
2,4-Dinitrotoluene	121-14-2	8270C
2,6-Dinitrotoluene	606-20-2	8270C
Di-n-octyl phthalate	117-84-0	8270C
1,4-Dioxane	123-91-1	8270C
Diphenylamine	122-39-4	8270C
Disulfoton	298-04-4	8270C
Ethyl methanesulfonate	62-50-0	8270C
Famphur	52-85-7	8270C
Fluoranthene	206-44-0	8270C
Fluorene	86-73-7	8270C
Hexachlorobenzene	118-74-1	8270C
Hexachlorobutadiene	87-68-3	8270C
Hexachlorocyclopentadiene	77-47-4	8270C
Hexachloroethane	67-72-1	8270C
Hexachloropropene	1888-71-7	8270C
Indeno(1,2,3-cd)pyrene	193-39-5	8270C
Isophorone	78-59-1	8270C
Isosafrole	120-58-1	8270C
Methapyrilene	91-80-5	8270C
3-Methylcholanthrene	56-49-5	8270C
Methyl methanesulfonate	66-27-3	8270C
2-Methylnaphthalene	91-57-6	8270C
Naphthalene	91-20-3	8270C
1,4-Naphthoquinone	130-15-4	8270C
1-Naphthylamine	134-32-7	8270C
2-Naphthylamine	91-59-8	8270C
2-Nitroaniline; o-Nitroaniline	88-74-4	8270C

APPENDIX IX TARGET ANALYTE LIST (APP IX-TAL)
VOCs, SVOCs, Pesticides, PCBs, Metals + Tin
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
3-Nitroaniline; m-Nitroaniline	99-09-2	8270C
4-Nitroaniline; p-Nitroaniline	100-01-6	8270C
Nitrobenzene	98-95-3	8270C
2-Nitrophenol; o-Nitrophenol	88-75-5	8270C
4-Nitrophenol; p-Nitrophenol	100-02-7	8270C
4-Nitroquinoline 1-oxide	56-57-5	8270C
N-Nitrosodi-n-butylamine	924-16-3	8270C
N-Nitrosodiethylamine	55-18-5	8270C
N-Nitrosodimethylamine	62-75-9	8270C
N-Nitrosodiphenylamine	86-30-6	8270C
N-Nitrosodi-n-propylamine; N-Nitrosodipropylamine; Di-n-propylnitrosamine	621-64-7	8270C
N-Nitrosomethylethylamine	10595-95-6	8270C
N-Nitrosomorpholine	59-89-2	8270C
N-Nitrosopiperidine	100-75-4	8270C
N-Nitrosopyrrolidine	930-55-2	8270C
5-Nitro-o-toluidine	99-55-8	8270C
Pentachlorobenzene	608-93-5	8270C
Pentachloronitrobenzene	82-68-8	8270C
Pentachlorophenol	87-86-5	8270C
Phenacetin	62-44-2	8270C
Phenanthrene	85-01-8	8270C
Phenol	108-95-2	8270C
p-Phenylenediamine	106-50-3	8270C
Phorate	298-02-2	8270C
2-Picoline	109-06-8	8270C
Pronamide	23950-58-5	8270C
Pyrene	129-00-0	8270C
Pyridine	110-86-1	8270C
Safrole	94-59-7	8270C
Sulfotepp; Tetraethyl dithiopyrophosphate	3689-24-5	8270C
1,2,4,5-Tetrachlorobenzene	95-94-3	8270C
2,3,4,6-Tetrachlorophenol	58-90-2	8270C
o-Toluidine	95-53-4	8270C
1,2,4-Trichlorobenzene	120-82-1	8270C
2,4,5-Trichlorophenol	95-95-4	8270C
2,4,6-Trichlorophenol	88-06-2	8270C
O,O,O-Triethyl phosphorothioate	126-68-1	8270C
1,3,5-Trinitrobenzene; sym-Trinitrobenzene	99-35-4	8270C
Polychlorinated Biphenyl Aroclors		
Aroclor 1016	12674-11-2	8082
Aroclor 1221	11104-28-2	8082
Aroclor 1232	11141-16-5	8082
Aroclor 1242	53469-21-9	8082
Aroclor 1248	12672-29-6	8082
Aroclor 1254	11097-69-1	8082
Aroclor 1260	11096-82-5	8082
Organochlorine Pesticides		
Aldrin	309-00-2	8081A
alpha-BHC	319-84-6	8081A
beta-BHC	319-85-7	8081A
delta-BHC	319-86-8	8081A

APPENDIX IX TARGET ANALYTE LIST (APP IX-TAL)
VOCs, SVOCs, Pesticides, PCBs, Metals + Tin
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
gamma-BHC (Lindane)	58-89-9	8081A
Chlordane	57-74-9	8081A
Chlorobenzilate	510-15-6	8081A
4,4'-DDD	72-54-8	8081A
4,4'-DDE	72-55-9	8081A
4,4'-DDT	50-29-3	8081A
Diallate	2303-16-4	8081A
Dieldrin	60-57-1	8081A
Endosulfan I	959-98-8	8081A
Endosulfan II	33213-65-9	8081A
Endosulfan sulfate	1031-07-8	8081A
Endrin	72-20-8	8081A
Endrin aldehyde	7421-93-4	8081A
Heptachlor	76-44-8	8081A
Heptachlor epoxide	1024-57-3	8081A
Isodrin	465-73-6	8081A
Kepone	143-50-0	8081A
Methoxychlor	72-43-5	8081A
Toxaphene	8001-35-2	8081A

Notes:

1 Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2 Chemical Abstracts Service registry number (CAS RN). Where "Total" is entered, all species that contain this element are included.

3 Analytical methods refer to analytical procedure numbers used in the U.S. Environmental Protection Agency (USEPA) publication, SW-846, "Test Methods for Evaluating Solid Waste," Current Edition.

Appendix IX Target Analyte List developed from Title 40 of the Code of Federal Regulations, Part 264, Appendix IX.

CHROMIUM SPECIATION ANALYSIS

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Total Chromium	Total	6010B
Hexavalent Chromium	18540-29-9	3060A/7196A

Notes:

1 *Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.*

2 *Chemical Abstracts Service registry number (CAS RN). Where "Total" is entered, all species that contain this element are included.*

3 *Analytical methods refer to analytical procedure numbers used in the U.S. Environmental Protection Agency (USEPA) publication, SW-846, "Test Methods for Evaluating Solid Waste," Current Edition.*

TABLE A4-2
SAMPLE CONTAINER REQUIREMENTS PER MATRIX
Morton Facility
Reading, Ohio

Parameter	Matrix	Method	Protocol	Sample Containers			Preservation	Holding Time
				Type	Required Volume	Quantity		
VOC [1]	water	8260B	SW-846	vial	40 ml	2 - 4	HCl to pH<2, Cool to 4 °C, Zero Headspace	14 days from Sample Date
SVOC [2]	water	8270C	SW-846	amber glass	1 liter	1	Cool to 4 °C	7 days from sampling to prep/ 40 days after prep to analysis.
PCBs [3]	water	8081A	SW-846	amber glass	1 liter	1	Cool to 4 °C	7 days from sampling to prep/ 40 days after prep to analysis.
Pesticides [4]	water	8082	SW-846	amber glass	1 liter	1	Cool to 4 °C	7 days from sampling to prep/ 40 days after prep to analysis.
Dioxins/Furans [5]	water	8280A	SW-846	amber glass	1 liter	2	Cool to 4 °C	30 days from sampling to prep/ 45 days after prep to analysis.
Metals [6]	water	6010B	SW-846	plastic	4 oz.	1	HNO_3 to pH<2	6 months from Sample Date
Cyanide	water	9012A	SW-846	plastic	4 oz.	1	NaOH to pH>12, Cool to 4 oC	14 days from Sample Date
Hexavalent Chromium	water	7196A	SW-846	plastic or glass	200 mL	1	Cool to 4 °C	24 hours
Mercury	water	7470A	SW-846	plastic	4 oz.	1	HNO_3 to pH<2, Cool to 4 °C	28 days from Sample Date
Chloride	water	325.3 or 300.0	40 CFR 136	plastic or glass	250 ml	1	Cool to 4 °C	28 days from Sample Date
Alkalinity [7]	water	310.1	40 CFR 136	plastic	4 oz.	1	Cool to 4 °C, Zero Headspace	14 days from Sample Date
Ammonia-Nitrogen	water	350.1	40 CFR 136	plastic	4 oz.	1	H_2SO_4 to pH<2, Cool to 4 °C	28 days from Sample Date
Nitrate/Nitrite	water	353.2	40 CFR 136	plastic	4 oz.	1	H_2SO_4 to pH<2, Cool to 4 °C	48 hours from Sample Date
Phosphate	water	365.2	40 CFR 136	glass	16 oz.	1	H_2SO_4 to pH<2, Cool to 4 °C	28 days from Sample Date
Phosphorous	water	365.2	40 CFR 136	plastic	4 oz.	1	H_2SO_4 to pH<2, Cool to 4 °C	28 days from Sample Date
Sulfide	water	376.1	40 CFR 136	plastic	16 oz.	1	NaOH, 20 drops Zinc Acetate to pH>9, Cool to 4 °C	7 days from Sample Date
TDS	water	160.1	40 CFR 136	plastic	4 oz.	1	Cool to 4 °C	7 days from Sample Date
TOC	water	415.1	40 CFR 136	plastic	4 oz.	1	H_2SO_4 to pH<2, Cool to 4 °C	28 days from Sample Date
TSS	water	160.2	40 CFR 136	plastic	16 oz.	1	Cool to 4 °C	7 days from Sample Date

TABLE A4-2
SAMPLE CONTAINER REQUIREMENTS PER MATRIX
Morton Facility
Reading, Ohio

Parameter	Matrix	Method	Protocol	Sample Containers			Preservation	Holding Time
				Type	Required Volume	Quantity		
VOC [1]	soil/sediment	8260B	SW-846	EnCore ™	4 oz.	3	Cool to 4 oC, Zero Headspace	48 hours from sampling to prep/14 days from prep to analysis
SVOC [2]	soil/sediment	8270C	SW-846	glass jar	16 oz.	3	Cool to 4 °C	14 days from sampling to prep/40 days from prep to analysis
PCBs [3]	soil/sediment	8081A	SW-846	glass jar	16 oz.	3	Cool to 4 °C	14 days from sampling to prep/40 days from prep to analysis
Pesticides[4]	soil/sediment	8082	SW-846	glass jar	16 oz.	3	Cool to 4 °C	14 days from sampling to prep/40 days from prep to analysis
Dioxins/Furans [5]	soil	8280A	SW-846	glass jar	8 oz.	1	Cool to 4 °C	30 days from sampling to prep/ 45 days after prep to analysis.
Metals [6]	soil/sediment	6010B	SW-846	glass jar	4 oz.	1	Cool to 4 °C	6 months from sampling to analysis
Hexavalent Chromium	soil/sediment	7196A	SW-846	plastic or glass jar	250 mL	1	Cool to 4 °C	30 days to digestion, 96 hours after digestion
Cyanide	soil/sediment	9012A	SW-846	glass jar	4 oz.	1	Cool to 4 °C	14 days from Sample Date
Mercury	soil/sediment	7471A	SW-846	glass jar	4 oz.	1	Cool to 4 °C	28 days from sampling to analysis
Sulfide [8]	soil/sediment	376.1	40 CFR 136	glass jar	4 oz.	1	Cool to 4 °C	7 days from Sample Date
Atterberg Limits	soil	D4318	ASTM D4318	glass jar	8 oz.	1	NA	NA
CEC	soil	9081	SW-846	glass jar	8 oz.	1	NA	NA
Grain Size	soil	4822	ASTM D421, 422	glass jar	8 oz.	1	NA	NA
Moisture Content	soil	D2216-90	ASTM D2216	glass jar	8 oz.	1	Cool to 4 °C	NA
pH	soil	9045C	ASTM D2976	glass jar	8 oz.	1	Cool to 4 °C	7 days from Sample Date
TOC	soil	Walkley Black	Walkley Black	glass jar	8 oz.	1	Cool to 4 oC	28 days from Sample Date

Notes:
[1] *VOC = Volatile Organic Compounds as listed in Table A1-1 or A1-2.*
[2] *SVOC = Semivolatile Organic Compounds as listed in Table A1-1 or A1-2.*
[3] *PCBs = Total Polychlorinated biphenyls as listed in Table A1-1 or A1-2.*
[4] *Pesticides = Pesticides as listed in Table A1-1 or A1-2.*
[5] *Dioxins/Furans = the Dioxin and Furan Congeners listed in Table A1-2.*
[6] *Metals = Inorganics analyzed by Method 6010B, as listed in Table A1-1 or A1-2.*
[7] *Alkalinity = Total Alkalinity, Carbonate, and Bi-Carbonate, as indicated in Table A1-3.*
[8] *Sulfide for soil is determined as per leachable method 376.1 of 40CFR Part 136.*

Acronyms :
TDS = Total Dissolved Solids
TOC = Total Organic Content
TSS = Total Suspended Solids
CEC = Cation Exchange Capacity
NA = Not Applicable

APPENDIX C

SAMPLE LOCATION NONMENCLATURE AND
PROTOCOL FOR LABELING FIELD SAMPLES (CRG-026)

Location Nomenclature
Supplemental Facility Investigation Work Plan

Location/ Sample Type	Next Number in Facility Investigation Sequence	Example Location Code
Monitoring well	26	Monitoring Well Identification: UAW26 – (total depth of well [1]) Soil Samples Collected from a Monitoring Well: UAW26 – (total depth of well [1]) – (beginning sample depth [1])
Stratigraphic Boring	12	STR12
DPT or Hand Auger	47	DP47 – (beginning sample depth [1])
Creek Bank Sediment	Reference existing stream stations – SS-1 to SS-12 and add a date reference If new locations are sampled along the Mill Creek Bank, the next number in sequence is 13.	SS –3 (Sample Date) SS – 13
Creek Bed Sediment	Reference prior creek bed sediment locations and add a date reference. If an entirely location is sampled, the next number is 8.	CS-2 (Sample Date) CS-8
Background	11	B11

Notes:
[1] depths are measured in feet below ground surface (ft. bgs)

DOCUMENT ISSUE COVER LETTER

1. TITLE Protocol for Labeling Field Samples

2. CLASSIFICATION (Check where appropriate)

☐ Confidential
☐ Controlled
X Quality System Related
☐ EHS Related
☐ Training Related

3. DOCUMENT TYPE

X Procedure ☐ Master List ☐ Specification/Master Copy

4. ISSUE DETAILS

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g) Review Date: (date must be reviewed by)
h) Obsolete issue removed by _____ Date_____

5. AUTHORIZATION (As appropriate)

	Signature & Date	Job Title
Written By	P Cichy & R Lantzy	Technical Fellows
Approved By	_____	Remediation Dept. Mgr.
	_____	_____
	_____	

6. DISTRIBUTION LIST (include job function) * See Attached List

Title:

Doc. No: CRG-026

REVISION LOG

REVISION NO.	REASON FOR CHANGE(S)	DATE
001	First Issue	01/04/01
002	Revised "sample code" format for field sample labels General update.	2/01/02
003	Modified some codes to include "site code" and fixed some errors in example codes.	3/11/02

FORM NO. CDO 000.004 DATED 11/12/92

Protocol for Labeling Field Samples

The following information will be included on sample labels affixed to field sample containers used for Rohm and Haas remediation projects:

- Site Identification—the site name and location or a unique project number which identifies the site

- A Unique Sample Code
  This is a critically important part of the label. It is made up of six (6) items.

  -The date: use the format "YYYYMMDD" e.g. 20020103 for January 3, 2002
  -The location: use the location code e.g. MW-21 (see restrictions below)
  -The depth at which the sample was taken:
  --for wells, use the depth in the well where the pump inlet was located prefixed with a "V" for Vertical e.g. V25
  --for soil samples use the "V" prefix followed by the sampled range e.g. V2-4
  --for samples from wells where the vertical depth of the sample is not known, use the "V" prefix followed by the depth of the midpoint of the screened interval followed by the character "@" e.g. V34@. The @ symbol indicates that the depth was derived and thus is not a measured value.
  -The use of preservation:
  for samples that would normally be preserved, such as VOA samples and metals samples, but where it is desired to also collect an unpreserved sample, indicate that the sample is unpreserved by including the character "U" in the sample code immediately after the depth entry.
  -The use of filtration: if the sample is filtered, place a "D" in the code immediately in front of the sample type to indicate that the sample contains only Dissolved components.
  -The sample type: e.g. "N" for a normal environmental sample (see List 1 below for other sample type codes)

  Currently the sample code is limited to 30 characters by a field length limitation in the EQuIS database. If you construct a sample code and it exceeds the 30 character limit, contact CRG to determine how to contract the sample code while assuring that the code remains unique. Refrain from using spaces in the code and use dashes only in the location code and depth range.

  Restrictions: Experience has shown that certain characters cause a problem with lab LIMS data systems and therefore should not be used in the location codes or the sample codes. (see list below)

The following characters must not be present in the sample code:

and sign &
back quote `
**backslash **
dollar sign $
double quotes "
pipe or vertical bar |
semi colon ;
single quotes '
colon :
any parenthesis or brackets, {}, (), [] forward slash /
asterisk *
greater than >
lest than <
question mark ?

Note: This limitation on acceptable characters is the principal reason that the previous convention of placing parentheses around the depth was replaced with the current convention of using a "V" prefix. (PTC, 2/1/02)

Examples of Some Typical Sample Codes

-A normal environmental sample from well MW-21 at 25 feet.

20020103MW-21V25N

Note: Depth numbers should reflect the depth unit typically used at the site i.e. feet when measurements are in feet, meters when the measurements are in meters.

-A pair of normal environmental samples, one that has the normal preservative called for by the sampling method and the other in which the preservative has not been added.

20020103MW-21V25N	with normal preservative
20020103MW-21V25UN	without preservative

-A normal environmental sample that has been filtered.

20020103MW-21V25DN

-A normal environmental sample where the preservative which is normally added has NOT been added and the sample has been filtered.

20020103MW-21V25UDN

-A normal environmental soil sample taken from the depth interval of 2 to 4 feet at soil sample location SS-34.

20020103SS-34V2-4N

-An historical normal environmental sample taken from a well but where the sample depth was unknown. The depths to the top/bottom of the well screen was 10/20.

20020103MW-21V15@N

A field duplicate is given the same code as the normal sample except that the designation "FD" is used instead of "N" e.g. 20020103MW-21V25FD

A matrix spike sample is given the same code as the normal sample except that the designation "MS" is used instead of "N" e.g. 20020103MW-21V25MS

A matrix spike duplicate is given the same code as the normal sample except that the designation "SD" is used instead of "N" e.g. 20020103MW-21V25SD

Note: When the work plan indicates that matrix spike and matrix spike duplicate samples are both to be taken, separate containers must be prepared by the lab for each of these samples. Past practice of using a single container to hold the material for both these samples has been discontinued and the sample type designation "MSD" eliminated.

Equipment Blanks are labeled with the date, the site code (for example LTG for the Lauterbourg, France site. See List 3 below.), and the suffix "EB" e.g. 20020103LTGEB

Trip Blanks are labeled with the date, site code, and the designation "TB". e.g. 20020103LTGTB When there is more than one trip blank for a given day, a unique sequence number should be added e.g. 20020103LTGTB-1

Field Blanks are labeled with the date, site code, and the designation "FB" e.g. 20020103LTGFB When there is more than one field blank for a given day, a unique sequence number should be added e.g. 20020103LTGFB-1

In some cases the Sample Code on the sample bottle label may need to be "blind", that is, with a unique designation that is not in the standard format and possibly

having no particular meaning in itself. In this case, the field staff must cross reference this designation with the correctly constructed Sample Code in the field notebook so that the data can be properly entered in the database when the results are provided by the lab.

- Date (format as year/month/day, i.e., yyyy/mm/dd)
- Time (HH:MM in a military format. Include leading zeroes and colon, e.g., **09:30, 13:45**)
- Initials of sampler
- Analysis to be performed on the sample
- "Filtered" or "Unfiltered" (this classifies the sample as "dissolved" or "total")
- Description of any preservation done
- Depth at which sample was taken
- Sample matrix (e.g., groundwater, surface water, soil, sediment)
  [see attached list 2 for sample matrix codes]

Additionally, sample labels may contain the following optional information:

- Sample collection method (grab vs composite)
- Container number (e.g., 1 of 2; 3 of 5)
- Comments—any other information

List 1

Sample Type Codes

Code	Description
EB	Equipment Blank (rinse water after washing)
D	Dissolved (indicates filtered sample)
FB	Field Blank
FD	Field Duplicate
MB	Material Blank (for background, baselines)
MS	Matrix Spike
N	Normal Environmental Sample
P	Preserved Sample (when normally unpreserved)
RD	Regulatory Duplicate; Split
RW	Rinse Water (before washing equipment)
SD	Matrix Spike Duplicate
TB	Trip Blank
U	Unpreserved Sample (when normally preserved)

List 2

Sample Matrix Codes

(Ref: US Environmental Protection Agency Region 5)

Most likely to be encountered

GS **Soil gas**
RW **Rinse water (rinse water before washing equipment)**
SE **Sediment (associated with surface water)**
SO **Soil**
WG **Ground water**
WH **Equipment wash water (rinse water after washing equipment)**
WP **Drinking water**
WS **Surface water**

Other possibilities

AA Ambient air
AD Drilling air
AE Air, vapor extraction well effluent
AQ Air quality control matrix
CA Cinder ash
CF Fly ash cinder
DC Drill cuttings
GE Gaseous effluent (stack gas)
GL Headspace of liquid sample

LA	Aqueous phase of multiple phase liquid or solid sample
LC	Liquid condensate
LD	Drilling fluid
LE	Liquid emulsion
LF	Floating/free product on groundwater table
LH	Free-flowing, or liquid waste containing < 0.5% dry solids
LM	Multiple phase liquid waste sample
LO	Organic liquid
LV	Liquid from vadose zone
MH	Hazardous multiple phase waste
Oil	Oil_1
SB	Bentonite
SC	Cement
SD	Drill cuttings, solid matrix
SF	Filter sandpack
SH	Solid waste containing ≥ 0.5% dry solids
SL	Sludge
SM	Water filter (solid material used to filter water)
SN	Miscellaneous solid materials—building materials
SP	Casing (PVC, stainless steel, cast iron, etc.)
SQ	Soil/solid quality control matrix
SR	Water filter residue (solid which is filtered out of water)
SS	Scrapings
ST	Solid waste
SW	Swab or wipe
TA	Animal tissue
TP	Plant tissue
TQ	Tissue quality control matrix
U	Unknown
W	Water
WA	Drill cuttings, aqueous matrix
WC	Drilling water (used for well construction)
WD	Well development water
WE	Estuary
WL	Leachate
WO	Ocean water
WQ	Water quality control matrix
WV	Water from vadose zone
WW	Waste water
WZ	Special water quality control matrix

List 3

Rohm and Haas Site Codes

ACM	ACIMA SWITZERLAND
AMF	AMERSFOORT NETHERLANDS

ANJ	ANJOU QUEBEC
AWP	ANTWERP BELGIUM
API	APIZACO MEXICO
VA	ARLINGTON VA
GRC	ATHENS GREECE
NZL	AUCKLAND NEW ZEALAND
THA	BANGKOK THAILAND
BAR	BARCELONA SPAIN
BRQ	BARRANQUILLA COLOMBIA
BEI	BEIJING CHINA
BEJ	BERHC
BLM	BLOOMINGDALE IL
BOG	BOGOTA COLOMBIA
BMB	BOMBAY INDIA
BRM	BREMEN GERMANY
BRB	BRISBANE AUSTRALIA
BR	BRISTOL PA
BRS	BROSSARD QUEBEC
BUD	BUDAPEST HUNGARY
ARG	BUENOS AIRES ARGENTINA
CAL	CALGARY ALBERTA
AUS	CAMBERWELL AUSTRALIA
CAP	CAPE CANAVERAL FL & BAHAMAS
CAS	CASTRONNO (VARESE) ITALY
CTC	CHARLOTTE TECH CNT
CNY	CHAUNY FRANCE
TWN	CHIAYI HSIEN TAIWAN
CHW	CHIC HTS WHSE
CHT	CHICAGO HTS PLANT
KIL	CHICAGO IL - KILBOURN
CGO	CHICAGO IL - RIVERSIDE
CIC	CICERO IL
CIP	CILEGON INDONESIA
CIN	CINCINNATI OH
CLK	CLARKSON ONTARIO
DMK	COPENHAGEN DENMARK
COR	CORNATION CAN
CED	CORP ENG BRISTOL
CRY	CROYDON ENGLAND
CRO	CROYDON PA
DAY	DAYTON OH
HOU	DEER PARK TX
DFZ	DELFZJIL NETHERLANDS
DET	DETROIT MI
DEW	DEWSBURY ENGLAND
ME	DUBAI MIDDLE EAST
ELK	ELK GROVE IL
ELM	ELMA WA
ELS	ELSTON PLANT CHICAGO
HON	FAR EAST HONG KONG
FSN	FOSHAN CHINA
FRK	FRANKFURT GERMANY
FRE	FRESNO CA
GRL	GARLASCO ITALY
GTL	GEELONG AUSTRALIA LAB
GEE	GEELONG AUSTRALIA PLT

GLN	GLENDALE AZ
SAL	GRAND SALINE TX
GRM	GRANGEMOUTH SCOTLAND
GRT	GRANTSVILLE UT
GRV	GREENVILLE SC
GDL	GUADALAJARA MEXICO
HAY	HAYWARD CA
HO	HOME OFFICE PHILA
HUT	HUTCHINSON KS
ILE	ILES-DE-LA-MADELEINE QUEBEC
TUR	ISTANBUL TURKEY
JAC	JACAREI BRAZIL
JKT	JAKARTA INDONESIA
JCC	JAPAN ACRYLIC CHEM
JAR	JARROW ENGLAND
KNK	KANKAKEE IL
PAK	KARACHI PAKISTAN
KNX	KNOXVILLE TN
LMI	LA MIRADA CA
BAY	LA PORTE TX
LDK	LANDSKRONA SWEDEN
LAN	LANSING IL
LSP	LAS PINAS PLT PHILIPPINES
LTG	LAUTERBOURG FRANCE
LIN	LINDBERGH ALBERTA
LST	LONE STAR PLANT
LGB	LONG BEACH CA
LA	LOS ANGELES CA
LVL	LOUISVILLE KY
LOU	LOUISVILLE KY
MAL	MALAYSIA
PHN	MANILA PHILIPPINES
MAN	MANISTEE MI
MDL	MEDELLIN COLOMBIA
MEM	MEMPHIS TN
MEX	MEXICO CITY MEXICO
MIL	MILAN ITALY
MWK	MILWAUKEE WI
MGV	MONTGOMERYVILLE PA
MOS	MOSCOW RUSSIA
MSP	MOSS POINT MS - EM
MSS	MOSS POINT MS - P2
MOZ	MOZZANICA ITALY
MZZ	MOZZATE ITALY
CHI	MT. PROSPECT IL
IND	MUMBAI INDIA
NAN	NANTONG CHINA
WEK	NEW IBERIA LA (WEEKS)
NWK	NEWARK CA
NTF	NEWTOWN PA FARM
AND	"NORTH ANDOVER, MA"
CLE	NORTH OLMSTED OH
OJB	OJIBWAY ONTARIO
ORR	ORR ROAD NC
OSA	OSAKA JAPAN

FRP	PAINESVILLE OH (FAIRPORT)
PAR	PARIS FRANCE
PRN	PARONA ITALY
PAT	"PATERSON, NJ"
CMP	PAULINIA BRAZIL
PER	PERTH AMBOY NJ
PHL	PHILADELPHIA PA
PLT	PLANT CAN
PTE	POINTE CLAIRE QUEBEC
PUG	PUGWASH NOVA SCOTIA
QPU	QINGPU PLANT
RED	READING PA
FLY	READING PA (FLYING HILLS)
REG	REGINA SASKATCHEWAN
RGW	RINGWOOD IL
RIT	RITTMAN OH
ROB	ROBECHETTO ITALY
RCH	ROCHESTER HILLS MI
RDL	RODEL INC
ROM	ROMANO D'EZZELINO ITALY (PULVERLAC)
ROS	ROSWELL GA
SLC	SALT LAKE CITY LIT
COS	SAN JOSE COSTA RICA
CHL	SANTIAGO CHILE
BRA	SAO PAULO BRAZIL
SMY	SEMOY FRANCE
KOR	SEOUL SOUTH KOREA
SHA	SHANGHAI CHINA
GCT	SHANGHAI CHINA (GCTC)
SER	SHANGHAI EAST RH CO
SHP	SHIPLEY
SFE	SHIPLEY FAR EAST - TOKYO
SVL	SILVER SPRINGS NJ
SNG	SINGAPORE (NAC)
SGP	SINGAPORE (PLANT)
STC	SINGAPORE TECH CNT
SMA	SOMA PLANT JAPAN
SOA	SOUTH AFRICA
SPB	SPARTANBURG SC
SH	SPRING HOUSE PA
STL	ST LOUIS MO
STP	ST PAUL MN
STR	STRULLENDORF GERMANY
SYD	SYDNEY AUSTRALIA
TAI	TAIPEI TAIWAN
TYO	TOKYO JAPAN
TOL	TOLUCA MEXICO
TOY	TOYO MRTN-TOKYO JAPAN
TUD	TUDELA SPAIN
TUS	TUSTIN CA
MTN	UNASSIGNED LOCATION CODES
VLB	VALBONNE FRANCE
VNA	VIENNA AUSTRIA
VSP	VILLERS ST. PAUL FRANCE
WTX	WALLER TX
WAR	WARRINGTON ENGLAND

WRS	WARSAW IN
ALX	WEST ALEXANDRIA OH
WH	WEST HILL ONT CAN
DEL	WILMINGTON DE
WIN	WINDSOR ONTARIO
WOB	WOBURN MA
WST	"WOODSTOCK, IL"
WYV	WYTHEVILLE VA
NG	Y NAGOYA JAPAN
ZRT	ZARATE ARGENTINA

APPENDIX D

CINCINNATI MILACRON MEMO FROM 1979

CINCINNATI MILACRON

Memo

To C. L. Adams
J. L. Hanley
T. G. Kugele
R. C. Witman

From P. A. Bautista

Location ANALYTICAL LAB

Date June 6, 1979

Subject SOIL TESTING FOR TIN CONTAMINATION

cc: G. E. Schaaf
J. A. Mazzei

This is an interim report on the survey of Cincinnati Milacron Chemicals soil contamination with tin metal. Analysis on re-samples of the Millcreek areas is pending. We are also planning on a comprehensive series of sampling this June, 1979, in order to complete the survey. Your comments and suggestions are requested.

from CLA file

Paul A. Bautista

Paul A. Bautista

PAB/mew

Enclosure

CINCINNATI
MILACRON

SOIL TESTING FOR TIN CONTAMINATION OF CINCINNATI MILACRON CHEMICALS INC. ENVIRONMENT

Extensive sampling of the soil in the general vicinity of the Research Lab, Buildings 12, 26 and 27 was undertaken in 1976 followed by another less extensive series in 1978. Complete test results are now available pointing to contamination of the surface soil to levels of 100-1000 ppm tin in the soil. Leaching into the subsurface regions did not occur, as a rule, as indicated by the low levels of 1-10 ppm in the core samples taken 6-12" below the surface. Normal levels of tin in soil is less than 5 ppm.

The sources of contaminations are run-off wastes from leaks developing on the aqueous tin chloride transfer pipes feeding into the tin tank farms; these pipes run mainly along the east fence line. Other sources are storage drums piled between Buildings 12 and 26, washings from replaced tin lines during maintenance operations, spills from kettles at Building 27 when rupture discs break and hosing down of contaminated building floors in cases of accidental spills.

The tin levels decreased appreciably from 500-1000 ppm at most locations in 1976 to 100-500 ppm in 1978. This is true in location Nos. 4, 5, 6, 7, 8 and 9. See Table I for a comparative evaluation. Most of the top soil in these areas were replaced after the 1976, but prior to 1978, samplings. Illustrations of tin distribution found during the two sampling periods are found on Figures 1 and 2.

Four points along the Millcreek bank were also sampled in 1976, which are at levels of 20-500 ppm, more or less evenly distributed in the surface and subsurface areas. See Figure 3 for a more complete illustration and more thorough information.

DAB/mcm

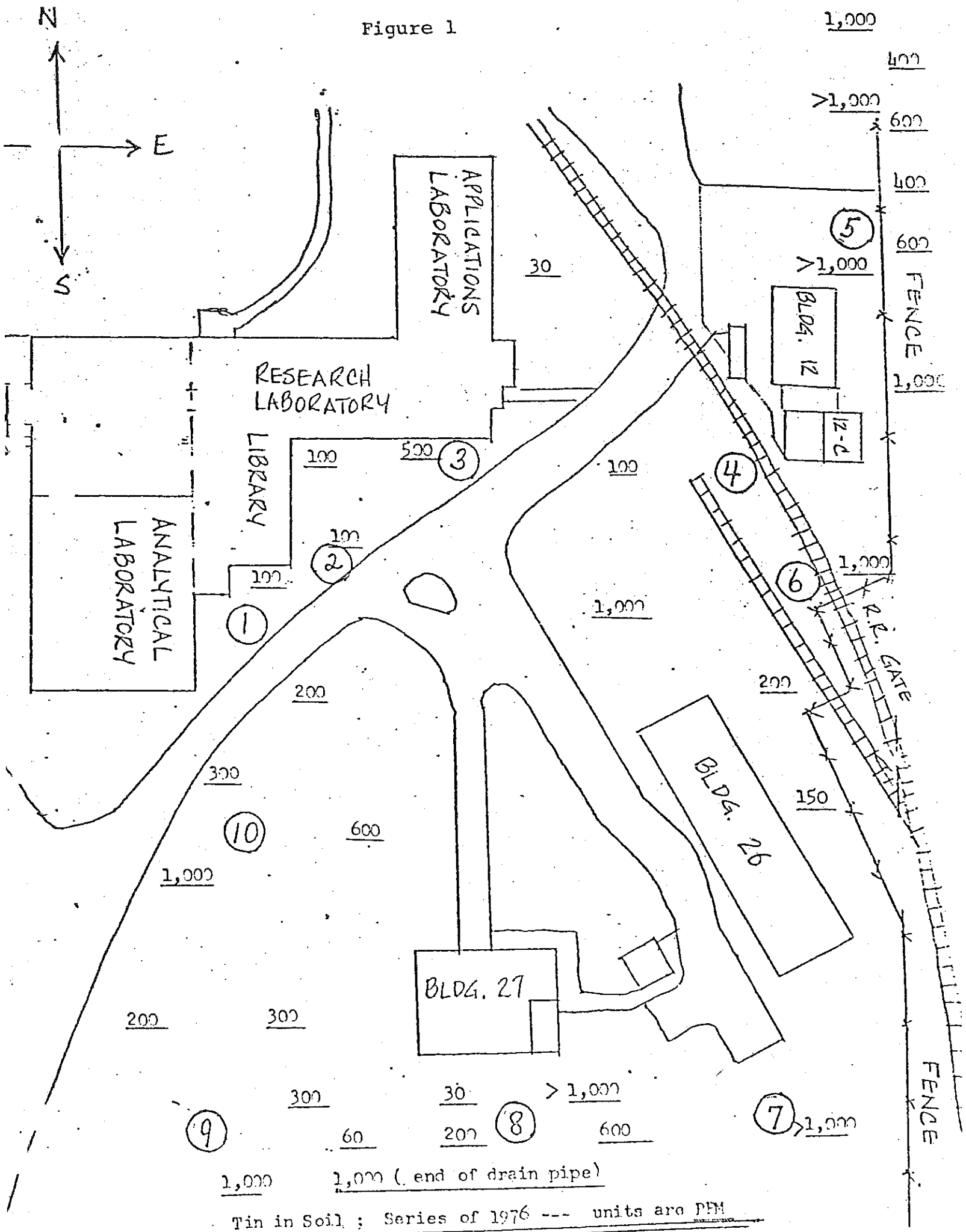
TABLE I

Soil Testing for Tin at

Cincinnati Milacron Chemicals Inc.

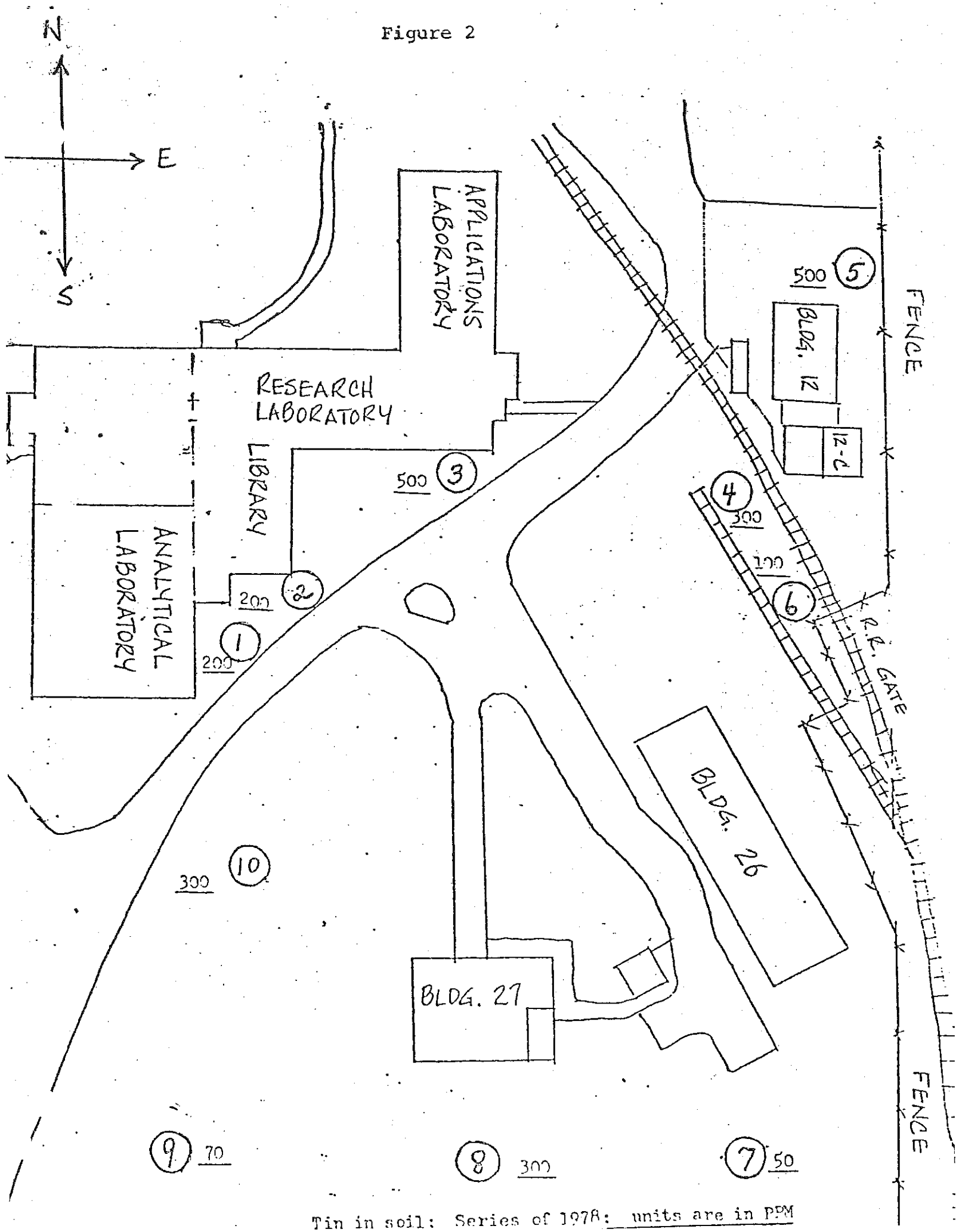
Location No.	Concentration of Tin in Soil (ppm)	
	1976	1978
South of Research Lab	100	200
South of Research Lab	100	200
South of Research Lab	500	500
South of Bldg. 12	1000	500
North of Bldg. 12	>1000	500
North of R.R. Gate	1000	100
Southeast of Bldg. 27	>1000	50
South of Bldg. 27	30-300	300
Southwest of Bldg. 27	1000	70
West of Bldg. 27	200-300	300
thers:		
East of Applications Lab	30	No Sample Taken
East of Bldg. 12 (Beyond Fence)	600-1000	No Sample Taken
Area Between Bldgs. 12 & 26	200-1000	100-300
North of Bldg. 27	600	No Sample Taken

Figure 1



Tin in Soil ; Series of 1976 --- units are PPM

Figure 2



Tin in soil: Series of 1978: units are in PPM

Figure 3

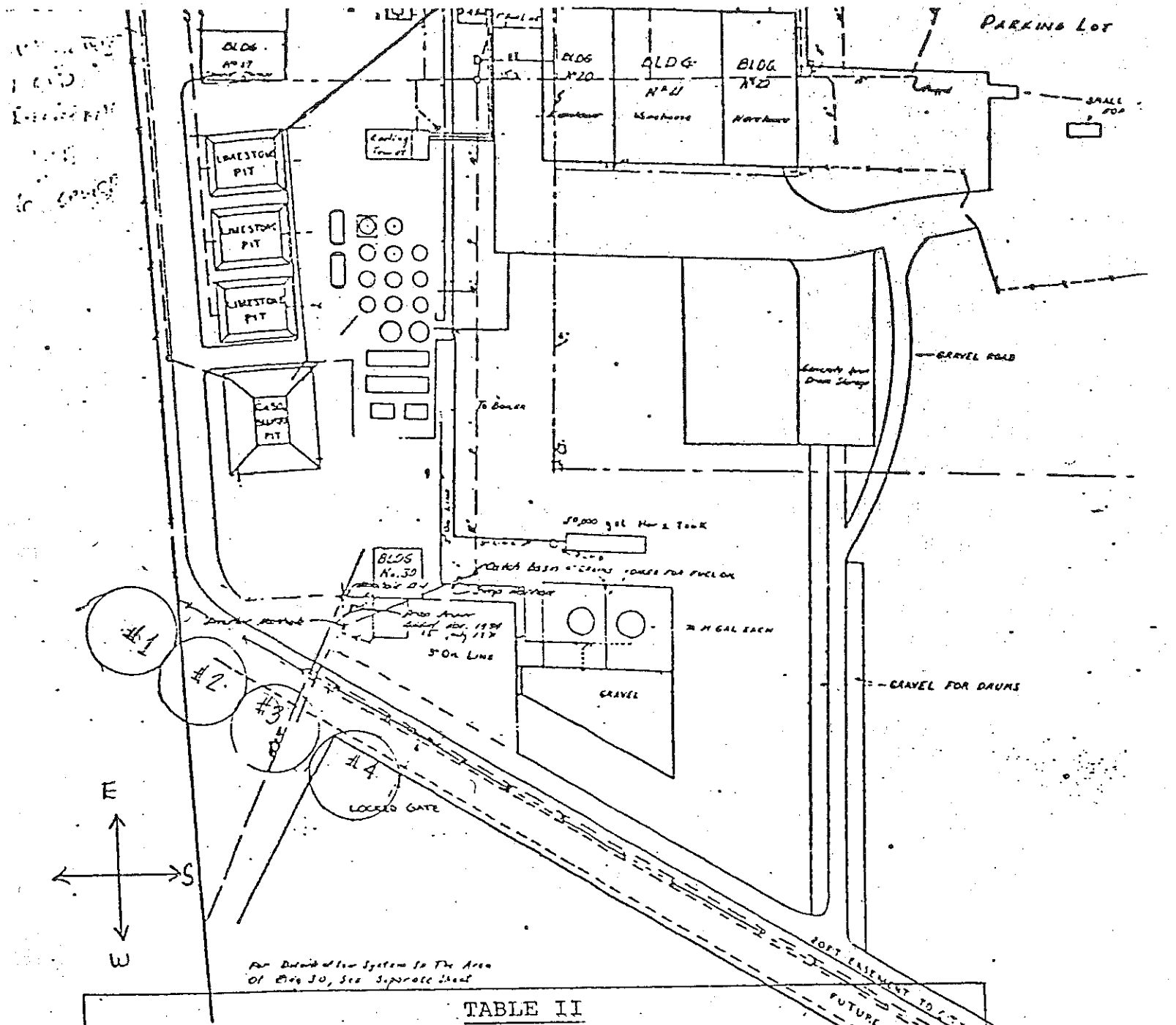


TABLE II

Soil Samples From the Millcreek Taken Approximately Two Feet Above the Water Line

Sample No.	Surface Sample	Core Sample, 12" Below Surface
1	20 ppm tin	10 ppm tin
2	500 ppm tin	500 ppm tin
3	200 ppm tin	200 ppm tin
4	50 ppm tin	20 ppm tin

APPENDIX E

USEPA COMMENTS AND ROHM AND HAAS RESPONSES ON REVISION 00 OF THE SUPPLEMENTAL FI WORK PLAN, AND RELATED CORRESPONDENCE

COMMENTS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA) ON THE MAY 2003 SUPPLEMENTAL FACILITY INVESTIGATION WORK PLAN MORTON INTERNATIONAL, INC. (Morton) READING, OHIO

The U.S. EPA'S review of the May 2003 Supplemental Facility Investigation (FI) Work Plan (Work Plan) for the Morton International, Inc. facility in Reading, Ohio indicates that the planned investigation adequately addresses most of the data gaps previously identified by U.S. EPA. However, the details of several elements of the proposed investigation require some revisions. These details are identified in the comments below, which are organized according to the respective section of the Work Plan. Also, further discussions are necessary regarding groundwater monitoring and identification of ecological receptors as discussed in the comments.

Geomatrix's responses follow each comment.

3.0 SUPPLEMENTAL SOIL INVESTIGATION

3.2 UAW17-40 Area

1. As part of the initial FI activities, two soil samples were collected from soil boring UAW17-40 at 1.5 feet and 5 feet below ground surface (ft bgs). Lead concentrations were reported at 28.4 milligrams per kilogram (mg/kg) and 128 mg/kg, respectively. To further delineate lead concentrations in this area, the Work Plan specifies the advancement of three additional soil borings adjacent to boring UAW17-40.

   These boring locations (illustrated on Figure 2 of the Work Plan) appear to be well placed to assess the lateral extent of lead contamination. However, the Work Plan does not adequately address the vertical extent of lead concentrations. Specifically, the Work Plan (page 6) states that "a single sample will be collected at a nominal depth of 5 ft bgs from each boring." This depth appears to be based on the depth at which the maximum concentration of lead was found during the FI. However, vertical sampling during the FI was limited, and the vertical distribution of lead is not well established. Consequently, additional vertical delineation is required to assess lead concentrations with depth using the soil sampling strategy for the FI per Section 5.2 of the FI Work Plan. The approved strategy includes continuous soil sampling to a depth of 15 feet (ft) below ground surface (bgs) or the water table, whichever is deeper. Morton shall provide appropriate revisions based on this comment.

<u>Response</u>

As discussed in the October 28, 2003 meeting at the Morton Facility, Geomatrix will modify the sampling and analytical program at UAW17-40 to address the USEPA comment. The agreed-upon modification is as follows:

- **At each of the three sampling points, the DPT boring will be advanced to the water table or a maximum depth of 15 feet below ground surface (bgs), whichever is**

shallower. Based on prior measurements, the depth to water in the vicinity of UAW17-40 is approximately 12 feet bgs.

- **If field evidence of impact is observed in any boring, a sample will be collected from that interval.**
- **In the absence of field evidence of impact, a total of four samples will be selected for analysis using the following protocol:**
  - **One sample from the 5-foot depth in each boring will be analyzed for lead, as originally proposed in the Supplemental FI Work Plan (three samples total).**
  - **One sample will be collected from each boring at 10 feet bgs, to be held by the laboratory pending analytical results from the 5-foot samples.**
  - **A sample from 10 feet bgs, from the boring with the highest lead concentration at the 5-foot depth will also be analyzed for lead (one additional sample, making a total of four).**

The Supplemental FI Work Plan will be modified to address this change in scope.

3.4 Former Surface Impoundments

2. The Work Plan specifies direct push technique (DPT) borings to further characterize contaminant concentrations in soil in the area of the former surface impoundments. The Work Plan (page 7) states that "at each DPT location, soil will be continuously sampled for lithology to a total depth of approximately 15 feet." However, the soil sampling strategy for the FI per Section 5.2 of the FI Work Plan indicates that sampling will be continued to a depth of 15 feet bgs or the water table, whichever is deeper. Morton shall provide appropriate revisions based on this comment.

<u>Response</u>

The Supplemental FI Work Plan was prepared with the benefit of the FI data, allowing improvements to certain of the original sampling protocols. Based on field measurements, the depth to water in the vicinity of the Former Surface Impoundments is approximately 10 to 11 feet bgs. Therefore, the proposed 15-feet total depth of the DPT borings in this area should extend beyond the water table. Despite this, the Work Plan will be modified to indicate that DPT borings will extend to a depth of 15 feet bgs or the water table, whichever is deeper.

3. The text from page 7 of the Work Plan specifies that 24 borings will be advanced in the surface impoundment area, from which 120 samples will be retained. Twelve of the 120 retained samples will be submitted for laboratory analysis. However, due to the importance of fully characterizing contaminant concentrations in this potential source area and the potentially complex distribution of contaminants due to the different affinities for adsorption of the various contaminants potentially released, analysis of 12 samples will not be sufficient to adequately characterize the lateral and vertical extent of soil contamination in this area. A greater density of analytical results is required. At least one sample from

each of the 24 borings is to be sent to the laboratory for analysis. Additional samples from a specific boring should be sent if there are strong indications of impact in that boring.

Response

As we expressed during the October 28 meeting, Rohm and Haas respectfully maintains that the sampling strategy, as currently stated in the Supplemental FI Work Plan, will provide a thorough and adequate characterization of the area. As we all observed during our site walk, the overall surface impoundment area is not large--less than a single acre. A large number of samples from this area have already been field screened, with 16 soil samples submitted for laboratory analysis. The most significant contaminants observed in these samples were volatile organic compounds (VOCs), specifically toluene and chlorobenzene (Geomatrix, 2002), both detectable by standard field screening methods.

The proposed investigation will add 24 new borings at the Former Surface Impoundments. All borings will be continuously sampled, with field screening. As noted above, each boring will completely penetrate the former impoundments, and advance into the underlying soils. By gridding the area in this way, it is reasonable to expect any significant anomalies within this area will be apparent in the field. Examples of such anomalies would include currently unknown accumulations of "source" materials like sludge, or nonaqueous phase liquids (NAPL). The analysis of 12 additional soil samples, in addition to the field screening results, will add considerable information to the characterization of this area.

As discussed on the October 28, 2003 site visit, we do not believe that the additional analyses requested by the USEPA would change either the nature of the risks identified at the Former Surface Impoundments, or the probable remedy. Based on our telephone discussion on November 14, 2003, we understand that the USEPA is in concurrence with this position, and that no revision to the Supplemental FI Work Plan is required on this issue.

4. When discussing the planned sampling program at the former surface impoundments, the Work Plan (page 7) quantifies the number of samples that will be sent to the laboratory for analysis. The soil sampling strategy for the FI per Section 5.2 of the FI Work Plan indicates that an analytical sample will be retained from the uppermost one (1) foot of soils if no evidence of impact is apparent in the field. For the purpose of sampling at the former surface impoundments, the soil sampling protocol shall be modified as follows:

> In the absence of field indications of impact, the samples sent for laboratory analyses will be selected from between the former bottom of the surface impoundment (five to six ft bgs according to the Current Conditions Report) and the total boring depth. In addition, in the absence of field indications of impact, the sampling depths should be varied from boring to boring to ensure a more complete delineation of contamination over the entire soil profile.

Response

The Supplemental FI Work Plan will be revised to include this protocol.

4.0 SUPPLEMENTAL GROUNDWATER INVESTIGATION

5. U.S. EPA considers that available site information raises various uncertainties with respect to the understanding of potential pathways of migration for groundwater contamination within the upper aquifer and between the upper and lower aquifers. Also, U.S. EPA's September 30, 2003, Documentation of Environmental Indicator (EI) Determination of Migration of Contaminated Groundwater Under Control further delineates monitoring requirements for the Morton facility. U.S. EPA would like to discuss the aspects related to these uncertainties and the EI determination at a meeting/conference call with Morton prior to reaching a decision on the scope of the supplemental groundwater investigation. Some aspects for discussion would be:

- The Draft FI Report suggests that contamination found at UAW15-50 may have migrated from a source area at the northwestern portion of the site. However, the existing lithologic data do not show an apparent connection between the Shallow and Upper Sands in the upper aquifer.
- Although the Draft FI Report indicates that the primary component of flow in the Deep Upper Aquifer Sands is southward, it is noted that the reported groundwater elevations were higher at the southern end of the facility. This indicates some inconsistencies with respect to the reported information on groundwater flow. It is noted that the available hydraulic data from the Deep Upper Aquifer Sands are sparse. Hydraulic information from additional locations may be necessary for understanding flow directions in the Deep Upper Aquifer Sands.
- The approach for identifying areas of hydraulic communication between the Deep Upper Aquifer Sands and the lower aquifer does not appear to be sufficient to fully monitor groundwater migration pathways between the Deep Upper Aquifer Sands and the lower aquifer. Additional monitoring appears to be necessary at locations where there may be potential hydraulic communication between the Shallow Upper Aquifer Sands and the Deep Upper Aquifer Sands. Moreover, U.S. EPA's September 30, 2003, Documentation of Environmental Indicator (EI) Determination of Migration of Contaminated Groundwater Under Control acknowledges that the results from investigations conducted by Pristine at and downgradient from the Morton facility indicate that contamination in the lower aquifer is related to former operations at Pristine per a Superfund Record of Decision for the Pristine facility. The EI determination documents that the Pristine site is currently addressing the remediation of contamination from the lower aquifer. In addition, the EI delineates the requirement for the Morton facility to monitor the migration of groundwater contamination within the upper aquifer as well as between the lower and upper aquifers. Additional monitoring is needed at areas where communication between the Deep Upper Aquifer Sands and lower aquifer may exist to ensure that the conditions of Migration of Contaminated Groundwater Under Control remain in place. For example, the vicinity of UAW15-50 appears to be an appropriate monitoring location for implementation of this requirement.

Response

As discussed in the October 28, 2003 meeting at the site, the three proposed wells described in the Supplemental FI Work Plan were designed and located to monitor the most likely migration pathways between the deep UA Sands and the Lower Aquifer. During that meeting, USEPA confirmed that the number and placement of wells proposed in the Supplemental FI Work Plan are adequate. USEPA further noted that the agency reserves the right to require additional assessment depending on the findings. No revision to the Supplemental FI Work Plan is required.

5.0 MILL CREEK

Insert from USEPA Cover Letter, discussing Mill Creek:
. . . U.S. EPA has determined that additional work is necessary pursuant to paragraph 60 of the AO. This request for additional work supersedes the requirements from U.S. EPA's November 25, 2002, request for additional work and February 18, 2003, letter of clarification regarding Mill Creek data gaps. Among other requirements, the U.S. EPA's previous request addressed the characterization of Mill Creek by means of sediment sampling and analysis using a parameter list to be designed based on site-specific conditions (inclusion of those compounds that are present at detectable concentrations in groundwater or in seeps from Mill Creek bank and those compounds that have potential to bioaccumulate).

Additional work is necessary for conducting a characterization of Mill Creek by means of, in addition to sediment, surface water sampling and analysis using a comprehensive list of constituents regardless of site-specific conditions. As determined by U.S. EPA, surface water and sediment sampling and analysis for a comprehensive list of parameters is necessary to fully characterize exposure to receptors in Mill Creek. Moreover, this information shall be considered when assessing cumulative risk. Therefore, surface water and sediments from the bed of Mill Creek shall be characterized for a comprehensive list of parameters, including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs) and metals from the Appendix IX-Target Analyte List used in the FI. Further, Morton should measure the total organic carbon content (TOC) of the sediment samples, which would be useful in assessing chemical bioavailability and toxicity in sediment. Based on the above, Morton shall conduct the following additional work:

- Conduct sampling of surface water at each location where sediment data are being collected per the Supplemental FI Work Plan.
- Conduct analysis of surface water and sediment using the Appendix IX-TAL.
- Conduct TOC analysis of sediment samples.
- The surface water and sediment data collected shall be utilized in the quantitative assessment of risks related to Mill Creek receptors as described in Section 5.0 of the Supplemental FI Work Plan.
- Morton shall include the above tasks in its revision of the Supplemental Facility Investigation Work Plan.

General Mill Creek Response

Based on this comment and our subsequent discussion during the site meeting on October 28, Rohm and Haas will perform the following:

- **Collect Mill Creek bed sediment and surface water samples at 6 locations along the Morton Facility boundary and the park area immediately to the south.**
- **Analyze these samples for VOCs, SVOCs, metals, pesticides, and PCBs from the established App IX-TAL, as well as TOC. As discussed in the site meeting and clarified in the email of October 31, 2003, dioxins and chlorinated furans have not been detected in any on-site or off-site sample. We therefore have proposed to delete the dioxin/furan analysis (7 compounds) from the sediment/surface water analytes. The USEPA concurred with proposed deletion in an email from Mirtha Capiro to Mark Hemingway dated November 19, 2003.**

Changes to the Mill Creek sampling program are discussed in greater detail in response to the comments listed below. The Supplemental FI Work Plan will incorporate these changes to the Mill Creek sampling and analysis.

Although Rohm and Haas is proceeding with the surface water sampling as requested, we must reiterate our concerns regarding the technical value of this work. We have concluded in past reporting that groundwater from beneath the Morton Facility and neighboring facilities such as Pristine and Cincinnati Drum does discharge to Mill Creek, and that this groundwater does contain low levels of several organics. It is also well known and documented that Mill Creek is a highly impacted urban stream, with dozens of known or suspected sources of contamination scattered along its length.

The data we have gathered on the character of the shallow UA Sand and Mill Creek suggest that groundwater flux to the creek is likely to be several orders of magnitude smaller than Mill Creek flow rates. In other words, any chemical detected in Mill Creek surface water is thousands of times more likely to have originated from one of the many contaminant sources upstream, than to be from groundwater discharging from beneath the Morton Facility.

If surface water data cannot be used to reach clear and unambiguous conclusions, Rohm and Haas does not believe it serves a useful purpose. It may have the opposite effect, in fact, by introducing results that cannot be readily interpreted, and therefore become sources of dispute.

6. U.S. EPA believes that it would not be appropriate to consider seep media as surface water and sediment for the purpose of risk screening/assessment for Mill Creek. Seeps do not represent creek conditions since creek bed media are likely to receive input from both seeps and groundwater inflow through the creek bed. In addition, seep areas may be more representative of soil conditions, rather than sediment areas. Seep data may be useful for understanding contaminant migration pathways associated with the site. It is noted that the prospects for collecting additional seep data under the Supplemental FI are uncertain due to

the scarcity of seeps.

Refer to the U.S. EPA's request for additional work from cover letter for further requirements regarding the characterization of Mill Creek by means of sediment and surface water sampling and analysis.

Response

As discussed in the October 28 site meeting, and with the expressed concurrence of the USEPA, seep and bank samples will be deleted from the scope of work. The Supplemental FI Work Plan will be revised to reflect this change. Sediment and surface water sampling is discussed above.

7. General observations of sediment characteristics should be recorded and described (e.g., clay, silt, or gravel substrate) as documented in the June 2002 Draft FI Report. This information is important to facilitate interpretation of differences in contaminant levels between sampling areas (e.g., depositional areas vs. non-depositional areas).

Response

All sampling must occur in depositional areas, given the absence of sediments in non-depositional areas. At each sampling location, field personnel will document the approximate areal extent, thickness, and lithologic/physical character of the sediment deposit. This will be incorporated into the field operating procedure (FOP) for Sediment Sampling included in the Supplemental FI Work Plan. See Response 11.

8. Dissolved metal concentrations are most applicable for comparing surface water concentrations to water quality criteria, with unless shellfish or other filter feeders may be present in Mill Creek. Morton may use total metal concentrations to assess risks to aquatic organisms, or may collect sample and analyze for both total and dissolved metals. However, if dissolved metal data are not collected, dissolved metal concentrations should be assumed to equal total metal concentrations in screening for risks.

Response

As discussed in the October 28 meeting, surface water samples will be analyzed for dissolved, and not total, metals. Samples will be filtered in the field, consistent with Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels, July 1996, USEPA. The Supplemental FI Work Plan will include the reference to this protocol.

9. Upstream Characterization: The text from the work plan indicates that Rohm and Haas will contact property owners and request access for the purpose of conducting sampling in Mill Creek. For any questions on access to Mill Creek, please contact the United States Army Corp of Engineers.

Response

A recent review of applicable Ohio property laws by the Rohm and Haas Legal Department indicates stream beds are not considered public property in Ohio (unless owned by a public entity), and that access agreements are required for sampling stream sediments. This interpretation was confirmed by the Ohio representatives of the U.S. Geological Survey present at the October 28 meeting. Rohm and Haas cannot therefore proceed with future sediment sampling in off-property areas without such access agreements.

As USEPA is aware from Rohm and Haas' previous efforts to obtain access for background sampling, neighboring property owners other than the City of Reading have not been willing to allow Rohm and Haas to sample on their property. We have every reason to believe that future efforts would yield similar results.

It has been suggested that upstream sampling could be legally performed at public stream crossings. Unfortunately, the nearest such crossing is at Glendale Milford Road, over a mile north of the facility, and upstream of a number of significant potential source areas (e.g., GE, Pristine, Cincinnati Drum, Formica, and an unknown number of Combined Sewer Overflows and other outfalls). Rohm and Haas believes it would be technically invalid to consider data from this location to be representative of conditions immediately upstream of the Morton Facility.

Based on this, Rohm and Haas does not propose to perform Mill Creek sampling upstream of the Morton Facility boundary. One of the six proposed sampling locations, however, will be placed as near as possible to the upstream Morton Facility boundary, subject to the presence of sediment.

4.0 PROJECT SCHEDULE AND REPORTING

10. Per U.S. EPA comment 5, the Agency suggests arranging a meeting or conference call to further discuss the groundwater monitoring and any other aspects from the supplemental investigations requiring clarification. Also, U.S. EPA representatives would like to conduct a site visit to facilitate discussions regarding the requirement for documentation of ecological receptors.

Response

This meeting and site visit occurred on October 28, 2003. Rohm and Haas would like to express its appreciation to USEPA for taking the time to perform the site visit, and hopes that the improved understanding always gained from such visits will prove useful as we finalize the site assessment process.

Appendix A Field Operating Procedures (FOPs)

Sediment Sampling From Creek/River Banks or Creek/River Beds

11. Protocols for sampling and analysis of sediments in Mill Creek are contained in a December 20, 2001 Evaluation of Mill Creek. However, Morton shall include the following protocol modifications as revisions to the Work Plan:

    - This section should be modified to indicate that sediment should be collected at a depth between zero and six inches consistent with a February 15, 2002, Scope and Schedule for Remaining Facility Investigation Field Work. U.S. EPA requests this modification because the top six inches of depth are the most relevant depth interval for assessing risks to ecological receptors. The Work Plan should also note that depositional areas of the stream will be targeted.
    - The procedure for sampling sediments states that the top few inches of sediment will be scraped off prior to collecting the sample. This section should note that a maximum of one inch of surface sediment should be removed and that sediment will be collected to a maximum depth of six inches. U.S. EPA requests this modification because the top six inches of depth are the most relevant depth interval for assessing risks to ecological receptors.
    - Morton has not previously submitted Standard Operating Procedures for collection of sediment from stream bed, including use of the EnCore TM Sampling System per the FI Report. The revised Work Plan shall include appropriate SOP.

Response

The protocols for sampling and analysis of sediments were provided in the FOP entitled "Sediment Sampling from Creek/River Banks or Creek/River Beds" included in Appendix A of the Supplemental FI Work Plan.

This FOP will be modified to reduce the amount of sediment scraped off at a given sampling location to a maximum of 1 inch, and to reflect a maximum sampling depth of six inches. Note that the scraping thickness may be less than one inch, or may be reduced to zero inches, for areas where sediment accumulations are particularly thin. The Supplemental FI Work Plan will also clarify that samples will be collected from depositional areas of the stream, where sediment is present.

The FOP currently does contain procedures for sediment sampling using the EnCore™ Sampling System.

Mark Hemingway

From: Capiro.Mirtha@epamail.epa.gov
Sent: Wednesday, November 19, 2003 4:51 PM
To: Mark Hemingway
Cc: Anne Haikola; Peter V Palena; Ronald J Lantzy
Subject: Re: Revised memo re dioxin/furan sampling in Mill Creek.

Mark,

U.S. EPA agrees with the rationale presented in you memo (below) for excluding dioxin/furans from the list of parameters for sampling in Mill Creek as part of the supplemental investigations for Morton International, Inc.

Please consider the above in your revisions to the May 2003 Supplemental Facility Investigation Work Plan per the proposed schedule. It is suggested that a copy of the memo may be included with the revised work plan. Alternatively, the text from the work plan may include the rationale you presented.

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

Mark Hemingway <MHemingway@geomatrix.com>
11/18/03 06:16 AM
To: Mirtha Capiro/R5/USEPA/US@EPA, Peter V Palena <PPalena@rohmhaas.com>, Ronald J Lantzy <RLantzy@rohmhaas.com>
cc: Anne Haikola <ahaikola@geomatrix.com>
Subject: Revised memo re dioxin/furan sampling in Mill Creek.

Mirtha--

Peter Palena requested I send you this email as a follow up to our discussion on Oct 28 regarding analytical parameters for the Mill Creek sediment and surface water samples.

In our analysis of FI soil and groundwater samples for the App IX TAL, we analyzed 41 soil and 15 groundwater samples, plus a number of blanks, for the dioxins/furans sublist detailed in our QAPP (Table A1-2). This sublist consists of three polychlorinated dibenzofurans and four polychlorinated dioxins. There were no detections, even qualified detections, of any of the seven analytes on the dioxins/furans sublist. The samples analyzed included both on-site and off-site (background) locations.

In summary, there is no indication that these compounds exist either on-property or in nearby off-property areas. If biologic degradation or another process was occurring that could generate these compounds from PCBs or other observed chemical species, we would also expect to see some detection in soils or groundwater. The complete absence of these compounds in any sample indicates that they were not released, nor are they being generated in situ from other processes.

As we discussed on Tuesday, the dioxin/furan sublist is an expensive analysis. Given the absence of any trace of these compounds in either on-site soil and groundwater samples or off-site soil samples, we believe it is reasonable to delete these seven compounds from the proposed Mill Creek evaluation work under the Supplemental FI activities. This request would apply both the surface water and creek bed sediment samples.

Please note that our App IX-TAL SVOC list does include the compound dibenzofuran (the non-chlorinated species). Our planned surface water and sediment analysis will include this compound.

I appreciate your consideration of this matter, and encourage you to contact Peter Palena or me if you have any questions.

Sincerely,

MARK P. HEMINGWAY, P.G.
Principal Hydrogeologist

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

ph (512)494-0333
fx (512)494-0334

Facility Investigation Work Plan
RCRA §3013 Administrative Order

Morton International, Inc. Facility
[EPA ID No. OHD 000 724 138]
Reading, Ohio

Prepared for:

The Rohm and Haas Co.

Prepared by:

Geomatrix Consultants, Inc.
1214 West Sixth Street
Austin, Texas 78703

November 2000

Project No. 6452

1214 West Sixth Street
Suite 201
Austin, TX 78703
(512) 494-0333 • FAX (512) 494-0334

GEOMATRIX

February 26, 2001

Ms. Mirtha Capiro
Project Coordinator
U.S. Environmental Protection Agency
Region 5
77 W. Jackson Boulevard, DRE-9J
Chicago, Illinois 60604-3590

RE: Facility Investigation (FI) Work Plan, Morton International Inc., Reading, Ohio
RCRA Docket No. R3013-5-00-001

Dear Ms. Capiro:

I have enclosed the hard copy of the red-lined edits to the FI Work Plan, Quality Assurance Project Plan, and Field Operating Procedure C-3. I have also included a modified version of Figure 4-2, showing extraction wells EW-1, EW-2, and EW-3.

As I mentioned in the email transmittal of these files, the red-lining causes some formatting problems, such as inappropriate page breaks. Once we finalize the red-line edits, the formatting problems will be automatically corrected.

Following your concurrence with these changes, we will issue replacement text sections and a replacement Figure 4-2, flagged "Revision 01" in the header, to all FI Work Plan recipients.

Please do not hesitate to call me if you have any questions.

Sincerely,
GEOMATRIX CONSULTANTS, INC.

Mark P. Hemingway
Principal Hydrogeologist

cc: Mr. Peter V. Palena, The Rohm and Haas Co.

Attachments

H:\6452\Field Prep\Mirtha Capiro RedLine Version Trans.doc

Facility Investigation Work Plan
RCRA §3013 Administrative Order

Morton International, Inc. Facility
Reading, Ohio

November 2000
Project No. 6452

This report was prepared by the staff of Geomatrix Consultants, Inc., under the supervision of the Hydrogeologist whose signature appears hereon.

The findings, recommendations, specifications, or professional opinions are presented within the limits described by the client, after being prepared in accordance with generally accepted professional practice. No warranty is expressed or implied.

Mark P. Hemingway, Principal Hydrogeologist

Prepared in Compliance with Administrative Order
RCRA Docket No. R3013-5-00-001, Paragraph 67

Certification by the Rohm and Haas Company

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: Bruce E Beiser

Name: BRUCE E BEISER

Title: PLANT MANAGER

Date: NOV. 15, 2000

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APPENDICES

Appendix A Quality Assurance Project Plan

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
- CDM - Camp Dresser & McKee Inc.
- CLP-TAL - Contract Laboratory Program Target Analyte List
- CMC - Cincinnati Milacron Chemicals, Inc.
- COPCs - chemicals of potential concern
- CSS - Combined Sewer System
- DPT - direct push technique
- E&E - Ecology and Environment, Inc.
- EDQLs - Environmental Data Quality Levels
- FI - Facility Investigation
- HAS – Hollow-Stem Auger
- HHRA - human health risk assessment
- HI - hazard index
- IRIS - USEPA Integrated Risk Information System
- LADD - Lifetime Average Daily Dose
- MCLs - Maximum Contaminant Levels
- mg/kg - milligrams per kilogram
- MLE - More Likely Exposure
- MSD - Metropolitan Sewer District
- OEPA - Ohio Environmental Protection Agency
- PAHs - polycyclic aromatic hydrocarbons
- PCBs - polychlorinated biphenyls

- PERA - preliminary ecological risk assessment
- PRC - PRC Environmental Management, Inc.
- PRGs - USEPA Region 9 Preliminary Remediation Goals
- QAPP - Quality Assurance Project Plan
- 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
- SVOCs – Semivolatile Organic Compounds
- SWMUs - Solid Waste Management Units
- TDS - Total Dissolved Solids
- TSS - Total Suspended Solids
- UCL - Upper Confidence Limit
- USCS - Unified Soil Classification System
- USEPA - U.S. Environmental Protection Agency
- VOCs - Volatile Organic Compounds

1.0 INTRODUCTION

On August 18, 2000, the U.S. Environmental Protection Agency (USEPA) Region 5 issued a Resource Conservation and Recovery Act (RCRA) §3013 Administrative Order (AO) to Morton International, Inc. (Morton). Morton is a wholly-owned subsidiary of the Rohm and Haas Co. (Rohm and Haas) and the owner and operator of a facility at 2000 West Street, Reading, Ohio [EPA ID No. OHD 000 724 138]. This facility is herein referred to as the Morton Facility or "the facility." Rohm and Haas submitted a written response to the AO on September 18, 2000. This response clarified some factual issues, and proposed a schedule under which Rohm and Haas would work to meet the AO objectives discussed below. Both the AO and Rohm and Haas' response are included as Exhibits to this Work Plan. Available information regarding the operations, history, and environmental conditions at the Morton Facility is summarized in the "Current Conditions Report" prepared by Geomatrix and submitted to the USEPA in September 2000. The Current Conditions Report also described implemented Interim Measures that address any potential immediate threat to human health and the environment.

The stated basic objective of the AO is 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." Specific areas of suspected environmental impact (i.e., study areas) are identified in the AO; these and additional areas are referenced in the Current Conditions Report. All areas referenced in these two documents will be addressed as part of Morton's effort to meet the basic AO objective. The AO requires Morton to meet this objective by June 1, 2002. In order to achieve this, Morton has commissioned Geomatrix to perform a Facility Investigation (FI).

This submittal, the FI Work Plan, describes a phased approach to meet the basic AO objective. The intent of this Work Plan is to address sampling locations, general field operating procedures, schedules, submittals, and quality assurance requirements for all phases of work. It is supported by the Quality Assurance Project Plan (QAPP), included as Appendix A to this FI Work Plan. The FI Work Plan and QAPP have been prepared in accordance with the requirements of the

AO, specifically those found in Paragraphs 57 through 59, and with applicable USEPA and Ohio EPA guidelines.

The activities described in this FI Work Plan will be implemented upon approval by the USEPA. The implementation of field investigative activities and the evaluation of the resulting data will comprise the FI. The findings will then be presented to the USEPA as a submittal termed the FI Report.

2.0 BACKGROUND INFORMATION

As noted in Section 1.0, a complete description of the Morton Facility setting, history, operations, and other background information is provided in the Current Conditions Report (Geomatrix, 2000). This section is intended to summarize information needed to support the description of sampling locations and other FI Work Plan elements.

The Morton Facility is located at 2000 West Street, Reading, Hamilton County, Ohio (Figure 2-1). The City of Reading is a northern suburb of Cincinnati, Ohio. The Morton Facility consists of a single tract of land totaling 34 acres. Of these, approximately 27 acres comprise the fenced, operational area of the facility. The remaining 7 acres contain baseball/soccer fields; Morton provides the use of these fields to the City of Reading.

Land use in the area of the Morton Facility is mixed, with industrial, commercial, recreational, and residential all present within 0.5 miles of the facility boundary. The Morton Facility is bounded:

- To the north by a drum recycling facility owned and operated by Cincinnati Drum Service (Cincinnati Drum) and by the Pristine Superfund Site (Pristine).
- To the south by an instrument manufacture facility and recreational facilities operated by the City of Reading.
- To the east by a Conrail railroad track; industrial and commercial properties lie beyond the railroad to the east.
- To the west by a municipal hike and bike trail; Mill Creek, a tributary of the Ohio River, lies beyond the hike and bike trail to the west.

The Morton Facility and its surroundings have been investigated with respect to environmental impact since the late 1970s. Detailed information regarding the history, setting and environmental character of the Morton Facility and its surroundings is provided in the Current

Conditions Report (Geomatrix, 2000). While it is not the intent of this FI Work Plan to provide a reiteration of that information, the following is immediately germane to FI Work Plan discussions.

2.1 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 will continue to be utilized for the FI and other activities performed in compliance with the AO. At the site, the two aquifers are believed to be typically separated by a low-permeability till stratum consisting predominantly of clay and silt. The degree of communication between the two aquifers probably varies locally depending primarily on the thickness and character of this till layer, but has not been evaluated in any detail.

The Upper Aquifer consists of transmissive interbeds within the shallow lacustrine deposits above the till. The overall thickness of this aquifer is typically 70 to 90 feet in the vicinity of the facility. For any given location within the Morton Facility, from one to three sand or gravelly sand interbeds may be present. 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 is believed to be interrupting the groundwater flow. Its impact on seepage formation along the creek, however, has never been quantified. 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 cities 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 gradient is predominantly controlled by the pumping of remediation wells for the Pristine Superfund Site. The capture zone from these wells encompasses the entire Morton Facility property (Conestoga-Rovers, 2000).

2.2 SOURCE AREAS

Paragraphs 16 through 23 of the AO identified several areas for investigation. Most of these areas correspond to single or multiple solid waste management units (SWMUs) identified in the 1998 RCRA Facility Assessment (RFA) performed by a USEPA contractor (TechLaw, 1998). A listing of the study areas referenced in the AO, and their corresponding SWMU designations where appropriate, is provided in Table 2-1. In addition, the Current Conditions Report identifies several areas of reported historic waste burial or potential waste management:

- Seven waste burial areas,
- Ignitable waste storage tank,
- Reactive waste storage tank, and
- Wastewater treatment tank.

As described in Sections 4.0 and 5.0 of this FI Work Plan, each of these areas will be addressed as part of the investigation.

2.3 EXTENT OF SOIL IMPACT

Chemical impact to soils has been identified at various locations across the Morton Facility. Organic constituents detected in surface soils consist primarily of pervasively distributed polycyclic aromatic hydro-carbons (PAHs) and pesticides, possibly representing background conditions. In addition, isolated detections of toluene and methylene chloride have been observed. Apparently elevated metals in soils include tin, vanadium, and magnesium. In the subsurface, the pattern of detection tends to mirror the character of impact to shallow groundwater (see Section 2.4), consisting notably of toluene, chlorobenzene, 1,2-dichlorobenzene, chlorinated aliphatics, and ethers. Concentrations are typically less than 10 milligrams per kilogram (mg/kg) total organics.

Organic impact to subsurface soils has been observed primarily in the north portion of the facility, near the Former Surface Impoundments. This may, however, simply be reflective of the greater number of data points in that area. Concentrations of some organics in subsurface soils were relatively high, ranging into the hundreds or thousands of mg/kg. In addition, a layer of dark staining, interpreted to represent chemical saturation, was observed across the west-central and northwest portion of the facility.

Currently the extent of impacted soils exposed at the surface should be minimal. Periodic expansion of Morton Facility buildings and operational areas, in addition to landscaping and grounds improvement, have left most operational areas covered with lawns, roads, pavement, or foundations. This includes most of the areas where historic waste management is documented to have occurred.

2.4 EXTENT OF GROUNDWATER IMPACT

Chemical impact to groundwater by volatile organics (VOCs), semivolatile organics (SVOCs), and inorganics (possibly including metals) has been identified throughout the northern and

western portions of the facility. It must be noted, however, that the most recent groundwater data collected for the facility dates from 1992. This data cannot be assumed to be representative of current groundwater conditions. Primary organic constituents in groundwater included benzene, toluene, ethylbenzene, and xylenes (BTEX), chloroform, methylene chloride, chlorobenzenes, acetone, chlorinated aliphatics, phenols, phthalates, amines, ketones, PAHs, and pesticides. Metals apparently elevated in groundwater include arsenic, chromium, lead, and possibly tin.

Impact from organics and inorganics to Upper Aquifer groundwater is probably still present across much of the north and west portions of the facility. Although a large part of this impact probably resulted from on-site sources, some contribution from off-site sources is likely. None of the existing data suggest that impact from on-site sources has migrated to the Lower Aquifer.

The entire facility lies within the boundaries of a Lower Aquifer dissolved-phase VOC plume believed to be emanating from Pristine. The primary constituents of this plume are chlorinated aliphatics, especially 1,2-dichloroethane (1,2-DCA). The migration of this plume is currently being controlled by the Pristine groundwater collection system. As noted in Section 2.1, the area of capture for this system covers the entire Morton Facility.

2.5 EXTENT OF IMPACT IN SURFACE WATER AND SEDIMENT

Previous studies of Mill Creek have documented the pervasive presence of impact along the 17 miles or so of its lower reaches (OEPA, 1994). This includes several miles of Mill Creek upstream of the Morton Facility. Runoff from the facility is collected and discharged to the Metropolitan Sewer District, and drainage from the historic areas of waste management or known impact does not enter Mill Creek. Although seepage of groundwater potentially impacted by facility operations has historically entered Mill Creek, the Groundwater Collection System was installed along the facility's western boundary in 1985 to address this seepage. Evaluations after the system's installation did not identify continuing active seeps along the west Morton Facility boundary. However, active and impacted seeps were documented west of (adjacent to) Cincinnati Drum in 1992.

Groundwater seeping to the surface along Mill Creek has historically exhibited field evidence of impact, including discoloration and odor. It has also been documented to contain a wide range of VOCs, SVOCs, pesticides, and other organics. Although the suite of organics detected has varied through time, routinely-observed organics include chlorobenzenes, amines, phthalates, BTEX, and ketones.

Mill Creek sediment samples, including those from upstream of the facility, have been documented to contain PAHs and pesticides. Other constituents historically identified in sediments include tin, chlorobenzenes, chlorinated aliphatics, BTEX compounds, and carbon disulfide. Given that the most recent sediment sampling was in 1992, there is no information available to delineate the current nature and extent of sediment impact.

2.6 INTERIM MEASURES

As discussed in Section 7.0 of the Current Conditions Report, the Morton Facility has performed a series of actions, termed Interim Measures under RCRA, that minimize any risk to the public and the environment. The Interim Measures implemented at the Morton Facility consist of:

- Installation and operation of the Groundwater Collection System from 1985 to the present. This system is intended to reduce or eliminate:
  - On-site migration of impacted Upper Aquifer groundwater from off-site sources; and
  - Off-site migration of impacted Upper Aquifer groundwater toward Mill Creek.
- Termination of source operations. Waste management activities have been terminated at all but one of the study areas identified in the AO or other areas identified in the Current Conditions Report. This includes the termination of surface impoundment use for treatment and disposal of facility wastewater. The single area still managing waste is the Combined Sewer System (CSS), which transports the facility's wastewater to its point of discharge into the Metropolitan Sewer District (MSD) public wastewater system.
- Pristine remediation. Because groundwater from both the Upper Aquifer and Lower Aquifer flows from Pristine onto the Morton Facility, the source removal and hydraulic control activities enacted as a part of Pristine's corrective action must be considered to

have an effect on on-site conditions. At a minimum, these activities allow the positive effects of natural processes and Morton Facility groundwater removal to be focused on existing on-site chemicals.

- Removal and coverage of impacted on-site surface soils. Direct human contact with shallow soils in site operational areas has been largely eliminated by the removal of impacted soils, or by paving, construction, and landscaping.

Based in part on the apparent effectiveness of these measures, there is no immediate endangerment to either human health or the environment posed by impact emanating from the Morton Facility.

3.0 PURPOSE & OBJECTIVES OF THE INVESTIGATION

As presented in Section 1.0 of this FI Work Plan, the basic objective of the AO is to ascertain the nature and extent of the hazard posed by hazardous wastes or materials that are present at or have been released from the Morton Facility. The AO requires that this basic objective be met by June 1, 2002. During a scoping meeting between the USEPA, Rohm and Haas, and Geomatrix on October 16, 2000, this basic objective was utilized to identify more detailed objectives or investigation goals, and the specific information needs relating to each of those objectives. The goals and pertinent information needs identified for the FI are:

Goal 1—Evaluate whether the migration of impacted groundwater is under control. Primary information needs:

- The character and extent of impact to the Upper Aquifer.
- The effectiveness of the french drain and the slurry wall.
- The nature of horizontal and vertical groundwater flow within the Upper Aquifer system.
- The nature of flow between the Upper Aquifer and the Lower Aquifer.
- The identification of any past or continuing releases to groundwater and soils from Morton Facility sources identified in the AO or the Current Conditions Report.

Goal 2—Evaluate whether current risks to human health and the environment are within acceptable limits. Primary information needs:

- The character and extent of impact to seeps and sediments in the east bank of Mill Creek.
- The character and extent of impact to on-site shallow (<15') soils.
- The character and extent of buried wastes.
- The presence, location and character of human and ecological receptors.

If additional potential information needs are identified during the course of the investigation, the USEPA and Rohm and Haas will evaluate the need for their inclusion relative to the basic AO objective and the two FI goals.

4.0 PHASES OF FIELD INVESTIGATION

The basic objective, goals, and pertinent information needs for the FI are identified and discussed in Section 3.0 of this FI Work Plan. As discussed in the Current Conditions Report, available data regarding environmental conditions at the Morton Facility is both limited and dated. Given this, it is not possible to establish the scope of the entire FI effort. Data from initial activities will be evaluated with regard to the FI objectives and goals; this evaluation will be used to develop a scope for subsequent field operations. In the case of monitoring well locations, for example, sufficient wells will be installed during an initial effort to characterize the overall pattern of groundwater impact at the facility. These data will then be used to identify locations for any additional wells required to meet the investigation goals.

Utilizing this approach, the USEPA and Rohm and Haas have agreed that the field investigation will be performed in three discrete phases. In general, each subsequent phase will build upon the information acquired in the preceding phase. The USEPA, Rohm and Haas, and Geomatrix will meet between Phases 1 and 2 and again between Phases 2 and 3 to review newly acquired data and to develop specific scope items for the upcoming phase.

The basic field tools and methods utilized during these three phases will be:

- Soil borings—Characterization of subsurface geology/hydrogeology, collection of soil samples for geochemical analysis, installation of monitoring wells, and viewing of soils and buried materials.

- Groundwater monitoring wells—Collection of groundwater samples from targeted strata, measurement of hydraulic conditions relating to groundwater movement. Although this FI Work Plan proposes the installation only of Upper Aquifer wells, Lower Aquifer wells may be required depending upon FI findings.

- Plugging and abandonment of obsolete monitoring wells—Removal of wells that may not be capable of providing representative groundwater samples, or that may provide conduits for fluid migration.

- Trenching—Viewing of soils and buried materials and collection of soil samples for geochemical analysis.

- Geophysical surveys—Location of buried objects, wastes, or materials.

- Visual reconnaissance—Identification and location of seeps, staining, stressed vegetation, and other indices of environmental impact, and for indications of surface runoff beyond the Morton Facility boundaries..

- Media sampling and analysis—Characterization of chemical and physical conditions within groundwater, soil, sediment, and surface water (seeps) at locations of interest. With regard to characterization of chemical impact, two analyte lists will be used for media analysis:

  - Appendix IX Target Analyte List (App. IX-TAL)—the analyte list provided in 40 Code of Federal Regulations 264, Appendix IX, with slight modifications based on discussions and agreements between Rohm and Haas, Geomatrix, and the USEPA. The App IX-TAL (Table A1-2 of the QAPP in Appendix A) consists of the following analyte groups: volatile organics (VOCs), semivolatile organics (SVOCs), pesticides, polychlorinated biphenyls (PCBs), dioxins and furans, and metals and other inorganic parameters.

  - Contract Laboratory Program Target Analyte List (CLP-TAL)— the USEPA's target analyte and compound lists under its Contract Laboratory Program. The CLP-TAL (Table A1-1 of the QAPP in Appendix A) consists of the following analyte groups: VOCs, SVOCs, pesticides, PCBs, and metals and other inorganic parameters.

In addition, selected samples will be analyzed for geotechnical and general water quality parameters discussed in Sections 5.3 and 5.6 of this FI Work Plan, and in Table A1-3 of the QAPP (Appendix A).

- Sewer inventory and integrity testing—Identification of inputs to the Combined Sewer System, and of areas of gross integrity failures.

- Ecological receptor survey—Identification of possible ecological receptors for Morton Facility constituents.

- Human receptor survey—Identification of possible human receptors for Morton Facility constituents.

These elements are individually discussed in greater detail in Section 5.0 of this FI Work Plan. A more detailed description of the scope within each phase, to the extent currently known, is provided in the following sections.

4.1 PHASE 1 FIELD INVESTIGATION

Phase 1 is intended to address information needs which will facilitate the understanding of the nature and extent of the hazard posed at the Morton Facility, and identify investigation needs for the Phase 2 and 3 assessments. These include:

- The overall nature and extent of Upper Aquifer groundwater impact.
- The character of site specific geology and hydrogeology.
- Identification and location of any indications of impact to Mill Creek's east bank.
- The occurrence of any surface water run-off from the Morton Facility
- The location and boundaries of buried wastes within the Former Swale Area and historic waste burial areas.
- The condition of the Combined Sewer System (CSS).

The scope of the Phase 1 investigation is illustrated on Figure 4-1. Specific tasks include:

- Advancement of 6 stratigraphic borings.
- Installation of 21 Upper Aquifer monitoring wells and/or well clusters.
- Collection of soil samples from stratigraphic and monitoring well borings for geochemical analysis. Note that two samples will typically be retained from each boring or well. In the case of well pairs or pair clusters, two samples will be retained from each pair or cluster location.
- Collection of soil samples from stratigraphic borings for geotechnical analysis. One sample will be retained for analysis from each distinct stratum within each of the six stratigraphic borings.
- Performance of an inventory of CSS inlets and waste inputs.
- Performance of a camera survey of those CSS segments suspected to have transported wastewater based on inventory, location, or historical knowledge.

- Visual reconnaissance of the east bank of Mill Creek adjacent to the Morton Facility boundary, to identify seeps, staining, stressed vegetation, or other indications of environmental impact.

- Visual reconnaissance for surface runoff beyond the Morton Facility boundaries.

- Performance of surface electromagnetic surveys of the Former Swale Area and five historic waste burial areas.

- Plugging and abandonment of up to 18 obsolete monitoring wells. The actual number abandoned will depend upon the number of wells that can be located.

- Collection and geochemical analysis of groundwater from:

  - All new Upper Aquifer monitoring wells;
  - Existing Morton Facility monitoring wells MW-EPA-1, MW-EPA-2, MW-EPA-3, and MW-EPA-4; and
  - Existing Pristine Upper Aquifer monitoring wells GW58, GW62, GW64, GW65, and GW67 (assuming access and sampling permitted by Pristine controlling entities and/or property owners).

As discussed in Section 9.0, Phase 1 is anticipated to commence in March 2001 and conclude in May 2001.

4.2 PHASE 2 FIELD INVESTIGATION

Phase 2 is intended to address several information needs. These include:

- The nature and extent of impact to Mill Creek east bank sediments or seeps.
- The occurrence of any surface water runoff from the Morton Facility.
- The nature and extent of soil impact at:

  - waste management areas;
  - waste burial areas; and
  - locations of integrity failures in the CSS.

- Soil and groundwater background concentrations.
- Character of ecological receptors.
- Degree of communication between the Upper and Lower Aquifers.
- Data gaps in the groundwater assessment based on Phase 1 data.

The scope of the Phase 2 investigation is illustrated on Figure 4-2. Specific tasks include:

- Advancement and sampling of soil borings at locations of gross failures in CSS integrity identified by the Phase 1 camera survey. Boring depths will be based on the depth of the CSS at the failure location, and on the observed depth to which soil impact extends.

- Advancement and sampling of three shallow (<5 feet depth) soil borings at SWMUs 1, 2, 3, 5, and former wastewater storage and treatment tanks.

- Advancement and sampling of three soil borings or excavation and sampling of three trenches at the Former Swale Area.

- Advancement of soil borings or excavation of trenches at historic waste burial locations.

  - At least one soil boring will be performed at Burial Area B, based on that area's reported history of waste burning.

  - If no geophysical anomalies are identified during the Phase 1 survey at any of locations A, C, D, or E, then one of these areas will be selected at random for at least one soil boring.

  - If a geophysical anomaly is identified during the Phase 1 survey at any of locations A, C, D, or E, then only those areas with anomalies will receive soil borings. Areas without anomalies will not be drilled.

- Advancement and sampling of soil borings at 10 background locations; i.e., areas not reasonably anticipated to be affected by Morton Facility operations or releases.

- Installation and sampling of supplemental Upper Aquifer monitoring wells, at locations identified as needed to meet FI objectives based on Phase 1 findings. Note that sampling of any Phase 2 wells installed after November 1, 2001 will be postponed until the Phase 3 groundwater sampling event in December 2001.

- Collection of soil samples from monitoring well borings for chemical analysis. Note that two samples will typically be retained from each boring or well for analysis. In the case of well pairs or well clusters, two samples will be retained for analysis from each pair or cluster location.

- Evaluation of vertical hydraulic communication at Upper Aquifer wells proximal to Pristine extraction wells EW-1, EW-2, and EW-3 (Figure 4-2). This evaluation will utilize the annual shutdown in Pristine pumping for maintenance purposes. It is anticipated that this will occur in early June 2001.

- Visual reconnaissance of the east bank of Mill Creek adjacent to the Morton Facility boundary, to identify seeps, staining, stressed vegetation, or other indications of environmental impact. Collection and laboratory analysis of sediment and seep samples from the east bank of Mill Creek.

- Visual reconnaissance for surface runoff beyond the Morton Facility boundaries.

- Performance of an ecological receptor survey.

- For those SWMUs and waste burial/management areas receiving soil borings as described above, performance of expanded soil sampling to delineate the extent of identified soil impact. This expanded sampling will utilize field screening and focused analyte lists as appropriate to delineate the initially characterized impact. Such expanded sampling may be incorporated into the facility-wide investigation efforts, depending upon the conditions identified at each investigated area.

- Measurement of water elevations in Upper Aquifer wells, both during typical (Pristine pumping) and atypical (Pristine shut-down) conditions, to evaluate the local hydraulic effects of Pristine pumping on the Upper Aquifer. Note that implementation of this activity will depend on willingness of Pristine operators to coordinate their activities with those of Rohm and Haas and Geomatrix. Rohm and Haas and Geomatrix have no control over Pristine operations.

As discussed in Section 9.0, Phase 2 is anticipated to commence in June 2001 and conclude in September 2001.

4.3 PHASE 3 FIELD INVESTIGATION

The primary focus of Phase 3 is to close any critical data gaps in the groundwater evaluation, and to acquire any information needed regarding identified or suspected human receptors. The scope of the Phase 3 investigation is illustrated on Figure 4-3. Specific tasks include:

- Installation and sampling of supplemental Upper Aquifer monitoring wells, at locations identified as needed to meet FI objectives based on Phase 2 findings.

- Collection of soil samples from monitoring well borings for chemical analysis. Note that two samples will typically be retained from each boring or well. In the case of well pairs or well clusters, two samples will be retained from each pair or cluster location.

- Visual reconnaissance of the east bank of Mill Creek adjacent to the Morton Facility boundary, to identify seeps, staining, stressed vegetation, or other indications of environmental impact.

- Visual reconnaissance for surface runoff beyond the Morton Facility boundaries.

- Collection and geochemical analysis of groundwater from:

  - All Phase 1, 2, and 3 Upper Aquifer monitoring wells;
  - Existing Morton Facility monitoring wells MW-EPA-1, MW-EPA-2, MW-EPA-3, and MW-EPA-4; and
  - Existing Pristine Upper Aquifer monitoring wells GW58, GW62, GW64, GW65, and GW67 (assuming access and sampling permitted by Pristine controlling entities and/or property owners).

- Collection of other data needed to close critical data gaps necessary to meet AO and FI Work Plan objectives. Such collection will be limited, however, by the practical time constraints imposed by the AO.

As discussed in Section 9.0, Phase 3 is anticipated to commence in November 2001 and conclude in December 2001.

5.0 FIELD INVESTIGATION ELEMENTS

Geomatrix will utilize a variety of methods and procedures in implementing the field investigation. These were referenced and briefly described by phase of investigation in Section 4.0 of this FI Work Plan. This section is intended to describe each of these elements in greater detail, and to provide specific references to field operating procedures delineated in the QAPP (Appendix A).

5.1 SOIL BORINGS

Certain borings are intended solely for the collection of stratigraphic information and/or soil samples. Other borings will be additionally used for the installation of monitoring wells, described in Section 5.4. Geomatrix may use borings to investigate suspected buried waste materials. Geomatrix may also use borings to verify the location of the Groundwater Collection System slurry wall and French drain, if these features cannot be located using other methods.

Soil borings will be typically advanced to total depths ranging from 5 to approximately 60 feet below ground surface (bgs). Depending upon their depth and use, borings will be advanced using direct push technique (DPT), hollow stem auger (HSA) drilling, or rotasonic drilling methods.

All drilling and sampling equipment will be decontaminated prior to use. All drilling sites will be surveyed for location and elevation. Those borings not intended for well installation will be grouted as soon as practicable after total depth is reached. Field operating procedures for this FI are included in the QAPP (Appendix A) for DPT, HSA drilling, rotasonic drilling, soil sampling, equipment decontamination, borehole destruction, investigation-derived waste management, and other related operations.

5.2 SOIL SAMPLING

Soil samples will be utilized to characterize subsurface lithology and stratigraphy, measure physical characteristics of various site strata, and measure concentrations of target analytes. The general soil sampling strategy for the FI will be as follows:

- Continuous soil sampling to a nominal depth of 15 feet bgs.
- Sampling at intervals of approximately 5 feet for the depth range from 15 to 50 feet bgs.
- Sampling at intervals of approximately 10 feet for depths below 50 feet bgs.

One surface soil sample will be retained for geochemical analysis (i.e., for the CLP-TAL or App. IX-TAL). This sample will represent the interval within the 0 to 3 feet depth range that exhibits the greatest degree of impact, based on field evidence. If no evidence of impact is apparent in the field, the analytical sample will be retained from the uppermost 1 foot of soils, disregarding any surface cover such as turf, mulch, rock, paving, or base material.

A second sample will be retained from the interval between 3 feet and either 15 feet bgs or the water table, whichever is deeper. The sample interval will be selected based on the following criteria in descending order of priority:

1. The soils exhibiting the greatest field indication of chemical impact.
2. The soils from the apparent interface between saturated and unsaturated conditions.
3. The soils at 15 feet bgs.

If FI data indicate that a modification of this sample collection strategy is appropriate, Rohm and Haas and Geomatrix will propose a modified strategy to the USEPA. Samples will be retained from each of the six stratigraphic borings for geotechnical analysis. One geotechnical sample will be retained from each of the major strata observed in each boring.

When using rotasonic drilling methods, samples will be collected directly from the inner casing or barrel advanced as part of the drill string, or from the plastic sampling sleeve. When using hollow stem auger drilling or direct push methods, samples will be collected using driven or pushed samplers, including split spoons, Shelby tubes, or equivalent methods. Soils retained for

VOC analysis will be containerized using the EnCore™ Sampler. If the soil texture prohibits the use of this method, such as for coarse sands or gravels, field preservation/acidification will be used for VOC samples.

Soil samples will be field screened for the presence of VOCs; this screening will include the use of a photoionization detector-type field organic vapor meter. All samples collected will be described in the field as to lithology, field indications of impact, and other pertinent data. Soils descriptions will be in general accord with the Unified Soil Classification System (USCS).

In the case of well clusters or well pairs, soil sampling for logging and laboratory analysis will be performed on only one of the borings at each pair or cluster location. Logging will be performed on the deepest boring at each location, in order to describe the most complete stratigraphic section.

All sampling equipment will be decontaminated prior to use, and unused samples will be managed as investigation-derived wastes. Field operating procedures for this FI are included in the QAPP (Appendix A) for soil sampling, sample labeling, storage, and shipment, equipment decontamination, use of the EnCore™ Sampler, field preservation/acidification, investigation-derived waste management, and other related operations.

5.3 SOIL ANALYSIS

Soil samples will be analyzed for either the App. IX-TAL or CLP-TAL described in Section 4.0. These analyte lists are fully defined in Tables A-1 and A-2 of the QAPP (Appendix A). Selected samples from the vicinity of the Former Surface Impoundments and the Former Swale Area will be analyzed for the App. IX-TAL. These sample locations are identified in Figures 4-1, 4-2, and 4-3. All other soil samples collected during the FI will be analyzed for CLP-TAL.

In addition to geochemical analysis, field personnel will select soil samples to be analyzed for geotechnical analysis. The geotechnical analytical parameters will be:

- Total organic carbon
- Cation exchange capacity
- Grain size distribution
- Moisture content
- Atterberg limits
- pH

All geotechnical and geochemical analysis will be performed at an EPA approved analytical laboratory and using the analytical techniques identified in the QAPP (Appendix A). Field operating procedures for this FI are also included in the QAPP for soil sampling, sample labeling, storage, and shipment, equipment decontamination, and other related operations.

5.4 MONITORING WELL INSTALLATION

Monitoring wells will be utilized to collect representative groundwater samples from targeted water-bearing zones, and to measure hydraulic parameters affecting or controlling groundwater flow (e.g, water levels). If stratigraphic borings indicate that multiple transmissive zones are present within the Upper Aquifer at a given location, then well clusters will be installed. Each well within a cluster will monitor a separate transmissive zone. All wells installed during the FI will be designated with a UAW prefix, indicating "Upper Aquifer Well." For well clusters, each individual well will be designated with an A, B, etc. indicating increasing depth of the transmissive zone being monitored.

All wells will be nominal 4-inch diameter and will be constructed of new polyvinyl chloride riser and stainless steel screen. All well materials will have threaded-type connections.

For well construction in borings drilled with rotasonic methods, wells will be constructed within the outer drive casing as that casing is withdrawn. Wells constructed in borings drilled with hollow-stem auger methods will be constructed through the auger stem, except in cases where the augers may be withdrawn without significant borehole collapse.

The annular space surrounding the well screen will be filled with a filter pack material, consisting of high-silica sand. The annular space above the filter pack will be sealed with a filter pack seal consisting of bentonite pellets or chips, and with an annular seal consisting of bentonite cement grout (2 to 5 percent bentonite by dry weight). All wells will be developed following installation, in order to remove construction-related fluids and improve the hydraulic communication between the well and the formation.

All wells will be surveyed for location and elevation. Well installation and development equipment will be decontaminated prior to use. Field operating procedures for this FI are included in the QAPP (Appendix A) for borehole drilling, monitoring well construction and development, investigation-derived waste management, and other related operations.

5.5 GROUNDWATER SAMPLING

Groundwater will be sampled at Upper Aquifer wells identified in Section 4.1 and 4.3 of this FI Work Plan. One sampling event collectively addressing all FI wells will be performed during Phase 1 of the FI. Wells installed during Phase 2 will be sampled individually as they are installed and developed, except that sampling of any wells installed after November 1, 2001 will be postponed until the Phase 3 groundwater sampling event in December 2001. All FI wells, including any installed during Phases 2 and 3, will be sampled during a second sampling event at the conclusion of Phase 3 well installation activities.

Sampling will be preceded by well purging using low flow purging techniques. At the completion of purging, based on the stabilization of field parameters, the sample will be collected from the purge pump discharge. If this method cannot be implemented for any reason (e.g., insufficient well yield), disposable bailers will be utilized as an alternate sampling method after purging. Field operating procedures for this FI are included in the QAPP (Appendix A) for monitoring well purging and sampling, field instrument calibration and use, sample labeling, storage, and shipment, equipment decontamination, and waste containerization and staging.

5.6 GROUNDWATER ANALYSIS

Groundwater will be analyzed for either the App. IX-TAL or CLP-TAL described in Section 4.0. These analyte lists are fully defined in the QAPP (Appendix A). Selected samples from the vicinity of the Former Surface Impoundments and the Former Swale Area will be analyzed for the App. IX-TAL. These sample locations are identified in Figures 4-1, 4-2, and 4-3. Note that only the samples from the shallowest wells at these locations will be analyzed for the App. IX-TAL. All groundwater samples from deeper wells, and all other groundwater samples collected during the FI will be analyzed for the CLP-TAL.

In addition to App. IX-TAL or CLP-TAL analysis, groundwater samples will be analyzed for General Water Quality parameters, consisting of:

- Alkalinity (bicarbonate/carbonate)
- Ammonia
- Nitrate/nitrite
- Phosphate
- Phosphorus
- Calcium
- Total Iron
- Magnesium
- Potassium
- Sodium
- Chloride
- Total Dissolved Solids (TDS)
- Total Suspended Solids (TSS)

General Water Quality analysis will be performed on all groundwater samples from the first groundwater sampling event, or from the initial sampling of each well not included in that event. Selected samples from the second sampling event will also be analyzed for these parameters.

Chemical analyses of groundwater samples will be performed at an EPA approved analytical laboratory using the analytical techniques identified in the QAPP (Appendix A). In addition, dissolved oxygen, temperature, pH, and specific conductance will be measured for each aqueous sample in the field.

Field operating procedures for this FI are also included in the QAPP for groundwater sampling, field instrument calibration and use, sample labeling, storage, and shipment, equipment decontamination, and other related operations.

5.7 GROUNDWATER LEVEL MEASUREMENTS

Groundwater levels will be measured in order to calculate groundwater elevations, which will in turn be used to evaluate the site specific vertical and horizontal groundwater gradients. This will assist in interpreting the nature of groundwater flow, both across the site and vertically between strata. Groundwater levels will be measured using an electric water level sounder (e-line) in all new and existing monitoring wells during every sampling event. Field operating procedures for this FI are included in the QAPP (Appendix A) for groundwater level measurements, equipment decontamination, and other related operations.

5.8 SEEP AND SEDIMENT SAMPLING

Seeps and sediments will be sampled in order to identify any potential impact to Mill Creek from current or historical facility operations. As discussed in Section 2.0, it is not known whether there are currently any active seeps in this area. Geomatrix will perform reconnaissance of the east bank of Mill Creek at least once per phase of work to check for the presence of active seeps. Such reconnaissance events will be scheduled such that at least one event occurs per calendar quarter for the first, second, and third quarters of calendar year 2001. If field personnel are present on-site during major rain events, field reconnaissance events will be performed following those events.

In order to supplement the visual assessment, field screening will be performed using:

- A photoionization detector for the presence of volatile organics; and
- An ultraviolet light for the presence of optical brighteners.

If active seeps or locations of apparently-impacted sediments are identified to the west of the Morton Facility, along the east bank of Mill Creek, surface water and sediment samples will be collected from each seep or sediment area identified. In the event that either no or relatively few

such areas are observed, sediment samples will be collected from the surface at least every 100 linear feet along the east creek bank, at the approximate elevation of historic seepage. Surface water samples will be collected only from active seeps, if any are present. If none are present, then no surface water samples will be collected.

There is currently no information regarding the presence or absence of environmental impact along Mill Creek adjacent to the Morton Facility. Given this, it is not known whether there will be any need to evaluate conditions upstream (i.e., to assess background Mill Creek conditions) or downstream (i.e., to evaluate the extent of identified impact) of the Morton Facility.

Sediments will be collected using a hand-driven tube sampler equipped with stainless steel liners. All equipment will be decontaminated prior to use. Sediments retained for VOC analysis will be containerized using the EnCore™ Sampler. If the sediment texture prohibits the use of this method, such as for sediments containing coarse sands or gravels, field preservation/acidification will be used for VOC samples.

Seep samples will be collected using dipper-type samplers directly from the seep itself, if possible. If necessary, the seep area may be excavated slightly to enhance accumulation and collection of the seeping water. Alternatively, Geomatrix may install drainage devices to direct seep water out from the creek bank, to facilitate collection. If the seep does not produce non-turbid water during the sampling period, then Geomatrix may elect to analyze both field-filtered and non-filtered samples to evaluate the impact of turbidity on analytical results. The need for this duplicate analysis will be determined based on initial analytical results. All excavation and sampling equipment will be decontaminated prior to use.

Field operating procedures are included in the QAPP (Appendix A) for sediment and surface water sampling, sample labeling, storage, and shipment, field instrument calibration and use, equipment decontamination, and other related operations.

5.9 SEEP AND SEDIMENT ANALYSIS

The analysis of seep and sediment samples is intended to identify and quantify any compounds derived from or migrating beneath the Morton Facility, as opposed to compounds that may be migrating along Mill Creek from upstream sources. Given this, seep and sediment samples will be analyzed only for those constituents (and their likely degradation products) detected in groundwater samples. Because only Phase 1 results will be available at the time of seep and sediment analysis, Phase 1 groundwater data will be used as the basis for selecting seep and sediment analytes. For the purposes of this FI Work Plan and the QAPP, it is assumed that all constituents detected will fall within the CLP-TAL. If App. IX-TAL constituents that are not included in CLP-TAL are detected in facility groundwater, however, then seep and sediment samples will be analyzed for those compounds. The App. IX-TAL or CLP-TAL are described in Section 4.0. These analyte lists are fully defined in the Tables A1-1 and A1-2 of the QAPP (Appendix A).

In addition, selected sediment samples will be analyzed for the geotechnical parameters identified in Section 5.3. All seep samples will be analyzed for the General Water Quality parameters identified in Section 5.6.

Chemical analyses of seep and sediment samples will be performed at a USEPA approved analytical laboratory using the analytical techniques identified in the QAPP (Appendix A). In addition, dissolved oxygen, temperature, pH, and specific conductance of surface water will be measured in the field. Field operating procedures for this FI are also included in the QAPP for seep and sediment sampling, field instrument calibration and use, sample labeling, storage, and shipment, equipment decontamination, and other related operations.

5.10 GEOPHYSICAL EVALUATION

Geophysical methods will be used to identify possible buried materials that may be a source of chemical impact. Specifically, electromagnetic surveys will be used to locate objects or areas with anomalous signatures of actual or induced electrical resistance. These may represent metallic objects, or simply areas with electrochemical characteristics that contrast with those in

the soils surrounding them. Geomatrix may also use geophysical methods to verify the location of the Groundwater Collection System slurry wall and French drain, if these features cannot be located using other methods.

Geophysical surveys will target specific evidence where historic or anecdotal records indicate waste materials may have been buried. Surveys will be performed by first establishing a reference grid across the area of interest. Grid nodes will be marked, and electromagnetic response will be measured at each node using a portable instrument.

Field operating procedures for this FI are included in the QAPP (Appendix A) for the performance of electromagnetic surveys and the calibration of geophysical instruments.

5.11 Plugging and Abandonment of Wells

Wells that are not considered to be capable of providing representative groundwater samples, or that may provide conduits for fluid migration due to construction, will be plugged and abandoned. Plugging will be performed by overdrilling the well using augers or the rotasonic casing, in order to destroy or disrupt the grout seal. Following the overdrilling, the casing will be removed from the augers or casing, and the resulting borehole will be grouted to the ground surface. All well materials, soils, and fluids removed from the subsurface during plugging and abandonment will be managed as investigation-derived waste.

Field operating procedures for this FI are included as Attachment 2 of the QAPP (Appendix A) for the plugging and abandonment of wells, management of investigation derived waste, and equipment decontamination.

5.12 Aquifer Testing

After the installation, development, and sampling of all monitoring wells, two well clusters will be selected for pumping or slug tests. Locations will be selected to provide data as representative of conditions across the Morton Facility as practicable. These tests will be used to quantify the hydraulic character of the aquifer materials at the test location. If, during the course

of the FI, it is determined that further pump testing at additional locations is needed to meet AO and FI objectives, then Rohm and Haas and Geomatrix will propose additional test locations to the USEPA. Test results will be analyzed using recognized and accepted hydrologic methods. All pumping or slug testing equipment will be decontaminated prior to use.

Aquifer testing will also include evaluations of the degree of communication between the Lower and Upper Aquifers at selected locations. The locations of interest are those where Geomatrix will be installing Upper Aquifer wells near existing Lower Aquifer extraction wells EW-1, EW-2, and EW-3. At these locations, the Lower Aquifer well will have pumping terminated in order to significantly change its water level. This will allow the characterization of hydraulic communication between the two aquifers at a location where the confining layer is thin to absent (the northeast portion of the Morton Facility, tested by EW-1 pumping), and where it is relatively thick (the southeast portion of the Morton Facility, evaluated by EW-2 and EW-3). In concert with the facility-wide information on the occurrence and thickness of the confining layer developed from the stratigraphic borings, this should allow Geomatrix and Rohm and Haas to reach basic conclusions about the relationship between the character of this confining layer and the degree of inter-aquifer communication across the Morton Facility.

The Upper Aquifer well or wells will be monitored for water-level changes using a datalogger/transducer combination or e-line.

Field operating procedures for this FI are included in the QAPP (Appendix A) for groundwater elevation measurements, equipment decontamination, pump and slug testing, and other related operations.

5.13 COMBINED SEWER SYSTEM CAMERA SURVEY

Geomatrix and operational personnel will perform an inventory of the locations, types, and inputs of all inlets and access points to the CSS. Based on this data, Geomatrix will commission and oversee a camera survey of those portions of the CSS known or suspected to have transported waste materials. The purpose of this survey will be to identify and locate major

breaches in the CSS's integrity. This information will be used to guide soil sampling, and also to direct repairs of any failed sections.

Camera surveys will be performed by a subcontractor experienced in surveys of industrial wastewater lines. A self-propelled, remotely-controlled video camera will be introduced into existing CSS access points. Camera images will be viewed real-time, and will be videotaped to document the survey findings. Surveys will be performed in a manner consistent with industry standards for such operations.

5.14 BACKGROUND EVALUATION

Given the nature of the setting and neighboring facilities, the background concentrations of organic and inorganic constituents are not assumed to be zero. To the contrary, Geomatrix anticipates that many of the CLP-TAL and App. IX-TAL compounds will be detectable in background soils and groundwater.

Geomatrix will establish background concentrations for soils as follows:

- Ten soil borings will be advanced during Phase 2 to nominal depths of 15 feet to collect samples for geochemical analysis. Boring locations will be identified by Geomatrix field personnel, and must be in locations that would not reasonably have been affected by current or historic Morton Facility releases. Off-property locations may be utilized.
- At each location, one soil sample will be retained from 0 to 3 feet bgs, and considered to represent surface soils. A second sample will be retained from approximately 15 feet bgs, and considered to represent subsurface soils.
- All samples will be analyzed for those CLP-TAL and App. IX-TAL constituents identified in FI soil or groundwater samples during Phase 1.

Geomatrix will establish background concentrations for groundwater by using data from FI wells upgradient of the property, including wells at the upgradient edge of the property. Analysis of groundwater samples from these wells is discussed in Section 5.6.

Background concentrations will be evaluated using a statistical method consistent with USEPA guidance. Background concentrations will be evaluated in accordance with Sections A1.4.2 and A1.4.3 of the QAPP. If appropriate, background values may be supplemented by literature values for specific constituents.

6.0 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT

The FI will include a screening-level ecological risk assessment (SERA). This SERA will be conducted in accordance with the most current USEPA guidance including:

- Guidelines for Ecological Risk Assessment, Final, USEPA/630/R-95/002F, April 1998a.
- Ecological Risk Assessment Guidance for Superfund - Process for Designing and Conducting Ecological Risk Assessments, Interim Final, USEPA 540-R-97-006, June 5, 1997.
- Ecological Risk Assessment Guidance for RCRA Corrective Action - Region 5, Interim Draft, October 1994.

The objective of the SERA is to identify constituents of concern present in environmental media, and to determine any potential risks these constituents pose to ecological receptors. The results of this assessment will be used to determine if the ecological risk assessment should move to the next level, or if the assessment process can be concluded.

The SERA is the first step in a tiered approach to ecological risk assessment. Under this tiered approach, sites are initially evaluated with respect to general criteria. If the evaluation indicates that the site does not exceed these criteria, the assessment may be concluded. Otherwise, the evaluation moves on to a tier where criteria are more quantitative and site specific; i.e., a preliminary ecological risk assessment (PERA).

Three processes are performed within each tier: problem formulation, analysis, and risk characterization. Each of these steps for the SERA is described in detail below.

6.1 PROBLEM FORMULATION

During the SERA problem formulation, a conceptual model for the site will be developed that addresses the following:

- Environmental setting and chemical constituents known or suspected to exist at the site.
- Chemical fate and transport mechanisms.
- Mechanisms of ecotoxicity associated with chemicals and potential receptors.
- Complete exposure pathways that may exist at the site.
- Selection of endpoints for ecological assessment.

Each of these conceptual model elements is discussed in greater detail below in Sections 6.1.1 through 6.1.5.

6.1.1 Environmental Setting

The natural resources of the site and surrounding area will be described with regard to vegetation, wildlife, available habitats, wetlands, etc. The description will include:

- The layout and topography of the site.
- A description of water bodies and wetlands.
- Any evidence of known or potential chemical impact.
- A description of existing aquatic, terrestrial and wetland ecological habitat types including dominant vegetation species present.
- Identification of any potentially sensitive environments.
- Identification of wildlife species observed, as well as those that may potentially reside at the site.

In order to complete the environmental setting section, a field reconnaissance survey of the site will be completed. The objectives of the survey are to:

- Map and describe plant communities and aquatic resources on and adjacent to the site.
- Observe wildlife species.
- Identify significant ecological resources.
- Observe evidence of stress to plants and animals, if any, from site-related chemical contamination.

This survey will be performed during Phase 2 of the FI, as discussed in Section 4.2.

6.1.2 Chemical Fate and Transport

The SERA will identify pathways for migration of a chemical constituent (e.g., groundwater transport to surface water). It will generally characterize the fate and transport of each class of constituent (e.g., VOCs, phthalates, metals) identified in sediment/soil and surface water, including bioaccumulation potential, adsorption potential and other factors involved in determining bioavailability of these constituents. Available information on site conditions will be incorporated into this discussion as necessary.

A preliminary list of chemical stressors and their suspected sources will be developed from a list of the chemicals used at the facility. The list will include those chemicals known or suspected to have been released. From this list, COPCs for the ecological risk assessment will be selected based on the inherent tocixity to ecological receptors and the ability to biomagnify or bioaccumulate. Only chemicals that are detected above background levels in 5 percent or more of samples will be considered for COPC selection (see discussion of background in Section 5.14 of the FI Work Plan, and Section A.4.2 and A1.4.3 of the Quality Assurance Project Plan (QAPP) from Appendix A).

COPCs may be VOCs, SVOCs, pesticides, metals, PCBs, or other constituents. Once identified, COPCs will be analyzed as discussed in Sections 6.2 and 6.3 to assess whether they are present at concentrations that may cause adverse ecological effects. Chemical stressor data will be summarized to illustrate frequency of detection, range of detected concentrations, and average concentration.

6.1.3 Ecotoxicity and Potential Receptors

The ecotoxicity of the identified COPCs in each medium of concern (i.e., soil, surface water, sediment) will be described in terms of the potential toxic effects. This information will be used to evaluate the importance of individual exposure pathways. The ecotoxicity information will be extrapolated from toxicological studies published in the professional literature.

The SERA will identify biological receptors and habitats that are or have been potentially exposed to COPCs. Information reviewed will include :

- descriptions of habitats and sensitive areas,
- soils, groundwater, surface water and sediment data,
- aerial photography, and
- other available mapping.

To the extent possible, this effort will utilize existing information.

6.1.4 Complete Exposure Pathways

A complete exposure pathway encompasses the source of chemical impact, the movement of a COPC through environmental media, and its occurrence at the point at which ecological

receptors may be exposed. Potential pathways that may exist in the vicinity of the Morton Facility will be identified to support the development of a conceptual model for the site.

Wildlife near the site may have incidental contact with or ingest constituents while foraging, nesting, or engaging in other activities in the terrestrial portions of the site. Chemical constituents may also adversely affect plants and animals in surrounding habitats via the food chain. Constituents in groundwater, for example, may be transferred to surface water in the vicinity of the site. Constituents in surface water may be taken up by aquatic life as well as semi-aquatic and terrestrial wildlife. These pathways and others will be considered based on FI and acceptable historical data.

6.1.5 Assessment and Measurement Endpoints

For the purposes of the SERA, assessment endpoints will be any adverse effects to ecological receptors, where receptors are plant and animal populations, communities, habitats, and sensitive environments. Assessment endpoints will be selected for the ecological risk assessment based on the potential pathways and receptors identified in the previous sections. For this SERA, the assessment endpoints will be generic, and may include protection of aquatic or terrestrial communities.

6.2 ANALYSIS

- The second step in the SERA is the preliminary ecological effects evaluation, and the establishment of chemical exposure levels that represent conservative thresholds for adverse ecological effects. These conservative thresholds are termed screening ecotoxicity values. Federal regulatory guidance provides a screening value for most complete exposure pathways, routes, and constituents. These screening values are termed Region 5 Environmental Data Quality Levels (EDQLs) and are media-specific.

The Region 5 EDQLs for soil, sediment, and surface water are presented in Tables A1-5, A1-7, and A1-8 in the QAPP (Appendix A). For the SERA, the exposure media and routes will be selected to be representative of the Morton Facility. The selection process and the recommendations of the SERA will be documented in the Facility Investigation Report (Section 8.1).

Physical stresses unrelated to chemical exposure are not considered in this evaluation.

For some chemicals, the laboratory's RL is greater than the EDQLs. If a chemical is detected in one or more samples, even if qualified as estimated, then that chemical will be selected as a COPC, subject to evaluation using the other selection criteria listed in Section 6.1.2. For use in the SERA, non-detect results will be addressed in a manner consistent with Section 5.3.3 of the USEPA Risk Assessment Guidance for Superfund (RAGS) (USEPA, 1989a)

6.3 RISK CHARACTERIZATION

The SERA will estimate the quantitative screening-level risk using the maximum concentration of each COPC in each media, and the EDQL values tabulated in the QAPP. For the screening-level risk calculation, the hazard quotient approach will be used. The "quotient method" compares environmental constituent levels with the EDQLs summarized in the QAPP. For each constituent and environmental medium, the hazard quotient will be expressed as the ratio of the maximum concentration in the media to the EDQL:

$$\text{Hazard Quotient}_i = \frac{C_{max}}{EDQL}$$

Where:

HQ	=	Hazard Quotient
C_{max}	=	Maximum concentration at site

An HQ less than one indicates that the chemical is unlikely to cause adverse ecological effects. It is important to emphasize that this approach is conservative, and probably overestimates the potential for adverse effects upon wildlife populations.

No EDQL has been published for some chemicals. If one of these chemicals is designated a COPC, the SERA will develop an EDQL for it. This EDQL will be based on site specific information and considerations. The assumptions and calculations used to develop an

EDQL will be representative of conditions at the Morton Facility, and will be documented in the Facility Investigation Report (Section 8.1).

6.4 ADDITIONAL ASSESSMENT

The potential ecological risks associated with the site will be summarized based on the results of the SERA. If these risks support the performance of an additional assessment, the SERA will provide the rationale and scope for such an assessment. This additional assessment would probably consist of a second-tier evaluation, (i.e., PERA).

7.0 HUMAN HEALTH RISK ASSESSMENT

This section of the FI Work Plan presents the scope of work for a human health risk assessment (HHRA) for the Morton Facility. The goals of the HHRA will be to identify potential adverse affects to humans, to identify data gaps or the need for further assessment, and to support the development of appropriate cleanup levels for the site. The HHRA will be prepared in a manner consistent with the most current USEPA requirements or guidance, including the selection of any models or data evaluation procedures. Models and data evaluation procedures selected will accurately represent site conditions at the Morton Facility and available information. Any deviations from USEPA requirements will be justified and documented in the Final Inspection Report (Section 8.1).

The following section presents the general approach to the HHRA for the Morton Facility. This is followed by a brief description of the technical approach to be employed.

7.1 APPROACH

Morton intends to retain ownership of the entire property and will continue to operate an industrial facility. Based on this understanding, the HHRA for the Morton Facility will be based on industrial land use. Future land use determination will be consistent with the OSWER directive entitled "Considering Land Use in the CERCLA Remedy Selection Process" (USEPA, 1995). If institutional controls or other measures become necessary to ensure that future use is consistent with risk assessment assumptions, it is anticipated that these controls can be readily implemented, given that the Morton Facility is the sole property of Rohm and Haas.

Groundwater use is also an important aspect that must be considered in the HHRA. As documented in the Current Conditions Report, groundwater in the area immediately surrounding the Morton Facility is not used as a source of potable water. Lower Aquifer water beneath the facility is also being hydraulically controlled by the remediation system for the neighboring Pristine Superfund Site. All groundwater exposure pathways identified based on FI data will be considered in the HHRA.

The Current Conditions Report also described potential recreational use of Mill Creek to the west of the Morton Facility. If site-related chemicals are detected in seep surface waters or bank sediments during the FI, then the HHRA will consider potential exposure to surface water and sediments.

The HHRA will be conducted in accordance with USEPA guidance. Any deviation from USEPA requirements will be documented in the FI Report (Section 8. 1), together with the rationale for the deviation. Documents summarizing these requirements, as well as USEPA and state guidance documents that may be used, are summarized in Section 10 of this FI Work Plan. In accordance with this guidance, the HHRA for the Morton Facility will consist of the following elements:

- Data Evaluation
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization

The following sections present a brief summary of the scope of each of these elements, as well as technical approaches specific to the Morton Facility.

7.2 DATA EVALUATION

The purpose of this step in the risk assessment process is to identify the chemicals that are potentially related to the facility, and for which there are data of sufficient quality to be used in a quantitative risk assessment (USEPA, 1989a). This subset of chemicals is referred to as the chemicals of potential concern (COPCs).

7.2.1 Data Quality

The first step in this process is to identify and evaluate available data to determine if they are of sufficient quality for inclusion in the risk assessment. At this time, only FI data, and not historical data, are expected to be considered by the HHRA. The following criteria will be considered in evaluating the quality of FI data:

- **Blank contamination** will be evaluated based on the results of field and laboratory blank data. Common laboratory contaminants [e.g., acetone and bis (2-ethylhexyl)phthalate] will be eliminated if detected concentrations are within ten times the associated blank

concentrations (USEPA, 1989). All other chemicals will be eliminated if detected concentrations are within five times blank concentrations (USEPA, 1989a).

- **Reporting Limits (RLs)** should be sufficiently low such that chemicals can be detected at levels of potential concern. If the laboratory RLs for a chemical exceed human health screening levels, the evaluation of that chemical will be addressed as described in Section 7.

Data judged to be of sufficient quality will be integrated into a single database. Once all data are incorporated into a single database, tabular summaries of the data will be presented for each environmental medium, i.e., soil, groundwater, surface water and sediment. Tables will present the range of detected concentrations, range of RLs, and frequency of detection for all chemicals detected in each medium. Separate summaries for groundwater will be prepared for on-site and off-site conditions.

7.2.2 Chemicals of Potential Concern

Not all chemicals detected at a site warrant a quantitative evaluation. At many sites, most chemicals are detected at so low a concentration as to pose a negligible risk and may be eliminated from further consideration. The list of COPCs will be refined for each environmental medium by comparing detected concentrations to risk-based screening criteria and background levels. All background evaluations are subject to review and approval by the USEPA.

Soil

The risk-based screening criteria used to identify COPCs in soil will be the USEPA Region 5 Risk-Based Screening Levels (RBSLs; USEPA, 1998b) and the USEPA Region 9 Preliminary Remediation Goals (PRGs; USEPA, 1999) for soil. The RBSLs include values based on ingestion and inhalation under a residential scenario, as well as protection of groundwater for use as drinking water. PRGs are available for residential and industrial land use, and are based on ingestion, dermal contact and inhalation. For this HHRA, as discussed below, RBSLs for groundwater protection and PRGs for industrial land use will be used to screen for COPCs in soil.

Because the Morton Facility will be an active industrial facility, the RBSLs based on ingestion and inhalation under a residential land use are not applicable for soils. Therefore, the PRGs for

an industrial land use will be used to identify COPCs for direct contact with soil. A chemical in soil may also be a COPC if it may migrate to groundwater. COPCs for soil based on this pathway will be identified using the RBSLs for groundwater protection. Therefore, a chemical detected in soil will be considered a COPC if the maximum detected concentration exceeds:

- the background concentration, and
- either the PRG for industrial land use or the RBSL for groundwater protection.

The lower of the PRGs and the groundwater protection RBSL are summarized for soil in Tables A1-5 of the QAPP (Appendix A).

Sediment

There are no human health risk-based screening criteria for sediment. In the absence of such criteria, the RBSLs and PRGs for soil will be used to identify COPCs in sediment. Given there off-site location, however, and the potential for recreational use of Mill Creek, it may not be appropriate to utilize industrial screening criteria. Therefore, a chemical detected in sediment will be considered a COPC if the maximum detected concentration exceeds either the PRG for residential land use or the RBSL for groundwater protection. This represents a conservative approach, because the degree of potential exposure to sediments in a stream is significantly lower than that for soil. The lower of the RBSLs based on groundwater protection and the PRGs for residential land are summarized for sediment in Table A1-7 of the QAPP (Appendix A).

Groundwater and Surface Water

COPCs for groundwater will be selected based on a comparison with federal Maximum Contaminant Levels (MCLs) for drinking water and PRGs for drinking water. Although surface water is not used as a drinking water source, MCLs and PRGs will also be used to select COPCs for surface water. Chemicals detected in these media will be considered COPCs if the respective maximum concentrations exceed:

- the background concentration, and
- the MCL, if available, or the PRG if an MCL is not available.

The applicable MCLs and PRGs are summarized in Tables A1-6 and A1-8 in the QAPP (Appendix A).

General

If chemicals are detected at the site that lack either a PRG or RBSL, then the USEPA procedures will be used to calculate missing values, if sufficient toxicity data are available. The calculation and selection of PRGs or RBSLs will be performed in a manner that is consistent with USEPA procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any reason such procedures or guidance cannot be followed, then the rationale for deviating from them will be documented in the FI Report. Compounds present only at levels at or below background concentrations will not be considered as COPCs. A complete discussion of the development of background levels for each environmental medium is provided in Section 5.14 of the FI Work Plan. All background evaluations are subject to review and approval by the USEPA. If no COPCs are identified for a particular medium and/or area, then further quantitative risk analysis will not be performed. The conclusions of the HHRA for this medium/area will be based on the comparison to screening criteria.

7.3 EXPOSURE ASSESSMENT

Exposure assessment is the process of describing, measuring or estimating the intensity, frequency, and duration of potential human exposure to COPCs in environmental media at a site. The approach to the exposure assessment follows the recommendations for conducting an exposure assessment provided in the "Risk Assessment Guidance for Superfund" (USEPA, 1989a), the more recent guidance in USEPA's "Guidelines for Exposure Assessment" (USEPA, 1992a), and associated guidance. In accordance with this guidance, an exposure assessment consists of three basic steps:

1. Characterization of the exposure setting (physical environment and potential receptors).
2. Identification of exposure pathways (potential sources, points of release, and exposure routes).
3. Quantification of pathway-specific exposures (exposure point concentrations and intake 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). It should be noted that the following discussion is based on existing knowledge about the site characteristics, including the presence of COPCs in soil and groundwater. The exposure assessment for the Morton Facility presented herein will be re-evaluated based on data collected during the FI.

Exposure assessment is conducted within the context of a site conceptual model (SCM). The purpose of the SCM is to describe current knowledge about chemical sources, likely migration pathways, exposure routes, and possible exposure scenarios. The SCM is also used to identify the data required to support a risk assessment. The SCM for the Morton Facility is illustrated in Figure 7-1.

7.3.1 Characterization of the 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. These factors 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.

7.3.1.1 Physical Setting Summary

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, 2000).

7.3.1.2 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 an industrial facility. This exposure assessment is based on 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 (E&E, 1991 and Geomatrix, 2000).

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 hydraulically controlled by the remediation system for the neighboring Pristine Superfund Site. Regardless, any exposure routes identified for groundwater will be evaluated by the HHRA.

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.

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

7.3.2 Characterization of 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.

7.3.2.1 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 worker involved in occasional construction or maintenance 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. These restrictions include security fencing, round-the-clock manned operations, and security guards. There is minimal potential for an occasional trespasser to gain access to operational areas of the site. Therefore, a trespasser will not be considered a potential on-site receptor.

7.3.2.2 Off-Site Receptors

Potential off-site receptors include individuals residing or working downwind of the facility. Potential off-site receptors also include individuals using Mill Creek for recreational purposes, such as fishing, swimming, or wading.

7.3.3 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 (USEPA, 1989a) an exposure pathway is defined by four elements:

- A source and mechanism of COPC release to the environment;
- An environmental receiving or transport medium (e.g., air, soil) for the released COPC;
- A point of potential contact with the medium of concern; and
- 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 7-1. Potential on-site receptors may be exposed to COPCs in surface and subsurface soil, and air. Potential off-site receptors may be exposed to COPCs in surface water, sediment, and air. Further discussion of potential exposure pathways is presented in the following subsections.

7.3.3.1 Sources, Mechanisms of Releases, and Mechanisms of Transport

The primary sources of chemicals in soils at the site were historical activities. Current activities at the facility 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 have potentially resulted in chemical impact in on-site soils and in on-site and off-site groundwater. A brief summary of the nature and extent of impact to various media is provided in Section 2.0 of this FI Work Plan; a more extensive tabulation of known impact is provided in the Current Conditions Report.

There are a number of mechanisms by which the chemical identified at the facility can migrate from one location to another or to other media. The USEPA (1989a) has identified several of these mechanisms. Based on current information, the relevance of these mechanisms to the Morton Facility is discussed below. These pathways will be re-evaluated based on information collected during the FI.

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 PAHs, pesticides, and metals. However, the majority of the facility is covered by structures, pavement, or grassy, landscaped areas that would prevent the resuspension of dusts. Therefore, this pathway is not expected to be relevant to the Morton Facility. Its potential relevance will be re-evaluated during the FI. The evaluation of fugitive dust relevance will be performed in a manner consistent with USEPA procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any reason such procedures or guidance cannot be followed, then the rationale for deviating from them will be documented in the FI Report.

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. None of the surface drainage from the site enters Mill Creek, so chemicals present in on-site soils are unlikely to be released to Mill Creek as a result of surface water runoff. All surface drainage enters the facility's Combined Sewer System (CSS) where it is transported to the Mill Creek Wastewater Treatment Plant operated by the Metropolitan Sewer District (MSD). Therefore, this pathway is not expected to be relevant to the Morton Facility. Its potential relevance will be evaluated during the FI. The evaluation of the relevance of surface water runoff will be performed in a manner consistent with USEPA procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any

reason such procedures or guidance cannot be followed, then the rationale for deviating from them will be documented in the FI Report.

Leaching (percolation). Chemicals present in soil may migrate downward to groundwater as a result of infiltration of precipitation. 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 downgradient as a result of groundwater transport. This pathway is 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 will be evaluated if chemicals with bioaccumulative properties are detected in Mill Creek during the FI. The evaluation of fish ingestion will be performed in a manner consistent with USEPA procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any reason such procedures or guidance cannot be followed, then the rationale for deviating from them will be documented in the FI Report.

7.3.3.2 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 air, off-site air, and off-site surface water and sediment in Mill Creek.

Potential exposure routes associated with chemicals in soil are incidental ingestion, dermal contact, inhalation of volatile chemicals and particulates suspended by mechanical and wind-related processes. Exposure routes associated with affected groundwater consist of inhalation of volatile chemicals released to air through volatilization. Groundwater-related exposure routes for construction workers would include dermal contact, incidental ingestion, and inhalation of

volatiles from groundwater that discharges into excavations. Exposure routes applicable to chemicals in surface water or sediments are incidental ingestion, dermal contact, and ingestion of fish.

7.3.3.3 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. Final exposure pathways will be evaluated as part of the HHRA.

On-Site Receptors

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

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 land use conditions. The estimation of indoor air concentrations from soil and groundwater will be performed in a manner consistent with USEPA procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any reason such procedures or guidance cannot be followed, then the rationale for deviating from them will be documented in the FI Report.

Construction Workers. Construction workers may be exposed to subsurface as well as surface soil via incidental ingestion and dermal contact. This receptor may also be exposed to ambient air containing volatile COPCs released as a result of volatilization from groundwater, non-

volatile COPCs (if detected during the FI) present on fugitive dusts carried by the wind or generated by construction activities, dermal contact with and incidental ingestion of groundwater in excavations, and/or volatile COPCs released from soil. These receptors could be present under current and future industrial land use conditions.

Off-Site Receptors

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 significantly less than that of the on-site workers, because residents are farther from the site. If the FI determines that Morton Facility constituents have migrated into the Lower Aquifer, then off-site residents could also be exposed to COPCs via ingestion of groundwater.

Recreational Users of Mill Creek. If COPCs are detected in Mill Creek seeps or sediments, off-site receptors could be exposed to COPCs in surface water (dermal contact and incidental ingestion) and sediment (dermal contact). If COPCs are detected in Mill Creek that can bioaccumulate in fish, then these receptors could be exposed via ingestion of fish.

7.3.4 Exposure Quantification

The following paragraphs describe how exposure will be 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 is defined by USEPA as the "highest exposure that is reasonably expected to occur at the site." In the event that the calculated risks based on the RME scenario exceed levels generally considered acceptable to regulatory agencies, the HHRA may consider a More Likely Exposure (MLE) scenario.

7.3.4.1 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 required for risk assessment calculations as currently required by USEPA guidance (1989a, 1992b). 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 log-normal), 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 Supplemental RAGS guidance (USEPA, 1992b) stipulates that the exposure point concentration estimates should be based on the 95 percent upper confidence limit (95 percent UCL) of the mean to estimate an RME scenario. USEPA (1992b) guidance presents two equations for calculating the 95 percent UCL of the mean, one based on a normal distribution and one on a log-normal distribution. The appropriate equation from USEPA (1992b) will be used for each individual dataset. The selection of the appropriate equation will be performed in a manner consistent with USEPA procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any reason such procedures or guidance cannot be followed, then the rationale for deviating from them will be documented in the FI Report.

Statistical analyses of the data distribution may be performed if the data are sufficient to support the analysis. Otherwise, visual interpretation will be used. In the event that the calculated 95 percent UCLs exceed the maximum detected value, the maximum value will be 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 RL for each sample. In this instance, non-detect results will be addressed in a manner that is equivalent to or more conservative than Section 5.3.3 of USEPA Risk Assessment Guidance for Superfund (USEPA, 1989a)

Soil

Exposure point concentrations for soil will be derived separately for three soil depths: surface soil, subsurface soil, and unsaturated zone soil. Surface soil represents the soil to which the industrial worker may be exposed and will be defined by soil samples collected between 0 and 1 foot bgs. Subsurface soil represents soil to which a construction worker may be exposed and will be defined by soil samples collected between 0 and 15 foot bgs. Unsaturated zone soil represents all soil within the unsaturated zone and will be defined by all soil samples above the water table.

Groundwater

Exposure point concentrations will be developed separately for on-site and off-site groundwater.

Surface Water and Sediment

If concentrations are detected in surface water and/or sediment above background levels, then exposure point concentrations will be developed from samples collected from potentially affected areas. Note that background evaluations for surface water and sediment, if necessary, must be approved by the USEPA.

Air

Exposure point concentrations for air will be estimated using fate and transport models. The pathways requiring modeling and the models that will be employed are summarized in Table 7-1.

7.3.4.2 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 noncarcinogenic effects. The LADD addresses exposures that may occur over varying durations averaged over a 70-year human lifetime and are used to estimate potential carcinogenic risks.

The equations for calculating AADD and LADD for ingestion and inhalation exposures will be those presented by the USEPA (1989a). The AADD and LADD equations for dermal exposures will be taken from the 1998 RAGS dermal guidance (USEPA, 1998c). The selection of AADD

and LADD equations will be performed in a manner consistent with USEPA procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any reason equations from sources other than USEPA guidance are selected, then the rationale for doing so will be documented in the FI Report.

7.3.4.3 Exposure Parameters

Exposure parameters are quantitative estimates of the frequency, duration, and magnitude of exposure to various media. The exposure parameters will be selected from USEPA guidance (1989a; 1991; 1997, 1999), or from site-specific factors, when applicable. The selection of exposure parameters will be performed in a manner consistent with USEPA procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any reason parameters from sources other than USEPA guidance are selected, then the rationale for doing so will be documented in the FI Report.

7.4 TOXICITY ASSESSMENT

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

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

The hazard identification step has been performed for all of the chemicals that have been detected to date at the Morton Facility. The 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 published by the USEPA 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 reference doses (RfDs) and cancer slope factors (SFs), respectively. The RfDs and SFs for the COPCs being evaluated will be gathered from the following USEPA sources, listed in order of preference:

1. USEPA Integrated Risk Information System (IRIS) on-line database, 2000.
2. USEPA, 1997b, Health Effects Summary Tables, FY-1997 Annual, Office of Solid Waste and Emergency Response, Washington, D.C.
3. USEPA, 1999, Region 9 Preliminary Remediation Goals (PRGs).

If lead is identified as a COPC in soil, it will be evaluated using either the Interim Soil Lead Guidance (USEPA, 1994b), the Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil (USEPA, 1996a), or other applicable guidance. The evaluation of lead in soils will be performed in a manner consistent with USEPA procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any reason such procedures or guidance cannot be followed, then the rationale for deviating from them will be documented in the FI Report.

7.5 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. Potential adverse noncarcinogenic health effects will be evaluated using the hazard index (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 will be calculated by summing the hazard quotients for all chemicals, regardless of toxic endpoint, as recommended by 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. It can be used as a screening tool, however, to rapidly identify those exposure scenarios for which exposure to multiple chemicals does not pose a noncarcinogenic health risk. 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.

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 as follows:

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

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. The estimated risks calculated in the HHRA will be compared with the USEPA acceptable risk range of $1x10^{-6}$ to $1x10^{-4}$ for sites where remediation is considered (USEPA, 1990a and 1990b).

7.6 UNCERTAINTY

Uncertainty is inherent in many aspects of the risk assessment process. Uncertainty generally arises from a lack of knowledge of (1) site conditions and future site use, (2) toxicity and dose-response of the COPCs, and/or (3) the extent to which an individual may be exposed (if at all) to the chemicals. This lack of knowledge means that assumptions must be made based on information presented in the scientific literature or on professional judgment. Although some

assumptions have significant scientific basis, many do not. In all cases, the assumptions made will be conservative. As a result, it is generally agreed that risk estimates tend to over-estimate the true risks associated with a site. USEPA recommends an evaluation of uncertainties in the risk characterization. Therefore, the assumptions that introduce the greatest amount of uncertainty and their effects on the findings of the HHRA will be discussed in the FI Report.

The identification and characterization of sources of uncertainty will be performed in a manner consistent with USEPA procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any reason such procedures or guidance cannot be followed, then the rationale for deviating from them will be documented in the FI Report.

8.0 SUBMITTALS

This section discusses the contents of the three types of reports that will be submitted during the FI process: the FI Report, Scoping Reports, and quarterly Progress Reports.

8.1 FACILITY INSPECTION REPORT

The FI Report will be submitted at the conclusion of field operations, sample analysis, and data evaluation, and will include the following information and documentation:

- A description of the field procedures and methods used.
- A discussion of the nature and rationale for any significant variances from the scope of work described in this FI Work Plan.
- The data obtained during the FI. This will include geochemical data, field measurements, and any other pertinent data. To the extent practicable, data will be presented in map and table format.
- A discussion of the achievement of data quality objectives, as specified in the QAPP (Appendix A).
- The methods and rationales used in the evaluation of data.
- Conclusions regarding the extent and character of environmental impact in the various media being investigated, focusing on constituents that have not been eliminated by appropriate screening methods (i.e., health-based screening, existence of sources or migration pathways, etc.).
- A conceptual model for the site hydrogeology. This will provide a description of the basic patterns of groundwater flow within the Upper and Lower Aquifers underlying the Morton Facility.
- A discussion of how the specific goals identified in Section 3.0 of this FI Work Planhave been addressed. Specifically, a discussion of whether impacted groundwater migration is under control, and human and ecological risks are within acceptable limits.
- The conclusions of the ecological and human health risk assessments discussed in Sections 6.0 and 7.0 of this FI Work Plan, including any recommendations for more detailed assessments.

- An evaluation of the condition of the Combined Sewer System (CSS).
- An evaluation of the effectiveness of ongoing Interim Measures at the site, including the groundwater collection system french drain and slurry wall.
- The physical and geotechnical characteristics of the various soils that underlie the Morton Facility.
- Supporting materials for FI data. These will include boring logs, monitoring well construction diagrams, aquifer test calculation sheets, and similar information. Laboratory analytical reports, including laboratory quality assurance/quality control (QA/QC) documentation, will be provided only in electronic form, because of its volume. The electronic format will be compatible with USEPA capabilities.

The schedule for the preparation and submittal of the FI Report is discussed in Section 9.0 of this FI Work Plan.

8.2 SCOPING REPORTS

Rohm and Haas and Geomatrix will meet with the USEPA between Phases 1 and 2, and again between Phases 2 and 3. The purpose of these meetings will be to summarize the findings of the previous phase(s), and to refine or develop the scope for the upcoming phase. Prior to these meetings, Geomatrix will prepare tabular and map summaries of the available data, with interpretations to the extent practicable. Geomatrix will also identify proposed locations for additional wells, sampling, or other data points, and a summary of the proposed upcoming work. Geomatrix will provide this information to the USEPA as far in advance of the meeting as is practicable, given the timing of meetings versus the receipt of data. Following the scoping meeting, Geomatrix will modify the scope proposal to reflect the decisions reached during the meeting; the resulting scoping report will also be provided to the USEPA.

8.3 PROGRESS REPORTS

Progress reports to the USEPA will be provided on a quarterly basis during the period of active field operations. Quarterly progress reports will be in memorandum or tabular format, and will

contain, at a minimum, the following information:

- A description and estimate of the percentage of the FI completed.
- Summaries of all findings in the reporting period, including significant results of sampling and analysis.
- Summaries of all changes made in the FI during the reporting period.
- Summaries of all contacts with representatives of the local community, public interest groups, or the Ohio government during the reporting period.
- Summaries of contacts made during obtaining access to off-site property.
- Summaries of all problems encountered during the reporting period, and actions taken to rectify those problems.
- Changes in relevant personnel during the reporting period.
- Projected work for the next reporting period.
- Copies of field documentation for activities during the preceding calendar quarter. This may include daily reports, inspection reports, field measurement forms, and other monitoring data.
- The Project Quality Assurance Report, generated by the Quality Assurance Officer, and described in Section A14.0 of the QAPP (Appendix A). As discussed in that section, these reports will include audit results, data quality objective achievement, corrective action for quality concerns, and other information.

The schedule for the submittal of these reports is discussed in Section 9.0 of this FI Work Plan.

8.4 OTHER SUBMITTALS

Geomatrix or Rohm and Haas will provide written notification (i.e., letter, facsimile, or electronic mail) to the USEPA Project Coordinator at least 10 calendar days prior to the performance of field work (AO Paragraph 77). If access to off-site property areas is required, Rohm and Haas will provide the USEPA with a copy of the pertinent access agreements (AO Paragraph 75).

9.0 SCHEDULE

Table 9-1 summarizes major FI milestones (i.e., activities or submittals) and their proposed due dates. The due date for completion of the three phases of field activities (November-December 2001) assumes that the investigation scope is limited to the tasks described in this FI Work Plan. If supplemental investigation activities are required based on findings, Rohm and Haas will propose an appropriate extension of this schedule duration. Once the FI Work Plan is approved, in accordance with Paragraph 66 of the AO, this schedule will be considered incorporated into the AO. As specified in Paragraph 90 of the AO, the schedule specified in the final and approved FI Work Plan may be modified by mutual agreement in writing between the Rohm and Haas and USEPA Project Coordinators.

Although Rohm and Haas wishes to expeditiously pursue the investigation of the site, it would be counterproductive to attempt a major field effort during the winter months, unless absolutely necessary. For this reason, Geomatrix and Rohm and Haas will be attempting to complete all field operations between March and December 2001.

10.0 BIBLIOGRAPHY

ATEC Associates, Inc., 1983, Final Report Hydrogeologic Assessment, Carstab Facility, Cincinnati, Ohio, September 2.

Camp Dresser & McKee Inc. (CDM), 1986, Final Remedial Investigation Report for Pristine, Inc. Site, Reading Ohio, July.

Cincinnati Milacron Chemicals, Inc. (CMC), March 29, 1979a, Memorandum from Robert J. Neubert to R. Witman.

Cincinnati Milacron Chemicals, Inc. (CMC), June 6, 1979b, Interoffice Memorandum from Paul A. Bautista to C.L. Adams, J.L. Hanley, T.G. Kugele, and R.C. Witman.

Code of Federal Regulations, 1999, Title 40.

Conestoga-Rovers & Associates (Conestoga-Rovers), 1996, Hydrogeologic Modeling Report, Lower Aquifer Investigation, Pristine, Inc. Site, August.

Conestoga-Rovers & Associates (Conestoga-Rovers), 2000, Round 13 Monitoring Well Sampling Results, Pristine, Inc. Site, April.

Ecology and Environment, Inc. (E&E), 1991, Screening Site Inspection Report for Carstab Corporation, Reading, Ohio, August 19.

Geomatrix Consultants, Inc., (Geomatrix), 2000, Current Conditions Report, Morton International, Inc. Facility, Reading, Ohio, September.

Ohio Environmental Protection Agency (OEPA), 1994, Biological and Water Quality Study of Mill Creek and Tributaries, Butler and Hamilton Counties, Ohio, Technical Report SWS/1993-12-9. Columbus, Ohio.

PEDCo Environmental, Inc. (PEDCo), 1982, Investigation of Seepage into the Mill Creek at the Carstab Chemical Production Facility in Reading, Ohio, Cincinnati, Ohio, February.

PRC Environmental Management, Inc. (PRC), 1993, Expanded Site Inspection Report, Carstab Corporation (Morton International, Inc.) Site, Cincinnati, Ohio, May 7.

TechLaw, Inc. (TechLaw), 1998, Preliminary Assessment/Visual Site Inspection Report for Morton International, Inc., Reading, Ohio, July 8.

U.S. Environmental Protection Agency (USEPA) , 1989a, Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A), Interim Final, USEPA/540/1/1-89/002, December.

U.S. Environmental Protection Agency (USEPA), 1989b, Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation Manual (Part A), Interim Final, USEPA/540/1/1-89/001, March.

U.S. Environmental Protection Agency, (USEPA), 1989c, Final RCRA Facility Investigation (RFI) Guidance, Volumes I-IV, EPA/530/SW-89-031, May.

U.S. Environmental Protection Agency (USEPA), 1990a, Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities, Proposed Rule, Federal Register, v. 55, p. 3078.

U.S. Environmental Protection Agency (USEPA), 1990b, National Oil and Hazardous Substances Pollution Contingency Plan, Federal Register, v. 55. 8666.

U. S. Environmental Protection Agency (USEPA), 1991, Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors, Office of Solid Waste and Emergency Response, OSWER Directive 9285.6-03, March 25, 1991.

U.S. Environmental Protection Agency (USEPA), 1992a, Guidelines for Exposure Assessment, Federal Register 57[104]:22888-22937, May 29.

U. S. Environmental Protection Agency (USEPA), 1992b, Supplemental Guidance to RAGS: Calculating the Concentration Term, Office of Solid Waste and Emergency Response, Publication 9285.7-081, May 1992.

U.S. Environmental Protection Agency (USEPA), 1994a, Ecological Risk Assessment Guidance for RCRA Corrective Action – Region 5, Interim Draft, October.

U.S. Environmental Protection Agency (USEPA), 1994b, Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWER Directive 9355.4-12, July 14.

U.S. Environmental Protection Agency (USEPA), 1996a, Technical Review Workgroup for Lead, Recommendation of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil, December.

U.S. Environmental Protection Agency (USEPA), 1996b, Soil Screening Guidance: User's Guide, Office of Solid Waste and Emergency Response, 9355.4-23, July.

U.S. Environmental Protection Agency (USEPA), 1996c, Soil Screening Guidance: Technical Background Document, Office of Solid Waste and Emergency Response, USEPA/540/R-95/128, May.

U.S. Environmental Protection Agency (USEPA), 1997a, Ecological Risk Assessment Guidance for Superfund – Process for Designing and Conducting Ecological Risk Assessments, Interim Final, USEPA 540-R-97-006, June 5.

U.S. Environmental Protection Agency (USEPA), 1997b, Health Effects Summary Tables, FY-1997 Annual, Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. Environmental Protection Agency (USEPA),1998a, Guidelines for Ecological Risk Assessment, Final, USEPA/630/R-95/002F, April.

U.S. Environmental Protection Agency (USEPA), 1998b, Region 5 RCRA Quality Assurance Project Plan Instructions, April.

U.S. Environmental Protection Agency (USEPA), 1998c, Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, Interim Guidance, Office Emergency and Remedial Response, Washington D.C.

U.S. Environmental Protection Agency (USEPA), 1999, Region 9 Preliminary Remediation Goals (PRGs).

U.S. Environmental Protection Agency (USEPA), 2000, Administrative Order Requiring Monitoring, Analysis, and Reporting, Region 5, Docket No. R3013-5-00-001, August 18.

U.S. Environmental Protection Agency (USEPA), 2000, Integrated Risk Information System (IRIS) on-line database.

U.S. Environmental Protection Agency (USEPA), 2000, Contract Laboratory Program Target Analyte List Developed From the USEPA Superfund Contract Laboratory Program, On line: http://www.epa.gov/superfund/programs/clp/target.htm.

Table 2-1
Identified Areas of Interest
Morton Facility
Reading, Ohio

Study Areas Identified in the Administrative Order

AO Paragraph Reference	Other Identification	Description
16	SWMU 1	Former Surface Impoundments
17	SWMU 2	Former Neutralization Tank
18	SWMU 3	Former Drum Storage Area
19	SWMU 5	Former Sulfide Waste Treatment Tank
20	SWMU 6 & 7	Groundwater Collection System Groundwater Treatment System
21	SWMU 9 & 11	pH Control System Combined Sewer System
22	SWMU 10	Former Swale Area
23	Mill Creek Seeps	Seeps on east bank of Mill Creek, west of Morton Facility.

Areas of Interest Not Identified in theAdministrative Order

Identification	Description
SWMU 4	Hazardous Waste Drum Storage Area
SWMU 8	Satellite Waste Accumulation Areas
5000-Gallon Ignitable Waste Storage Tank	AST formerly used for storage of "ignitable waste."
12,000-Gallon Reactive Waste Storage Tank	AST formerly used for storage of "reactive waste."
Wastewater Treatment Tank	AST formerly used for wastewater treatment.
Waste Burial Location A	Burial location of small quantities of sodium and various lab samples, estimated total of 55 gallons.
Waste Burial Location B	Area reportedly used to burn waste solvents (notably hexane, heptane, and methanol). Possible location of three drums, contents unknown, buried in lime and soda ash fill.
Waste Burial Location C	One drum of sulfur monochloride buried in lime and soda ash fill.
Waste Burial Location D	Possible location of one or two drums, contents unknown, buried in lime and soda ash fill.
Waste Burial Location E	Former burial location of pipes and equipment, including sodium metal in pipes, from a building explosion and fire. The debris was later removed.
Waste Burial Location F	Possible location of three drums, contents unknown, buried in lime and soda ash.

Notes:
AO – Administrative Order (USEPA, 2000); AST – Aboveground Storage Tank
SWMU = Solid Waste Management Unit

TABLE 9-1
FACILITY INVESTIGATION SCHEDULE
Morton Facility
Reading, Ohio

Date	Activity	Purpose
September 11, 2000	Initial Meeting	Refine schedule, discuss broad objectives and key facts
October 2, 2000	Submittal of Current Conditions Report	Provide basic description of setting, history, and operations, to allow for proper scoping and review of Facility Investigation (FI) Work Plan
October 16, 2000	Scoping Meeting	Discuss preliminary review of CCR, describe and discuss proposed scope of FI, including detailed scope of Phase 1 activities
November 21, 2000	Submittal of FI Work Plan	Describe procedures, methods, locations, depths, etc. for FI, including logic or strategy of successive phases Develop QA/QC and health and safety protocols
November 2000 through January 2001	Agency Review of FI Work Plan and CCR	Allow for on-going review, discussion, and modification of investigation approach
March 2001 through May 2001	Phase 1 of FI • On-Site Upper Aquifer Wells • On-Site Upper Aquifer Stratigraphic Borings • Plug and Abandon Obsolete On-Site Wells • Soil and Groundwater Sampling • Combined Sewer System Inventory and Camera Survey • Visual Reconnaissance of East Bank of Mill Creek • Electromagnetic Surveys	• Asses the overall nature and extent of Upper Aquifer groundwater impact • Characterize site specific geology and hydrogeology • Identify any indications of impact to Mill Creek's east bank • Identify location and boundaries of any buried wastes within the Former Swale Area and historic waste burial areas • Identify probable release points from Combined Sewer System
June 2001	Scoping of Phase 2	Discussion and meetings between Rohm and Haas and USEPA to review Phase 1 findings and plan details of Phase 2

TABLE 9-1
FACILITY INVESTIGATION SCHEDULE
Morton Facility
Reading, Ohio

Date	Activity	Purpose
July 2001 through September 2001	Phase 2 of FI • Install Supplemental Upper Aquifer Wells • Groundwater Sampling • Aquifer Testing • Mill Creek Sediment & Seep Testing • SWMU Soil Borings • Background Assessment • Geophysical Survey of Former Swale • Ecological Survey	• Complete on-site and off-site assessment of shallow aquifer. • Characterize hydraulics of shallow aquifer, and possible communication with deeper aquifer • Characterize soil impact at potential release and suspected waste burial sites • Characterize residual or on-going impact to creek • Characterize background conditions in soils and groundwater • Evaluate potential for drummed waste burial • Identify potential ecological receptors.
October 2001	Scoping of Phase 3	Discussion and meetings between Rohm and Haas and USEPA to review Phase 2 findings and plan details of Phase 3
November 2001	Phase 3 of FI • Characterization of any Identified Human Receptors • Final Upper Aquifer Well Installation • Trenching or Drilling at Former Swale Area	• Provide information for HHRA • Close any remaining data gaps • Evaluate any detected anomalies in Former Swale Area
April 2001 through October 2001	Provide quarterly Progress Reports by 15th of month after each quarter's close: April, July, and October. Progress Reports will not be submitted in January 2002.	Provide information to keep agency up to date for discussions and activity modification planning.

TABLE 7-1
SUMMARY OF MIGRATION PATHWAY MODELS
Morton Facility
Reading, Ohio

Migration Pathway	Model
Generation of Fugitive Dusts	Particulate Emission Factor (PEF) Model
Volatilization from Soil	Volatilization Factor (VF) or Jury BAM Model
Volatilization from Groundwater	Volatilization Factor (VF) or Jury Behavior Assessment Model (BAM)
Dispersion in Ambient Air	Box Model
Dispersion in Indoor Air	Box Model

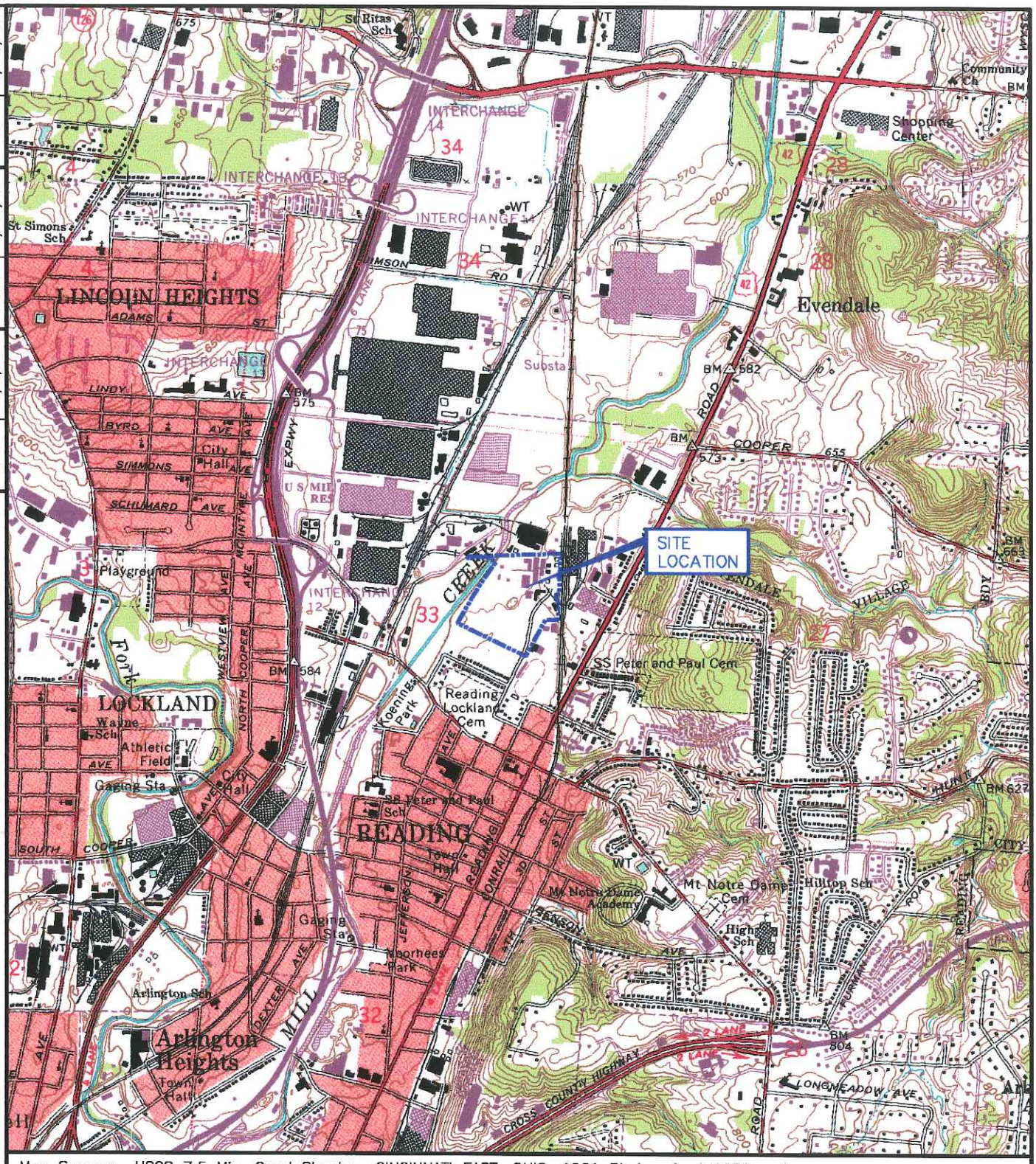
Note:
The selection, formulation, and application of any models used will be performed in a manner that is consistent with U.S. Environmental Protection Agency procedures and/or guidance, representative of conditions at the Morton Facility, and documented in the FI Report. If for any reason such procedures or guidance cannot be followed, then the rationale for deviating from them will be documented in the FI Report.

TABLE 9-1
FACILITY INVESTIGATION SCHEDULE
Morton Facility
Reading, Ohio

Date	Activity	Purpose
December 2001 through February 2002	Data Evaluation and FI Report Preparation	Tabulate and interpret FI findings
March 1, 2002	Submittal of FI Report	Provide FI findings in a form suitable for agency and public review
March 2002 through May 2002	Agency Review and Rohm and Haas Revision of FI Report	Finalize FI Report.

Note: The dates provided are best estimates for completion of the Field Investigation task. However, dates are subject to change based on field conditions, changes in scope, and other unanticipated events or factors.

DRAFT BY	RPS 8/5/00	PROJ. CHK	AMH 9/26/00	APPRV. BY	MPH 9/26/00



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

-N-

0 2000

APPROXIMATE SCALE (FEET)

QUADRANGLE LOCATION

GEOMATRIX

SITE LOCATION MAP

PREPARED FOR

ROHM AND HAAS CO. – READING, OHIO

Project No. 6452

Figure No. 2–1

6452A01.DWG

Base Map Source: American Process Design, Inc., Cincinnati, OH., Proj. No. 16151, 410, 6/4/98.

0 60 120
APPROXIMATE SCALE (FEET)

-N-

EXPLANATION

- MW-1 — MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PEDCO, 1982 AND ATEC, 1983)
- S4 — SURFACE SOIL SAMPLE LOCATION AND IDENTIFICATION NUMBER (E&E, 1991)
- S1 — SUBSURFACE SOIL SAMPLE LOCATION AND IDENTIFICATION NUMBER (E&E, 1991)
- S3 — SEDIMENT SAMPLE LOCATION AND IDENTIFICATION NUMBER (E&E, 1991)
- MW-EPA-1 — UPPER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
- S-12 — SEDIMENT SAMPLE LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
- SS-1 — SURFACE SOIL SAMPLE LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
- 1978-1 — SEDIMENT OR SURFACE SOIL SAMPLE LOCATION AND IDENTIFICATION NUMBER (CMC, 1979b)
- MORTON FACILITY PROPERTY BOUNDARY
- A — LOCATION OF REPORTED WASTE BURIAL
- STRATIGRAPHIC BORING LOCATION
- NEW UPPER AQUIFER WELL OR WELL CLUSTER LOCATION
- NEW UPPER AQUIFER WELL LOCATION (APP. IX ANALYSIS)
- EXISTING LOWER AQUIFER WELL CLUSTER LOCATION AND IDENTIFICATION NUMBER
- RECOVERY WELL LOCATION (APP. IX ANALYSIS)
- PLANNED PLUGGING AND ABANDONMENT
- RECONNAISSANCE OF MILL CREEK
- SURFACE GEOPHYSICAL SURVEY

Major Phase 1 Activities

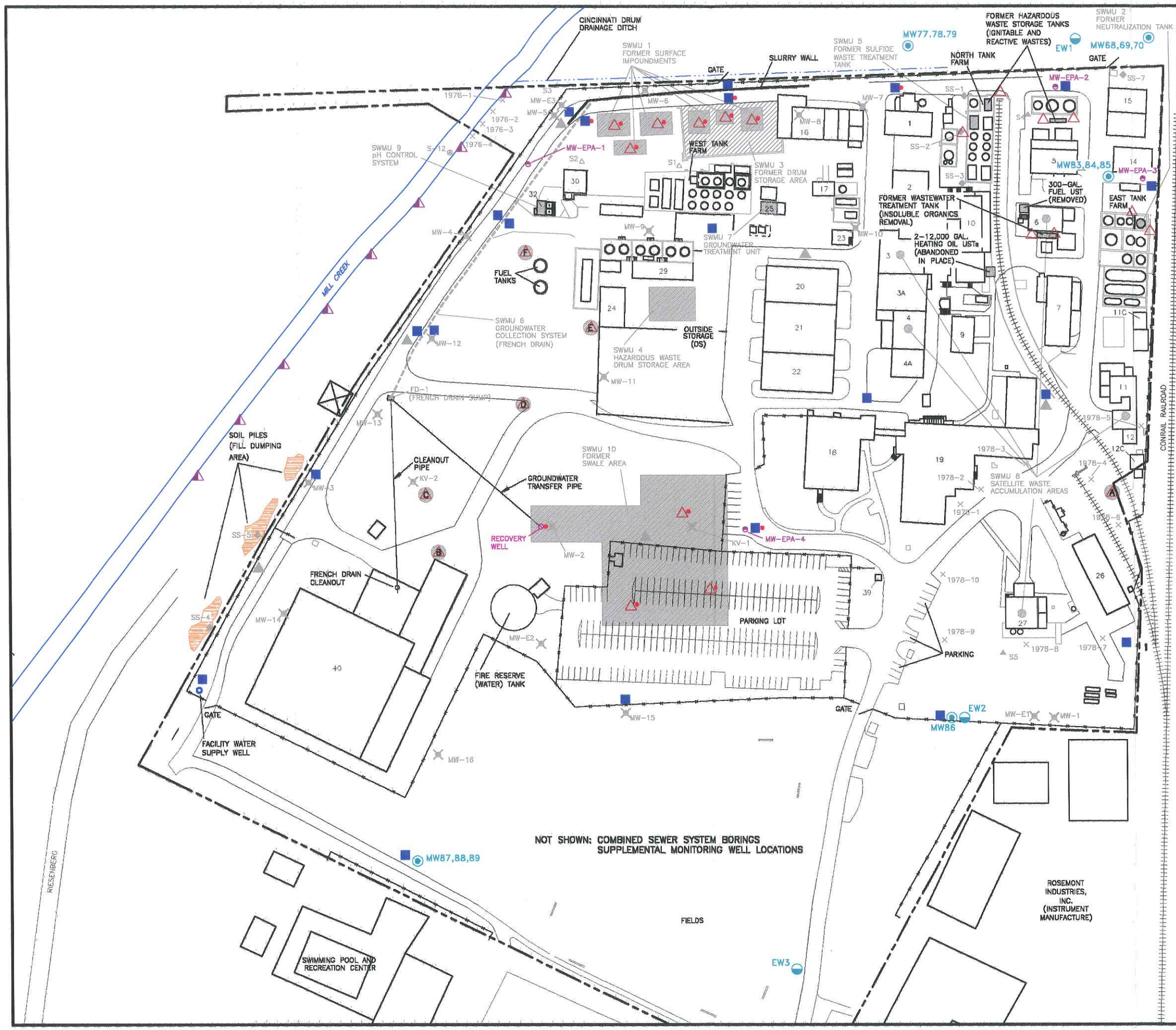
Stratigraphic Borings
Installation of Monitoring Wells
Combined Sewer System Inventory and Camera Survey
Reconnaissance of Mill Creek East Bank
Geophysical Survey of Former Swale Area and Historic Burial Areas
Initial Groundwater Sampling at New and Selected Existing Upper Aquifer Wells
Soil Sampling at Boring and Well Locations
Plug and Abandon Obsolete Wells

PHASE 1
OF FACILITY INVESTIGATION
PREPARED FOR
ROHM AND HAAS CO.
READING, OHIO

GEOMATRIX

Project No.	FIGURE
6452	4-1

6452D07.DWG



Base Map Source: American Process Design, Inc., Cincinnati, OH., Proj. No. 16151, 410, 6/4/98.

0 70 140
APPROXIMATE SCALE (FEET)

-N-

EXPLANATION

- MW-1 — MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PEDCO, 1982 AND ATEC, 1983)
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- S-12 — SEDIMENT SAMPLE LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
- SS-1 — SURFACE SOIL SAMPLE LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
- 1978-1 — SEDIMENT OR SURFACE SOIL SAMPLE LOCATION AND IDENTIFICATION NUMBER (CMC, 1979b)
- MORTON FACILITY PROPERTY BOUNDARY
- LOCATION OF REPORTED WASTE BURIAL
- STRATIGRAPHIC BORING LOCATION
- NEW UPPER AQUIFER WELL OR WELL CLUSTER LOCATION
- NEW UPPER AQUIFER WELL LOCATION (APP. IX ANALYSIS)
- EXISTING LOWER AQUIFER MONITORING WELL CLUSTER LOCATION AND IDENTIFICATION NUMBER
- RECOVERY WELL LOCATION (APP. IX ANALYSIS)
- PLANNED PLUGGING AND ABANDONMENT
- NEW SEDIMENT/SEEP SAMPLING LOCATION
- NEW SOIL BORING LOCATION
- NEW SOIL BORING LOCATION (APP. IX ANALYSIS)
- LOWER AQUIFER EXTRACTION WELL LOCATION AND IDENTIFICATION NUMBER

Major Phase 2 Activities

Soil Borings at Locations of Sewer Failures (SWMU 9 & 11)
Shallow Soil borings at SWMUs 1, 2, 3, 5, Historic Wastewater Tanks
Soil Borings or Trenches at Former Swale Area
Borings or Trenches at Historic Burial Areas
Borings for Soils Background Evaluation
Installation of Supplemental Upper Aquifer Monitoring Wells
Hydraulic Communication Tests at Lower Aquifer Wells
Mill Creek Sediment/Seep Sampling
Ecological Receptor Survey

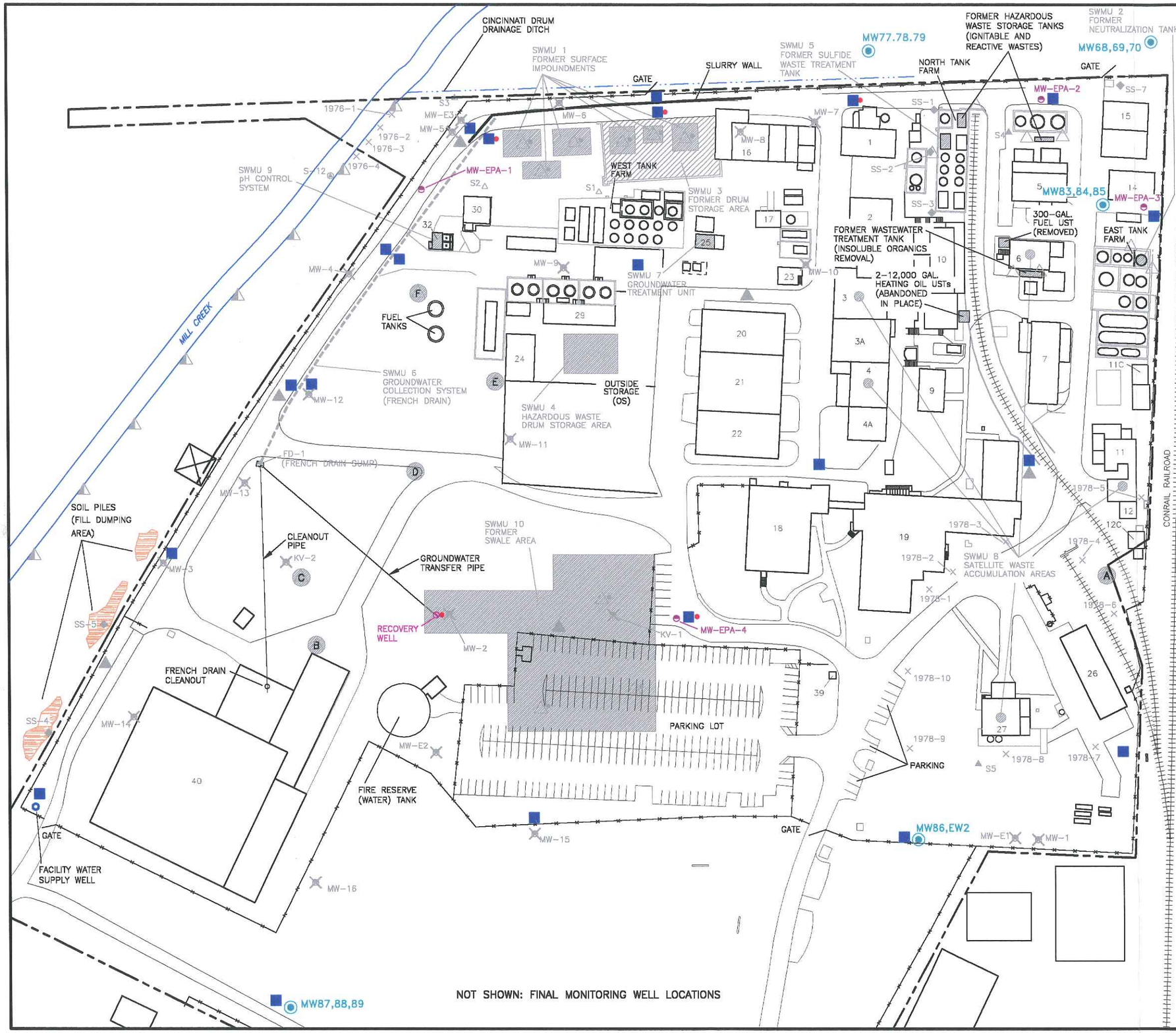
PHASE 2
OF FACILITY INVESTIGATION
PREPARED FOR
ROHM AND HAAS CO.
READING, OHIO

GEOMATRIX

Project No.	FIGURE
6452	4-2

6452D10.DWG

Revision 01, March 2001



Base Map Source: American Process Design, Inc., Cincinnati, OH., Proj. No. 16151, 410, 6/4/98.

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APPROXIMATE SCALE (FEET)

-N-

EXPLANATION

- MW-1 — MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PEDCO, 1982 AND ATEC, 1983)
- S4 — SURFACE SOIL SAMPLE LOCATION AND IDENTIFICATION NUMBER (E&E, 1991)
- S1 — SUBSURFACE SOIL SAMPLE LOCATION AND IDENTIFICATION NUMBER (E&E, 1991)
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- S-12 — SEDIMENT SAMPLE LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
- SS-1 — SURFACE SOIL SAMPLE LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
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- MORTON FACILITY PROPERTY BOUNDARY
- A — LOCATION OF REPORTED WASTE BURIAL
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- NEW UPPER AQUIFER WELL LOCATION (APP. IX ANALYSIS)
- EXISTING LOWER AQUIFER WELL CLUSTER LOCATION AND IDENTIFICATION NUMBER
- RECOVERY WELL LOCATION (APP. IX ANALYSIS)
- PLANNED PLUGGING AND ABANDONMENT
- NEW SEDIMENT/SEEP SAMPLING LOCATION
- NEW SOIL BORING LOCATION
- NEW SOIL BORING LOCATION (APP. IX ANALYSIS)

Phase 3

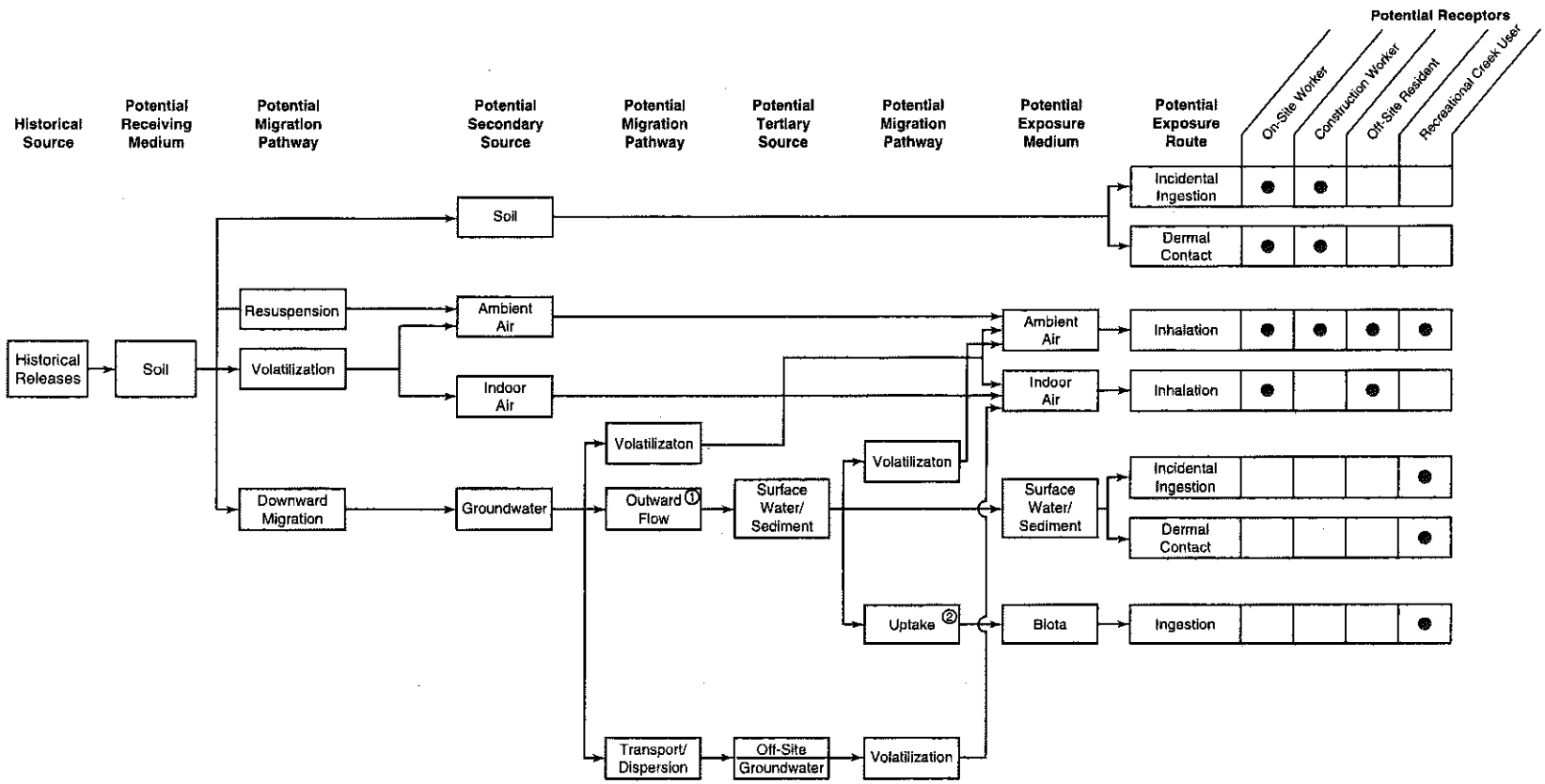
Final Installation of Supplemental Upper Monitoring Wells
Human Receptor Characterization
Second Groundwater Sampling at New and Selected Existing Upper Aquifer Wells

PHASE 3
OF FACILITY INVESTIGATION
PREPARED FOR
ROHM AND HAAS CO.
READING, OHIO

GEOMATRIX

Project No.	FIGURE
6452	4-3

6452D09.DWG



Notes

1 Evaluated if groundwater affects creek.

2 Evaluated if bioaccumulative chemicals detected.

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

GEOMATRIX

Project No.	Figure
6452.000	7-1

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EXHIBIT 1

RCRA §3013 ADMINISTRATIVE ORDER, AUGUST 18, 2000

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION 5

IN THE MATTER OF:	)	**RCRA Docket No.** R3013-5-00-001
	)	
Morton International, Inc.	)	
2000 West Street	)	
Reading, Ohio 45215-3431	)	
	)	
EPA ID No. OHD 000 724 138	)	**PROCEEDING UNDER SECTION**
	)	**3013 OF THE RESOURCE**
Respondent.	)	**CONSERVATION AND RECOVERY**
	)	**ACT, 42 U.S.C. § 6934**

ORDER REQUIRING MONITORING, TESTING, ANALYSIS AND REPORTING

I. JURISDICTION

1. The Administrator of the United States Environmental Protection Agency (EPA) is issuing this Administrative Order (Order) to Morton International, Inc. (Morton) under Section (§) 3013 of the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. § 6934. The Administrator has delegated the authority to issue orders under RCRA § 3013 to the Chief, Enforcement and Compliance Assurance Branch; Waste, Pesticides and Toxics Division; U.S. EPA Region 5.

2. Morton International, Inc. (Morton or Respondent) is a corporation organized under the laws of the State of Indiana.

3. On June 30, 1989, the State of Ohio (State) received final authorization pursuant to RCRA § 3006(b), 42 U.S.C. § 6926(b), to operate a hazardous waste program in lieu of the federal hazardous waste program established under RCRA Subtitle C. Pursuant to the Memorandum of Agreement (MOA) between the State of Ohio and EPA, EPA expressly retains its rights to issue Orders and bring actions under § 3013 of RCRA and any other applicable federal statute.

4. This Order is based upon the administrative record compiled by EPA and incorporated herein by reference. The record is available for review by the Respondent and the public at EPA's regional office at 77 West Jackson Boulevard, Chicago, Illinois 60604.

II. PARTIES BOUND

5. The provisions of this Order shall apply to and be binding upon Respondent and its officers, directors, employees, agents, contractors, successors, and assigns.

6. No change in ownership, corporate, or partnership status relating to the facility described in this Order will in any way alter the status or responsibility of Respondent under this Order. Any conveyance by Respondent of title, easement, or other interest in the facility described herein, or a portion of such interest, shall not affect Respondent's obligations under this Order. Respondent shall be responsible for and liable for any failure to carry out all activities required of Respondent by this Order, irrespective of its use of employees, agents, contractors, or consultants to perform any such tasks.

7. Respondent shall provide a copy of this Order to all contractors, subcontractors, laboratories, and consultants retained to conduct or monitor any portion of the work performed pursuant to this Order within seven (7) calendar days of the effective date of this Order, or on the date of such retention, and Respondent shall condition all such contracts on compliance with the terms of this Order.

8. Any documents transferring ownership and/or operations of the facility described herein from Respondent to a successor-in-interest shall include written notice of this Order. In addition, Respondent shall, no less than thirty (30) days prior to transfer of ownership or operation of the facility, provide written notice of this Order to its successor-in-interest, and written notice of said transfer of ownership and/or operation to EPA.

III. FINDINGS OF FACT

9. Respondent owns and operates a chemical manufacturing plant located at 2000 West Street, Reading, Ohio on approximately 34 acres (facility) in Hamilton County, Ohio.

10. Mill Creek runs along the western side of the facility. The creek which originates north of the facility, flows for approximately ten (10) miles south of the facility into the Ohio River. The Conrail Railroad tracks run along the eastern side of the facility. Bordering the facility to the north are Cincinnati Drum Service, a drum recycling facility; and Pristine, Inc., a former hazardous waste incineration and disposal facility which is currently a National Priorities List site. A public recreational area is located to the south. This recreational area (which consists of a city park, a public pool, athletic fields, and a municipal stadium) is owned by Morton and managed by the City of Reading. Approximately 12,000 residents live within a one (1)-mile radius of the facility, with the closest residences being located about 750 feet to the south of the Morton facility.

11. Prior to 1949, a dairy farm occupied the western and southern portions of the property currently occupied by the Morton facility. At the same time, the northern section was

occupied by a fireworks manufacturing facility which later became a winery and smokehouse. Since 1950, the facility has operated as a chemical manufacturing plant that produces additives for the plastic and petroleum industries, including synthetic heat stabilizers and lubricants for rigid polyvinyl chloride, asphalt performance chemicals, antioxidants, plastic lubricants, and specialty chemicals. In addition, the facility has supplied chemical products to the textile, paper, and other miscellaneous industries. Previous owners of the facility include Cincinnati Milling Machine, which conducted business under the name of Carlisle Chemical Works from 1949 to 1970, and later changed its name to Cincinnati Milacron; and Carstab Corporation (Carstab), a division of Thiokol, Inc., from 1980 to 1982. Carstab Corporation merged with Morton International Inc. in 1982. The companies separated in 1989, with Morton retaining ownership of the facility. According to a letter dated April 28, 2000, written by David Kurland, Senior Counsel for Rohm and Haas Company, on June 22, 1999, Morton International Inc. was acquired by Rohm and Haas Company. Mr. Kurland's letter states that although Morton is now a wholly owned subsidiary of Rohm and Haas "the owner and operator of the facility for legal and regulatory purposes continues to be Morton."

12. The facility is currently regulated under RCRA as a generator of hazardous waste. Wastes generated (currently or in the past) on-site include spent halogenated solvents (EPA Hazardous Waste Numbers F001 and F002), spent non-halogenated solvents (EPA Hazardous Waste Numbers F003, F004 and F005), recovered methanol (EPA Hazardous Waste Numbers U154, D001, F001, F003 and F005), liquid methanol by-product (EPA Hazardous Waste Numbers F002, F003 and F005), spent solvents and residues (EPA Hazardous Waste Numbers D001, D002, F002, F003 and F005), spent acidic solvents and residues (EPA Hazardous Waste Numbers D001 and D002), recovered acid layers (EPA Hazardous Waste Number D003), scrubber solutions from pollution control processes (EPA Hazardous Waste Numbers D002 and D003), laboratory wastes (EPA Hazardous Waste Numbers D001, D002, D003, D004, D005, D006, D008, D010, D011, U196, F002, F003 and F005), scrap residues containing arsenic and lead (EPA Hazardous Waste Numbers D004 and D008), filter papers and residues (EPA Hazardous Waste Numbers D001, D002, D004, D006 and D008), press cakes and filter cartridges (EPA Hazardous Waste Numbers D002 and D008), solid and liquid wastes from chemical processes (EPA Hazardous Waste Numbers D001, D002, D003, D004, D008, F003, F002 and F005), and spill cleanup solids (EPA Hazardous Waste Numbers D002, D004, D007, D008).[1]

---

[1] EPA first promulgated regulations on May 19, 1980 (45 Fed. Reg. 33073), for the identification and listing of wastes that are regulated under RCRA as hazardous wastes for purposes of 40 C.F.R. Parts 262 through 265, 268, 270, 271, and 124 (regulatory hazardous wastes). Regulatory hazardous wastes include wastes that are designated by EPA Hazardous Waste Numbers beginning with the letters D, F, K, P and U. EPA Hazardous Waste Numbers D001 through D003 are described in 40 C.F.R. §§ 261.21 through 261.23. EPA Hazardous Waste Numbers D004 through D043 are described in 40 C.F.R. § 261.24. EPA Hazardous Waste Numbers beginning with "F" are listed and described in 40 C.F.R. § 261.31. EPA Hazardous

13. Local aquifers include unconsolidated glacial outwash deposits of gravel, sand and silt (upper aquifer) and permeable bedrock consisting of shale and limestone (lower aquifer). A 1959 Ohio Department of Natural Resources report states that the upper glacial deposits and the lower permeable bedrock are hydraulically connected. A potential exists for the facility's contaminants to migrate into the upper and lower aquifers.

14. Well fields located within three (3) miles of the facility supply drinking water to three (3) municipalities (Glendale, Lockland and Wyoming) with a population of over 19,000. The city's wells are screened near the surface of the bedrock. Two (2) former City of Reading well fields were located less than one (1) mile from the facility. Some of these wells were closed after concentrations of volatile organic compounds (VOCs) exceeding Maximum Contaminant Levels (MCLs), primarily 1,2-dichloroethane, were detected in the groundwater from the wells. The source of the VOC contamination has not been established due to the complex nature of the local geology.

15. The Respondent currently employs approximately 180 people at the facility.

Description of Study Areas

16. From 1950 to 1980, six former surface impoundments were used for neutralization and disposal of wastes consisting primarily of dilute hydrochloric acid, methanol, dilute sulfuric acid, resorcinol, and benzoic acid. The disposed wastes may have also contained metals, waste oils, and benzene compounds. Each impoundment is unlined and has been filled in with soil. See Facility Map from Attachment 1, "Former Surface Impoundments."

17. A 10,000-gallon fiberglass tank was formerly used as a hazardous waste neutralization treatment tank. The processes associated with the former hazardous waste tank included neutralization of low pH process wastewaters. Currently, this tank is used for product storage and the wastewater neutralization process has been transferred to a pH control system (see later text). Morton or the previous owner/operator(s) of the facility have not completed a certification of RCRA closure for this tank that complies with 40 C.F.R. § 265.111 . There are no available data to determine whether there have been any releases

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Waste Numbers beginning with "K" are listed and described in 40 C.F.R. § 261.32. EPA Hazardous Waste Numbers beginning with "P"and EPA Hazardous Waste Numbers beginning with "U" are listed and described in 40 C.F.R. § 261.33.

The scope of RCRA § 3013 extends not only to such regulatory hazardous wastes, but also to wastes that are hazardous wastes pursuant to RCRA § 1004(5), even though they might not be regulatory hazardous wastes.

from the tank from the time it was used as a hazardous waste management unit. See Facility Map from Attachment 1, "Former Neutralization Tank."

18. A concrete storage pad was used as a hazardous waste drum storage area. Hazardous wastes formerly stored in this area included ignitable waste, spent solvents and, potentially, other liquid hazardous wastes generated at the facility. The concrete pad contains several cracks. Morton or the previous owner/operator(s) of the facility have not completed a certification of RCRA closure for this storage area that complies with 40 C.F.R. § 265.111. There are no available data to determine whether there have been any releases from this area from the time it was used as a hazardous waste storage unit. See Facility Map from Attachment 1, "Former Drum Storage Area."

19. A 10,000-gallon steel aboveground tank was formerly used for storage of hazardous waste, including high pH wastewaters generated by the sulfurizing of fats and oils. The waste was periodically shipped off-site for disposal. The tank is currently used for storing fuel oil. Morton or the previous owner/operator(s) of the facility have not completed a certification of RCRA closure for this tank that complies with 40 C.F.R. § 265.111. There are no available data to determine whether there have been any releases from this tank from the time it was used as a hazardous waste management unit. See Facility Map from Attachment 1, "Former Sulfide Waste Treatment Tank."

20. A groundwater collection system is in place at the facility. This system consists of four components: a french drain, an extraction well, a collection sump and a concrete slurry wall. Contaminated groundwater containing VOCs, semivolatile organic compounds (SVOCs), metals, and, potentially, other contaminants is extracted from the subsurface and transferred to a groundwater treatment unit. A large portion of the treated groundwater is recirculated as make-up water in the facility's recirculating non-contact cooling water system. The remainder of the treated water is discharged to the Municipal Sewer District of Greater Cincinnati (MSDGC). The purpose of the groundwater collection system is to prevent contaminated groundwater from migrating off the site and into Mill Creek. Due to the facility lacking a ground-water monitoring program, there are no groundwater data available to evaluate the effectiveness of the groundwater collection system. See Facility Map from Attachment 1; "French Drain", "Extraction Well", "Collection Sump", and "Concrete Slurry Wall."

21. The facility's wastewater enters a combined sewer system that flows to a pH control system and ultimately discharges to the MSDGC (the facility's wastewater includes a combination of specialty chemical process streams, wash down, cooling water, boiler plant blowdown, sanitary waste, and storm water runoff). The combined sewer system includes floor trenches and weir pits. Prior to the installation of the pH control system in 1993, the combined sewer system discharged directly to the MSDGC and portions of the unit may have potentially discharged to the former surface impoundments. Based on a July 8, 1998, Preliminary Assessment/Visual Site Inspection (PA/VSI) Report from

TechLaw, Inc. (TechLaw), TechLaw representatives were not able to obtain information regarding the construction and exact location of the combined sewer system, including information on how the trenches and the weir pits are connected to the pH control system. In addition, TechLaw representatives were not able to obtain information regarding the constituents of the wastewater. There are no available data to determine whether there have been any releases from the combined sewer system. See Facility Map from Attachment 1, "Location of the Combined Sewer System Unknown."

22. A former swale area may have been used as a dumping ground prior to 1950 when the property was part of a dairy farm. In the early 1950's this area may have been used for the disposal of lime sludge by Carlisle Chemical Works. The area was investigated by OEPA in June 1980 in response to a complaint from a former employee alleging the dumping of waste drums in this area. The results from the Ohio Environmental Protection Agency (OEPA) investigation and further sampling and analysis in this area indicate that there have been releases of VOCs and metals from the swale area into soil and groundwater. See Facility Map from Attachment 1, "Former Swale Area."

23. Based on TechLaw's PA/VSI Report, in June 1979, OEPA became aware of possible releases at Carstab after OEPA personnel observed discolored groundwater leaching from the east bank of Mill Creek along the boundary of Carstab and Cincinnati Drum. The PA/VSI Report adds that during a July 30, 1980, meeting with Carstab representatives, OEPA requested that Carstab perform a hydrogeologic study to determine the source of leachate at Mill Creek and to identify a method of controlling or removing the leachate releases. See Facility Map from Attachment 1, "Mill Creek."

Notifications and Inspections

- **Notification of Hazardous Waste Activity; Part A and Part B applications; and change from treatment, storage and disposal facility to generator status**

24. Pursuant to §3010 of RCRA, Carstab notified EPA of its hazardous waste activity. In its notification dated August 8, 1980, Carstab identified itself as a generator of hazardous waste and an owner/operator of a treatment, storage, and/or disposal facility for the following hazardous wastes:

    (A) Hazardous wastes from non-specific sources identified at 40 C.F.R. §261.31 including F005 (spent non-halogenated solvents); commercial chemical products, manufacturing chemical intermediates, off-specification commercial chemical products, or manufacturing chemical intermediates identified at 40 C.F.R. §261.33(f), including U154 (methanol);

(B) Hazardous wastes exhibiting the characteristic of ignitability, corrosivity, reactivity, and toxicity identified at 40 C.F.R. §261.21 through 261.24, including D001, D002, D003, and D000 (the type of toxicity was not specified); and

(C) Other listed materials may occasionally be disposed of in small quantities from laboratory operations.

25. Carstab submitted to EPA a RCRA Part A application dated November 13, 1980, that identified the following hazardous wastes at the facility (hazardous waste was managed as follows: container storage (S01), 350,000 gallons capacity; tank storage (S02), 17,000 gallons capacity; and tank treatment (T01), 59,000 gallons per day):

(A) Hazardous wastes from non-specific sources identified at 40 C.F.R. §261.31 including F001 (spent halogenated solvents), F003, F004, and F005 (spent non-halogenated solvents);

(B) Hazardous wastes exhibiting the characteristic of ignitability, corrosivity, reactivity, and toxicity identified at 40 C.F.R. §261.21 through 261.24, including D001, D002, D003, and D000 (the type of waste toxicity was not specified).

26. In a March 31, 1982, letter to Carstab, EPA requested submission of a RCRA Part B application for the facility.

27. In a September 14, 1982, letter, Carstab notified EPA of its decision to revert to generator status effective October 1, 1982.

28. On April 1, 1985, the Ohio Environmental Protection Agency (OEPA) issued a letter to Dr. Raymond Phillips of Carstab confirming that the Hazardous Waste Activity Status for the facility was that of generator only with less than ninety (90) day storage.

29. On June 29, 1989, EPA received a Notification of Hazardous Waste Activity from Morton, dated June 26, 1989, which indicated the change in ownership of the facility to Morton International, Inc. In addition, Morton identified itself as a generator only with less than ninety (90) day storage. Four wastes from nonspecific sources were included: F001, F002 (spent halogenated solvents), F003, and F005 (spent non-halogenated solvents). Four wastes exhibiting characteristics of Non-Listed Hazardous Wastes were included: D001 (ignitable), D002 (corrosive), D003 (reactive), and D000 (characteristic of toxicity--the type of waste toxicity was not specified).

30. Morton currently stores hazardous waste for less than ninety (90) days in a Hazardous Waste Storage Area. The Hazardous Waste Storage Area is not a study area at the facility.

The facility's study areas are identified and described above in this section of the Order under "Description of Study Areas".

- **Notification of Hazardous Waste Site**

31. Carstab submitted a Notification of Hazardous Waste Site to EPA pursuant to § 103(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), dated June 1, 1981. According to the notification, from 1950 to 1980, Carstab Corporation handled wastes from chemical sources, including organics, inorganics, acids, and bases. The notification identifies six (6) impoundments formerly used for treatment, storage and disposal, consisting of one clean water basin, two settling ponds, and three limestone-filled neutralization pits. As the notification indicates, the settling ponds were dredged of sludge and all impoundments were filled. The notification also indicates that "A small area near or under the parking lot is suspected of being used for disposal of building materials and waste sludge in the early fifties. A few drums of waste may have been buried in the lower part of the plant."

- **1990 CERCLA Screening Site Inspection (SSI)**

32. As documented by an August 19, 1991, CERCLA Screening Site Inspection (SSI) Report for Carstab prepared for EPA by Ecology and Environment, Inc. (E&E), E&E collected groundwater and soil samples from various areas of the facility in order to determine whether EPA Target Compound List (TCL) compounds and Target Analyte List (TAL) analytes were present at the facility. Also, E&E collected a sediment sample from a location situated on the east bank of Mill Creek, adjacent to the northwest corner of the facility's property. Samples were analyzed for EPA TCL VOCs, SVOCs, pesticides, and polychlorinated biphenyls (PCBs), and EPA TCL metals.

33. Groundwater samples were collected only from the upper aquifer.

34. Analytical results from the groundwater sampling revealed the presence of VOCs, SVOCs, and metals in groundwater, including the following (maximum concentration values in parenthesis): chlorobenzene (56 parts per billion [ppb]), 1,2-dichlorobenzene (12 ppb), arsenic (32.7 ppb), and vanadium (660 ppb).

35. The analytical results from the soil sampling revealed the presence of VOCs, SVOCs, PCBs, and metals in soil, including the following (maximum concentration values in parenthesis): Aroclor 1254 (550 ppb), arsenic (8.7 ppb), chlorobenzene (12,000 ppb), 1,2-dichlorobenzene (3,300,000 ppb), ethylbenzene (1,600 ppb), fluoranthene (1,000 ppb), pyrene (740 ppb), toluene (5,000 ppb), xylenes (82 ppb), and vanadium (30.8 ppb). Concentration values in parenthesis are estimated with the exception of those from fluoranthene and vanadium.

36. The analytical results from sediment sampling revealed the presence of VOCs, SVOCs, and metals in sediments including the following (concentration values in parenthesis): benzo(a)anthracene (370 ppb), benzo(a)pyrene (440 ppb), benzo(k)fluoranthene (400 ppb), bis(2-ethylhexyl)phthalate (500 ppb), 2-butanone (180 ppb), chlorobenzene (54 ppb), ethylbenzene (82 ppb), fluoranthene (1,000 ppb), phenanthrene (540 ppb), pyrene (740 ppb), xylenes (82 ppb), and vanadium (17.9 ppb). Concentration values in parenthesis are estimated with the exception of those from fluoranthene and vanadium.

37. All of the examples of SVOCs cited above are also known as polycyclic aromatic hydrocarbons (PAHs) with the exception of bis(2-ethylhexyl)phthalate.

- **1993 CERCLA Expanded Site Inspection Report**

38. Based on a May 7, 1993, CERCLA Expanded Site Inspection (ESI) Report for Carstab prepared for EPA by PRC Environmental Management, Inc. (PRC), PRC collected samples from groundwater and soil from various areas of the facility in order to document any observed releases, levels of contamination, and attribution of hazardous substances. Also, PRC collected sediment samples on the eastern bank of Mill Creek adjacent to the facility. The samples were analyzed for EPA TCL VOCs, SVOCs, pesticides, and PCBs. Also, the samples were analyzed for EPA TAL metals and cyanide.

39. Groundwater samples were collected only from the upper aquifer.

40. Analytical results from the groundwater sampling revealed the presence of VOCs, SVOCs, and metals in groundwater, including the following (maximum concentration values in parenthesis): acetone (2,700 ppb), benzene (48 ppb), chlorobenzene (2,300 ppb), 1,2-dichlorobenzene (4,700 ppb), 1,4-dichlorobenzene (640 ppb), ethylbenzene (110 ppb), nickel (57.7 ppb), toluene (630 ppb), vanadium (14.6 ppb), and xylene (360 ppb).

41. Analytical results from soil sampling revealed the presence of SVOCs, PCBs, and metals in soil, including the following (maximum concentration values in parenthesis): Aroclor 1254 (1,000 ppb as estimated), dibenzo(a,h)anthracene (900 ppb), benzo(a)pyrene (7,600 ppb), benzo(g,h,i)perylene (3,300 ppb), bis(2-ethylhexyl)phthalate (1,200 ppb), indeno(1,2,3-c,d)pyrene (3,600 ppb), and vanadium (29.3 ppb).

42. Analytical results from sediment sampling conducted at a location adjacent to the former surface impoundments (location S-12), revealed the presence of VOCs, SVOCs, PCBs, and metals in sediments, including the following (concentration values in parenthesis): Aroclor 1254 (120 ppb), benzo(a)anthracene (360 ppb), benzo(a)pyrene (320 ppb), benzo(g,h,i)perylene (280 ppb), benzo(k)fluoranthene (310 ppb), bis(2-ethylhexyl)phthalate (210 ppb), chlorobenzene (16 ppb), chrysene (410 ppb), fluoranthene (970 ppb), indeno(1,2,3-c,d)pyrene (260 ppb), phenanthrene (540 ppb),

pyrene (850 ppb), and vanadium (17.8 ppb). Concentration values in parenthesis are estimated with the exception of those from chlorobenzene, fluoranthene, chrysene, and vanadium.

43. All of the examples of SVOCs cited above are also known as PAHs with the exception of bis(2-ethylhexyl)phthalate.

- **1998 RCRA Preliminary Assessment/Visual Site Inspection (PA/VSI)**

44. Prior to conducting a VSI at the facility, TechLaw conducted a PA of the available EPA and OEPA file materials regarding past compliance history, evidence of past releases, potential migration pathways, potential for exposure to any released hazardous constituents, closure methods and dates, citizen complaints, manufacturing processes and waste management practices at the Morton facility. The PA conducted by TechLaw documented the following:

    (A) From December 1980 to January 1981, Carstab installed fourteen (14) groundwater monitoring wells for the purpose of conducting a hydrogeologic investigation as requested by OEPA. The results from the Carstab investigation did not provide adequate data to satisfy the OEPA requirements.

    (B) On May 21, 1982, OEPA requested that the former swale area be investigated for the presence of buried drums, buried optical brighteners waste, and any potential groundwater contamination.

    (C) On December 1, 1982, and January 12, 1983, OEPA issued to Carstab the Director's Final Findings and Orders requesting that Carstab complete additional studies to determine the extent of off-site migration of wastes from the facility, including leachate entering Mill Creek, and to identify appropriate remedial measures.

45. On May 12, 1998, TechLaw conducted a VSI at the facility. The purpose of the inspection was to identify and characterize solid waste management units (SWMUs) and areas of concern. A total of eleven SWMUs were identified, including the former surface impoundments (SWMU 1), former neutralization tank (SWMU 2), former drum storage area (SWMU 3), hazardous waste drum storage area (SWMU 4), former sulfide waste treatment tank (SWMU 5), groundwater collection system (SWMU 6), groundwater treatment unit (SWMU 7), satellite waste accumulation areas (SWMU 8), pH control system (SWMU 9), former swale area (SWMU 10) and combined sewer system (SWMU 11).

46. According to a July 8, 1998, PA/VSI Report prepared for EPA by TechLaw: "releases to soil and groundwater are documented at the Former Surface Impoundments (SWMU 1) and the Former Swale Area (SWMU 10), resulting in the designation of a high release potential for these units. The Groundwater Collection System (SWMU 6) and Groundwater Treatment Unit (SWMU 1) were installed to collect and treat contaminated groundwater and prevent off-site migration of contaminants through the shallow aquifer. Thus, although the release potential is high for SWMU 1 and 10, the facility has apparently implemented measures to prevent off-site migration of hazardous constituents through shallow groundwater. The effectiveness of the Groundwater Treatment Unit (SWMU 7) in removing contaminants should be analyzed, however, in order to ensure that the treated water does not pose a further threat of contamination. In addition, since it appears that deeper portions of the aquifer are used for domestic purposes in the vicinity of the Morton facility, potential contaminant migration from the Former Surface Impoundments (SWMU 1) and Former Swale Area (SWMU 10) to the deeper portions of the aquifer should be investigated. Furthermore, it is recommended that sediments in Mill Creek (adjacent to the facility) be investigated to determine the extent of impacts from past contaminated leachate releases associated with the Former Surface Impoundments (SWMU 1)." Also, the report indicates that "The Combined Sewer System (SWMU 11) was not directly observed during the VSI, and the construction and exact location were not confirmed by Morton representatives. Additional information regarding the Combined Sewer System (SWMU 11) should be provided by Morton representatives so that the potential for release from the unit can be determined."

Effects on Human Health or the Environment

47. The constituents identified as present at the site by the CERCLA inspections, as described above in paragraphs 32- 43 may cause the following effects on human health or the environment:

(A) Acetone: Dermal absorption and inhalation are the main routes of exposure to acetone. Acute (short-term) exposure can cause dizziness and/or loss of consciousness. Chronic (long-term) exposure may damage the liver and kidneys. Acetone has a slight chronic and acute toxicity to aquatic life.

(B) Arsenic: Arsenic is a known carcinogen, and a potential teratogenic agent. Its main path of exposure to humans is through inhalation and dermal absorption. Long term exposure can cause nerve and liver damage, narrowing of the blood vessels, and affect red blood cell production. Arsenic in the presence of acid may release a deadly gas, arsine. Potential health effects from ingestion include skin damage; circulatory system problems, and increased risk of cancer. Arsenic has high acute toxicity to aquatic life, birds, and land animals. It has a low solubility in water and is

persistent in water, with a half-life of 200 days. Arsenic has high chronic toxicity to aquatic life, and is known to bioaccumulate in fish tissues.

(C) Benzene: Benzene is a possible component of petroleum and grease. It is a carcinogen in humans and possibly a teratogen. Short-term exposures can cause dizziness, convulsions, irregular heartbeat and even death. Long-term exposures can cause aplastic anemia, which can cause death. Benzene has high acute toxicity to aquatic life. Long-term exposures in the environment cause shortened life spans, reproductive problems, and lower fertility. Benzene is a component of petroleum and is used as a solvent.

(D) Bis(2-ethylhexyl)phthalate: Bis(2-ethylhexyl) phthalate is a carcinogen and a teratogen and may damage the testes. Repeated exposure may affect the kidneys and liver. This chemical has applications in pump operations.

(E) 2-butanone (methyl ethyl ketone): Acute (short-term) exposure to this chemical, via inhalation, results in irritation to the eyes, nose and throat, and can depress the central nervous system. Limited information is available on the chronic (long-term) effects of methyl ethyl ketone in humans. However, studies in animals have reported effects on the central nervous system, liver, and respiratory system, and impaired fetal development, as well as fetal malformation. Methyl ethyl ketone is used as a solvent.

(F) Chlorobenzene: This chemical is classified as a human toxicant. Long-term exposure of humans to chlorobenzene affects the central nervous system. Signs of neurotoxicity include numbness, cyanosis, hyperesthesia (increased sensation), and muscle spasms. Chlorobenzene is used as a solvent for paints and as a heat transfer medium.

(G) 1,2-dichlorobenzene (o-dichlorobenzene): Long-term exposure to this chemical through ingestion can potentially cause damage to the nervous system, liver, kidneys and blood cells. This chemical is used as solvent for waxes, gums, tars, and other petroleum derivatives, and as a degreasing agent and a heat transfer medium.

(H) 1,4-dichlorobenzene (p-dichlorobenzene): Short-term exposure to this chemical, via inhalation in humans, causes irritation of the skin, throat, and eyes. Long-term inhalation exposure in humans results in effects on the liver, skin, and central nervous system. This chemical is used as an insecticidal fumigant.

(I) Ethylbenzene: Very high acute exposures can cause trouble breathing, paralysis, and death. There is some evidence to suggest ethylbenzene may damage a developing fetus. High chronic exposure may cause liver damage. Ethylbenzene has a high chronic and acute toxicity to aquatic life. Ethylbenzene is a component of petroleum and is sometimes used as a solvent.

(J) Nickel: Nickel carbonyl is the most acutely toxic form of nickel in humans, with the lung and the kidney as the target organs. Symptoms such as headache, vomiting, chest pains, dry coughing, and visual disturbances have been reported from acute inhalation exposure in humans. Contact dermatitis, consisting of itching of the fingers, wrists, and forearms, is the most common effect in humans from long-term nickel exposure. Respiratory effects, such as asthma and an increased risk of chronic respiratory infections, have also been reported in humans from inhalation exposure to nickel.

(K) Polychlorinated Biphenyls (PCBs): Aroclor 1254 is a chlorobiphenyl, one of the primary chemicals in PCBs, named according to the percentage of chlorine in the mixture (54%). Others include aroclor 1242, 1248, and 1260. The main path of exposure to humans is through inhalation and dermal absorption. Short-term exposure to PCBs can damage the liver. Chronic exposures pose cancer risks, possible liver damage, and damage to the nervous system. Dermal and ocular effects, including skin irritation, chloracne, hyperpigmentation and eyelid and conjunctival irritation, have been observed in humans occupationally exposed to aroclor 1254 and other aroclor formulations. Acute toxic effects of PCBs in the environment may include death of animals, birds, or fish. PCBs have high chronic toxicity to aquatic life, and are known to bioaccumulate in fish.

(L) Polycyclic aromatic hydrocarbons (PAHs): PAHs are a group of over 100 different chemicals that are present in the heavy fraction of petroleum distillate and produced from the incomplete burning of coal, petroleum and other organic substances. Acenaphthene can cause liver and kidney damage at high levels. Benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene and indeno(1,2,3-c,d)pyrene and others are human carcinogens. Carbazole and chrysene are possible human carcinogens. In addition, laboratory mice ingesting benzo(a)pyrene developed birth defects. Acenaphthylene, benzo(a)anthracene, benzo(k)fluoranthene, and phenanthrene may be mutagenic. Carbazole is capable of causing death or permanent injury due to exposures of normal use. It can be incapacitating and poisonous and requires special handling. PAHs tend to combine with dust and are carried

into water, soil and crops. PAHs are often associated with petroleum, coal and coke products.

(M) Toluene: The main concerns in chronic exposures is possible mutations in living cells, possible damage to a developing fetus, and liver damage. Exposure to this chemical has also been linked to problems in the nervous system, kidney, and circulatory problems. Toluene has been suspected to cause congenital defects in infants born to mothers who were exposed to or who abused toluene during pregnancy. Toluene has caused leaf membrane damage in plants. It may accumulate in fish tissues. Toluene is a component of petroleum and is also used as a solvent.

(N) Vanadium: In the form of vanadium pentoxide, this chemical is classified as a toxicant and has been associated with respiratory and skin irritation through inhalation and dermal exposure. Laboratory studies in animals have shown the development of histopathologic changes in lungs and decrease in growth rate. Among other manufacturing applications, vanadium pentoxide is used as a developer in photography and in the manufacturing of yellow glass inhibiting ultraviolet light transmission.

(O) Xylenes: Acute exposure to xylenes can cause nausea and lightheadedness. Xylenes may damage the developing fetus. Chronic effects include bone marrow damage, low blood cell count, liver damage, and kidney damage. Xylene is moderately soluble in water, and its chronic toxic ecological effects may include shortened life span, reproductive problems, and lower fertility. Xylenes are components of petroleum and are also used as a solvent.

IV. CONCLUSIONS OF LAW

48. Respondent's facility is a "facility or site" within the meaning of § 3013(a) of RCRA, 42 U.S.C. § 6934(a).

49. Respondent is a "person" as defined in § 1004(15) of RCRA, 42 U.S.C. § 6903(15).

50. Respondent is an "owner" and "operator" of the facility within the meaning of § 3013(a) of RCRA, 42 U.S.C. § 6934(a).

51. § 1004(27) of RCRA, 42 U.S.C. § 6905(27) defines the term "solid waste" to mean "any garbage, refuse . . . and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations . . ."

52. § 1004(5) of RCRA, 42 U.S.C. § 6903(5), defines the term "hazardous waste" to mean:

> a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may-
>
> > (A) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
> >
> > (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

53. § 1004(3) of RCRA, 42 U.S.C. § 6903(3), defines the term "disposal" to mean "the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters."

V. FINDING OF SUBSTANTIAL HAZARD

Upon the basis of the foregoing Findings of Fact, and pursuant to § 3013(a) of RCRA, 42 U.S.C. § 6934(a), EPA makes the following determinations:

54. Hazardous wastes within the meaning of § 1004(5) of RCRA, 42 U.S.C. § 6903(5), are present at the facility and were treated, stored or disposed there.

55. The presence of hazardous wastes at the facility and/or the release of hazardous wastes from the facility may present a substantial hazard to human health or the environment.

56. The action required by this Order are reasonable to ascertain the nature and extent of such hazard.

VI. ORDER

57. Based on the Findings of Fact, Conclusions of Law and Findings of Substantial Hazard as set forth above, Respondent is hereby ordered, pursuant to § 3013 of RCRA, 42 U.S.C. § 6934, to submit three (3) copies of a written proposal to EPA within thirty (30) days from the issuance of this Order, for carrying out monitoring, testing, analysis, and reporting in order 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 Respondent's facility. The facility's study areas are identified and described in Section III of this Order under "Description of Study Areas". Respondent is hereby ordered to implement such proposal once approved, or modified and approved, by EPA. Respondent is hereby

ordered to complete implementation of such proposal by June 1, 2002. All work undertaken pursuant to this Order shall be performed in a manner consistent with "Interim Final RCRA Facility Investigation (RFI) Guidance," Volumes I-IV, EPA/530/SW-89-031, May 1989, and all other applicable EPA guidance. Applicable guidance may include, but is not limited to, documents listed in Attachment 2: References. Respondent's written proposal shall be specific and shall include, but is not limited to, the following:

(A) a work plan, including schedule and proposal for progress reports, to evaluate (based on field data, tests, and cores) the hydrogeologic conditions at the facility and Mill Creek, including the determination and description of: (i) regional and facility specific stratigraphy and distribution of hydrogeologic units; (ii) regional and facility specific groundwater flow patterns, recharge and discharge areas, and seasonal variations in the groundwater flow regime; (iii) characteristics of hydrogeologic units, including hydraulic conductivity and hydraulic interconnections between saturated zones; (iv) hydrogeologic cross-sections showing the extent of hydrogeologic units in the vicinity of the facility; (v) water-level contours and/or potentiometric maps; (vi) the direction and velocity for the vertical and horizontal components of flow at the facility, (vii) man-made influences that may affect the hydrogeology of the facility such as the groundwater collection system at the site (i.e., the system's design, operation, and objectives).

(B) a work plan, including schedule and proposal for progress reports, to characterize the location, design, and operation of the combined sewer system.

(C) a soil sampling and analysis work plan, including schedule and proposal for progress reports, to collect and analyze representative soil samples to determine the nature and extent of any soil contamination in and around the former surface impoundments, the former neutralization tank, the former drum storage area, the former sulfide waste treatment tank, the former swale area and the combined sewer system. The plan shall include the number, location, depth of samples, the analysis parameters, and quality assurance measures.

(D) a sediment sampling and analysis work plan, including schedule and proposal for progress reports, to collect and analyze representative sediment samples to determine the nature and extent of contamination in sediments in Mill Creek adjacent to and downstream from the former surface impoundments, the former neutralization tank, the former drum storage area, the former sulfide waste treatment tank, the former swale

area, and the combined sewer system. The plan shall include the number, location, depth of samples, the analysis parameters, and quality assurance measures.

(E) a leachate and run-off sampling and analysis work plan, including schedule and proposal for progress reports, to determine the nature and extent of contaminated leachate and run-off flowing into Mill Creek from portions of the facility adjacent to and downstream from the former surface impoundments, the former neutralization tank, the former drum storage area, the former sulfide waste treatment tank, the former swale area and the combined sewer system. The plan shall include the number, location, depth of samples, the analysis parameters, and quality assurance measures.

(F) a groundwater sampling and analysis work plan, including schedule and proposal for progress reports, to characterize the groundwater quality and the extent of any groundwater contamination, both vertically and horizontally, which may exist in, around or on the former surface impoundments, the former neutralization tank, the former drum storage area, the former sulfide waste treatment tank, the former swale area and the combined sewer system. The plan shall include the number, location and frequency of samples to be taken, the analysis parameters, and quality assurance measures.

58. Each of the required work plans described above shall be designed to define the nature, location, extent, direction and rate of movement of any hazardous wastes or hazardous waste constituents which are present at or have been released from the facility. Each work plan shall document the procedures the Respondent shall use to conduct the investigations necessary: (1) to characterize the potential pathways of migration of hazardous waste and hazardous waste constituents; (2) characterize the sources of hazardous waste and/or hazardous waste constituent contamination; (3) define the degree and extent of hazardous waste and/or hazardous constituent contamination; and (4) identify actual or potential receptors.

59. Respondent shall insure that laboratories used by Respondent for analyses perform such analyses according to the EPA methods included in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (SW-846) or other methods deemed satisfactory to EPA. If methods other than EPA methods are to be proposed, Respondent shall submit all protocols to be used for analysis to EPA at least thirty (30) calendar days prior to the commencement of the analyses. Respondent shall also ensure that laboratories used by

Respondent for analyses participate in a quality assurance/quality control program equivalent to that which is followed by EPA.

60. Based on work performed under the work plans described above, EPA may determine that additional investigation, analysis, and/or reporting is necessary to meet the purposes of this Order. If EPA determines that Respondent shall perform additional work, EPA will notify Respondent in writing and specify the basis for its determination that additional work is necessary. Within fifteen (15) days after the receipt of such determination, Respondent shall have the opportunity to meet or confer with EPA to discuss the additional work. If required by EPA, Respondent shall submit for EPA approval a work plan for the additional work. EPA will specify the contents of such work plan. Such work plan shall be submitted by Respondent within thirty (30) days of receipt of EPA's determination that additional work is necessary, or according to an alternative schedule established by EPA.

61. The written proposal and all reports or documents required to be submitted under this Order shall be mailed to:

Mirtha Capiro, Project Coordinator
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard, DE-9J
Chicago, IL 60604

VII. SUBMISSIONS / AGENCY REVIEW

62. EPA will review all plans, reports, or other submittals required under this Order. EPA may: (a) approve the submission, (b) approve the submission with modifications, (c) disapprove the submission and direct Respondent to re-submit the document after incorporating EPA's comments, or (d) disapprove the submission and assume responsibility for performing all or any part of the work. As used in this Order, the terms "approval by EPA," "EPA approval," or a similar term means the action described in (a) or (b) of this paragraph.

63. Prior to approval in writing, or approval with modifications in writing, no plan, report, or other submittal shall be construed as approved and final. Oral advice, suggestions, or comments given by EPA representatives will not constitute approval, nor shall any oral approval or oral assurance of approval be considered binding.

64. Upon receipt of a notice of disapproval in paragraph 62 above or a request for a modification, Respondent shall, within fifteen (15) days, or such longer time as specified by EPA in its notice of disapproval or request for modification, correct the deficiencies and resubmit the plan, report, schedule, other item for approval. Notwithstanding the notice of disapproval, or approval with modifications, Respondent shall proceed, at the

direction of EPA, to take any action required by any non-deficient portion of the submission.

65. Within ten (10) days following EPA approval, or approval with modifications, of the a plan, Respondent shall implement the approved document.

66. All plans, reports, and/or other submittals required by this Order are, upon approval or approval with modifications by EPA, incorporated into this Order as if fully set forth in text herein. Any noncompliance with such EPA-approved plans, reports, specifications, schedules, and attachments shall be noncompliance with this Order. Oral advice or approvals given by EPA representatives shall not relieve Respondent of its obligation to obtain any formal, written approvals required by this Order.

67. In all instances which this Order requires written submissions to EPA, each submission must be accompanied by the following certification signed by a "responsible official":

> I certify that the information contained in or accompanying this submission is true, accurate, and complete.

For the purpose of this certification, a "responsible official" means a person in charge of a principal facility function, or any other person who performs similar decision-making functions for the facility.

VIII. PROJECT COORDINATORS

68. EPA hereby designates as its Project Coordinator:

> Mirtha Capiro
> U.S. Environmental Protection Agency, Region 5
> 77 West Jackson Boulevard, DE-9J
> Chicago, IL 60604

69. Within ten (10) calendar days of Respondent's receipt of this Order, Respondent shall designate a Project Coordinator and submit the designated Project Coordinator's name, address, and telephone number in writing to EPA.

70. Each Project Coordinator shall, on behalf of the party that designated that Project Coordinator, oversee the implementation of this Order and function as the principal project contact.

71. Respondent shall provide EPA with a written notice of any change in its Project Coordinator. Such notice shall be provided at least seven (7) calendar days prior to the change in Project Coordinator.

IX. THREATS TO PUBLIC HEALTH OR THE ENVIRONMENT

72. If EPA's Project Coordinator determines that activities in compliance or noncompliance with this Order have caused or may cause a release of hazardous waste or waste constituents, or a threat to the public health or to the environment, EPA may require that Respondent stop further implementation of this Order for such a period of time as may be needed to abate any such release or threat and/or undertake any action which EPA determines is necessary to abate such release or threat; and may require Respondent to resume implementation of this Order.

X. SAMPLING AND DOCUMENT AVAILABILITY

73. The Respondent shall submit to EPA, upon request, the results of all sampling and/or tests or other data generated by, or on behalf of, the Respondent in implementing the requirements of this Order.

XI. ACCESS

74. Respondent shall provide access at all reasonable times to the facility and facility property and to all records and documentation relating to conditions at the facility and the activities conducted pursuant to this Order to EPA and its employees, contractors, agents, consultants, and representatives. These individuals shall be permitted to move freely at the facility in order to conduct activities which EPA determines to be necessary.

75. To the extent that activities required by this Order, or by any approved work plans prepared pursuant hereto, must be done on property not owned or controlled by Respondent, Respondent will use its best efforts to obtain site access agreements in a timely manner from the present owners of such property. Best efforts as used in this paragraph shall include the payment of reasonable compensation in consideration of granting access. Respondent shall provide EPA's Project Coordinator with a copy of any access agreements.

76. Nothing in this Order limits or otherwise affects EPA's right of access and entry pursuant to applicable law, including RCRA and CERCLA.

77. Respondent shall notify EPA in writing at least ten (10) calendar days before engaging in any field activities, including but not limited to sampling, well-drilling, and installation of equipment. At the request of EPA, Respondent shall provide or allow EPA or its authorized representatives to take split and/or duplicate samples of all samples collected by Respondent pursuant to this Order.

XII. RECORD PRESERVATION

78. Respondent shall retain, during the pendency of this Order and for a minimum of five (5) years after its termination, a copy of all data, records, and documents now in its possession or control, or in the possession of control of its contractors, subcontractors, representatives, or which come into the possession of control of the Respondent, its contractors, subcontractors, or representatives, which relate in any way to this Order. Respondent shall notify EPA, in writing, at least ninety (90) days in advance of the destruction of any such records, and shall provide EPA with the opportunity to take possession of any such records. Such written notification shall reference the caption, docket number and date of issuance of this Order and shall be addressed to:

Chief
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
EPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604

In addition, Respondent shall provide data, records and documents retained under this Section at any time before the expiration of the five year period at the written request of EPA.

XIII. INFORMATION SUBMITTED TO EPA

79. Any information that Respondent is required to provide or maintain pursuant to this Order is not subject to the Paperwork Reduction Act of 1995, 44 U.S.C. § 3501 et seq.

80. Respondent may assert a business confidentiality claim in the manner described in 40 C.F.R. § 2.203(b) covering all or part of any information submitted to EPA pursuant to this Order. Any assertion of confidentiality shall be adequately substantiated by Respondent when the assertion is made in accordance with 40 C.F.R. § 2.204(e)(4). Information submitted for which Respondent has asserted a claim of confidentiality as specified above shall be disclosed by EPA only to the extent and manner permitted by 40 C.F.R. Part 2, Subpart B. If no such confidentiality claim accompanies the information when it is submitted to EPA, it may be made available to the public by EPA without further notice to the Respondent.

XIV. RESERVATION OF RIGHTS

81. EPA expressly reserves all statutory and regulatory powers, authorities, rights, remedies, both legal and equitable, including any which may pertain to Respondent's failure to comply with any of the requirements of this Order, specifically including, without

limitation, the right to commence a civil action against Respondent seeking an order requiring compliance with this Order and/or the assessment of penalties under § 3013(e) of RCRA, 42 U.S.C. § 6934(e), and all rights EPA has pursuant to RCRA § 3013(d) to conduct monitoring, testing and sampling at the facility, and to analyze any samples taken, and to seek reimbursement from Respondent for the costs of such activity. This Order shall not be construed as a covenant not to sue, or as a release, waiver or limitation of any rights, remedies, defenses, powers and/or authorities, civil or criminal, which EPA has under RCRA, CERCLA, the Safe Drinking Water Act (SDWA), the Clean Air Act (CAA), or any other statutory, regulatory, or common law enforcement authority of the United States.

82. EPA expressly reserves all rights and defenses that it may have, including the right both to disapprove of work performed by Respondent pursuant to this Order, and to order that Respondent perform additional tasks.

XV. OTHER APPLICABLE LAWS

83. All actions required to be taken pursuant to this Order shall be undertaken in accordance with the requirements of all applicable federal, state, and local laws, regulations, permits, and ordinances.

84. Compliance by Respondent with the terms of this Order shall not relieve Respondent of its obligations to comply with RCRA, or any other applicable federal, state, or local laws, regulations, permits, and ordinances.

85. This Order is not and shall not be interpreted to be a permit, or as a ruling or a determination of any issue related to a permit, under federal, state or local law; nor shall this Order in any way affect Respondent's obligation, if any, to secure such a permit; nor shall this Order be interpreted in any way to affect or waive any of the conditions or requirements that may be imposed as conditions of such permit or of Respondent's right to appeal any conditions of such permit. Respondent shall obtain or cause its representatives to obtain all permits and approvals necessary under such laws and regulations.

XVI. OTHER CLAIMS

86. Nothing in this Order shall constitute or be construed as a release from any claim, cause of action, demand, or defense in law or equity, against any person, firm, partnership, or corporation for any liability it may have arising out of or relating in any way to the generation, storage, treatment, handling, transportation, release, or disposal of any hazardous waste constituents, hazardous substances, hazardous wastes, pollutants, or contaminants found at, taken to, or migrating from the facility.

87. By issuance of this Order, the United States and EPA assume no liability for injuries or damages to persons or property resulting from any acts of omissions of Respondent or its agents, contractors, subcontractors or other representatives.

88. Neither the United States nor EPA shall be a party or be held out as a party to any contact entered into by the Respondent or its directors, officers, employees, agents, successors, representatives, assigns, contractors, or consultants in carrying out activities pursuant to this Order.

XVII. SUBSEQUENT MODIFICATION OF ORDER

89. Except as provided in paragraphs 72 and 90, this Order may only be modified by written amendment signed by the Branch Chief or the Regional Administrator, EPA, Region 5.

90. Modifications in any schedule adopted pursuant to this Order may be made in writing by EPA's Project Coordinator.

91. No informal advice, guidance, suggestions, or comments by EPA shall be construed to modify the requirements of this Order. Routine communications exchanged verbally, in person or by telephone, between the parties to facilitate the orderly conduct of work contemplated by this Order shall not alter or waive any rights and/or obligations of the parties under this Order.

XVIII. STATEMENT OF SEVERABILITY

92. If any provision or authority of this Order, or the application of this Order to any party or circumstances, is held by any judicial or administrative authority to be invalid, the application of such provisions to other Parties or circumstances and the remainder of the Order shall not be affected thereby.

XIX. TERMINATION AND SATISFACTION

93. Respondent may seek termination of this Order by submitting to EPA a written document which indicates Respondent's compliance with all requirements of this Order, and the associated dates of approval correspondence from EPA.

94. The provisions of this Order shall be deemed satisfied upon Respondent's receipt of written notice from EPA that Respondent has demonstrated to the satisfaction of EPA that the terms of the Order, including any additional tasks determined by EPA to be required pursuant to this Order, have been satisfactorily completed. This notice shall not, however, terminate Respondent's obligations to comply with any continuing obligations

hereunder, including without limitation, Section XII (Record Preservation), XIV (Reservation of Rights), and XV (Other Applicable Laws).

XX. OPPORTUNITY TO CONFER

95. In accordance with § 3013(c) of RCRA, 42 U.S.C. § 6934(c), Respondent or its representative may confer in person or by telephone with EPA regarding this Order. The opportunity to confer with EPA may be pursued by the Respondent before the proposal described in paragraph 57 from Section VI of this Order is due within thirty (30) days after the issuance of this Order. At such conference, Respondent may discuss the following with EPA: the Order, its applicability to the Respondent, the correctness of any factual determinations upon which the Order is based, the appropriateness of any action which Respondent is hereby ordered to undertake, and any other relevant and material issue.

96. The scheduling of a conference with EPA does not relieve Respondent of the obligation to submit the written proposal required under Section VI of this Order within thirty (30) days of the date of issuance of this Order, or to implement the proposal once approved, or approved with modifications, by EPA.

97. At the conference described above, Respondent may appear in person and/or by attorney or other representative. Additionally, Respondent may submit written comments to the EPA Project Coordinator addressing issues that could be raised in the conference within the time frames set for conducting such conference.

98. Any request for a conference with EPA, and other questions regarding this Order should be directed to:

Thomas Nash
Associate Regional Counsel
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard, C-14J
Chicago, IL 60604
(312) 886-0552

If Respondent fails to request a conference within the time periods provided in this Section, or fails to agree upon a date to schedule such conference within the time periods provided in this section, Respondent shall be deemed to have waived its right under § 3013 of RCRA to confer with EPA regarding this Order.

XXI. POTENTIAL CONSEQUENCES OF FAILURE TO COMPLY

99. In the event Respondent fails or refuses to comply with the terms and provisions of this Order, EPA may commence a civil action in accordance with § 3013(e) of RCRA, 42 U.S.C. § 6934(e), to require compliance with such Order and to assess a civil penalty (consistent with 40 C.F.R. Part 19) not to exceed $5,500 for each day during which such failure or refusal occurs.

100. If EPA determines that Respondent is not able to conduct the activities required by this Order in a satisfactory manner, or if actions carried out are deemed unsatisfactory, then EPA or its representatives may conduct such actions deemed reasonable by EPA to ascertain the nature and extent of the hazard at the property and/or facility of Respondent. EPA or its representatives may then order Respondent to reimburse the costs of such activity pursuant to § 3013(d) of RCRA, 42 U.S.C. § 6934(d).

XXII. EFFECTIVE DATE/DATE OF ISSUANCE

101. The effective date of this Order is the date it is signed by the Branch Chief. The date of issuance of this Order shall be the same date as the effective date.

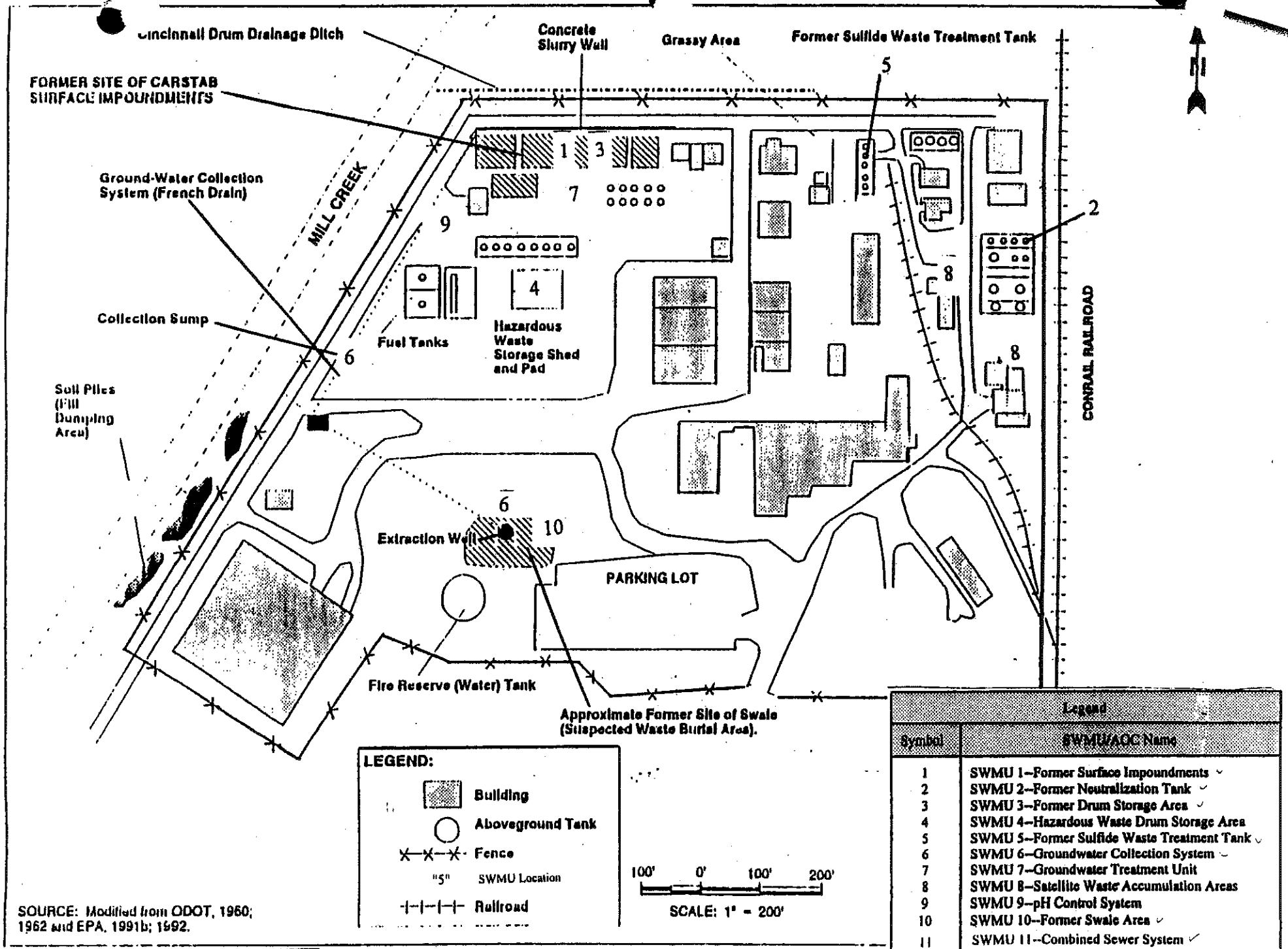
IN THE MATTER OF MORTON INTERNATIONAL, INC.
2000 West Street
Reading, Ohio 45215-3431

IT IS SO ORDERED

Joseph M. Boyle

Joseph Boyle, Chief
Enforcement & Compliance Assurance Branch
Waste, Pesticides and Toxics Division
U.S. Environmental Protection Agency/ Region 5

August 18, 2000
Date



SOURCE: Modified from ODOT, 1960; 1962 and EPA, 1991b; 1992.

Morton International, Inc., Reading, Ohio
Facility Layout and SWMU and AOC Location Map

ATTACHMENT 1

ATTACHMENT 2

REFERENCES
MORTON INTERNATIONAL, INC.
READING, OHIO
U.S. EPA ID No. OHD 000 724 138

The following list identifies guidance documents, in addition to those documents already referenced in the Order, and other information which may be useful to Morton International, Inc. in implementing the Order. This list is not exhaustive in that it does not include every guidance document applicable to work performed under a RCRA §3013 Administrative Order.

"*Health and Safety Requirements of Employees Employed in Field Activities*," EPA Order 1440.2, July 12, 1981.

"*RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD)*," OSWER Directive 9950.1, September 1986.

"*RCRA Facility Assessment (RFA) Guidance*," EPA/530/SW-86/053, October 1986.

"*Data Quality Objectives for Remedial Response Activities*," EPA/540/G-87/003 & 004, OSWER Directive 9335.0-7B, March 1987.

"*Alternate Concentration Limit Guidance, Part I: ACL Policy and Information Requirements*," Interim Final, OSWER Directive 9481.00-6C, July 1987.

"*A Compendium of Superfund Field Operations Methods*," Two Volumes, EPA/540/P-87/001a&b, OSWER Directive 9355.0-14, August 1987.

"*Technology Screening Guide for Treatment of CERCLA Soils and Sludges*," EPA/540/2-88/004, September 1988.

"*Ground-Water Modeling: An Overview and Status Report*," EPA/600/2-89/028, December 1988.

"*Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation Manual*," Interim Final, EPA/540/1-89/001, March 1989.

"*Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference Document*," EPA 600/3-89/013, March 1989.

"*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities*," Interim Final, EPA/530/SW-89/026, April 1989.

"*Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*," EPA/600/4-89/034, April 1989.

"*Interim Final RCRA Facility Investigation (RFI) Guidance*," Volumes I-IV, EPA/530/SW-89-031, May 1989.

"*Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)*," Interim Final, EPA/540/1-89/002, December 1989

"*Air/Superfund National Technical Guidance Study Series*," Volumes I-IV, EPA 450/1-89-001,002,003,004 (1989 and 1990).

"*Framework for Ecological Risk Assessment*," EPA/630/R-92/001, February 1991.

"*Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors*," OSWER Directive 9285.6-03, March 25, 1991.

"*Handbook: Ground Water*," Volumes I and II, EPA/625/6-90/016 (a&b), September 1990 and July 1991.

"*Characterizing Heterogeneous Wastes: Methods and Recommendations*," EPA/600/R-92/033, Feb. 1992.

"*Final Guidance for Data Useability in Risk Assessment*," (Parts A & B), OSWER Directive 9285.7-09A, April 1992.

"*Handbook of RCRA Ground-Water Monitoring Constituents: Chemical and Physical Properties*," EPA/530/R-92/022, September 1992.

"*Ground-Water Monitoring: Draft Technical Guidance*," EPA/530-R-93-001, November 1992.

"*Statistical Training Course for Ground-Water Monitoring Data Analysis*," EPA/530/R-93/003, 1992.

"*Subsurface Characterization and Monitoring Techniques: A Desk Reference Guide*," EPA/625/R-93/003b, May 1993.

"*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*," SW-846, Third Edition as amended by Update III or latest, U.S. EPA, June 1997.

"*Standard Guide for Risk Based Corrective Action Applied to Petroleum Release Sites*," ASTM E-1739-95, November 1995. (As approved by Region 5 guidance policy)

"*Conducting Risk-Based Corrective Action for Federally-Regulated UST Petroleum Releases*," U.S. EPA, Region 5, December 7, 1995.

"*Sitting at the RCRA Data Quality Level Table, Update 1*," U.S. EPA, Region 5, Memorandum, December 14, 1995.

"*Soil Screening Guidance: Users Guide*," OSWER Publication 9355.4-23, April 1996.

"*Soil Screening Guidance: Technical Background Document*," EPA/540/R-95/128, May 1996.

"*Region 5 Ecological Data Quality Levels*," Final Report, August 26, 1996.

"*EPA's Proposed Guidelines for Ecological Risk Assessment*," 61 Fed. Reg. 47552, September 9, 1996. (Note: Final document to be released in early-1998.)

"*Ecological Data Quality Levels, RCRA Appendix IX Hazardous Constituents*," U.S. EPA, Region 5, Draft Report, August 18, 1997.

EXHIBIT 2

MORTON INTERNATIONAL, INC. PROPOSAL FOR CARRYING OUT MONITORING, TESTING, ANALYSIS AND REPORTING AND RESPONSE TO ORDER REQUIRING MONITORING, TESTING, ANALYSIS, AND REPORTING SEPTEMBER 18, 2000.

100 INDEPENDENCE MALL WEST, PHILADELPHIA, PA 19106-2399 USA
TELEPHONE (215) 592-3000 CENTRAL FAX (215) 592-3377

David C. Kurland, Esq.
Tele: (215) 592-3691
Fax: (215) 592-3227
E-mail: David_C_Kurland@RohmHaas.com

ROHM AND HAAS

September 18, 2000

Via Facsimile (312) 886-7160
and Overnight Courier
Airbill # 1009412 6453

✓Ms. Mirtha Capiro
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics DivisionU.S.
Environmental Protection Agency
Region 5 (DE-9F)
77 West Jackson Street
Chicago, Illinois 60604-3590

Mr. Thomas Nash
US Environmental Protection Agency
Region 57.
7 West Jackson Boulevard C-14J
Chicago, IL 60604-3590

Re: RCRA Docket No. R3013-5-00-001

Morton International Inc.'s Proposal for Carrying Out Monitoring, Testing, Analysis and Reporting, and
Response to Order Requiring Monitoring, Testing, Analysis and Reporting

Morton hereby submits the attached Proposal for Carrying Out Monitoring, Testing, Analysis and Reporting ("Proposal"), as required by the Order Requiring Monitoring, Testing, Analysis and Reporting, RCRA Docket No. R3013-5-00-001 ("Order"). As agreed at our September 11, 2000 meeting, the Proposal sets forth a schedule by which Morton will submit a Current Conditions Report for the facility, and Workplans for the work required by Section VI of the Order, followed by the implementation of the Workplans and final reporting. The investigation is scheduled for completion by the June 1, 2002 date set forth in the Order, with input and cooperation of EPA. Morton presented a draft of the Proposal by letter dated August 31, 2000 from Mr. Kurland of Rohm and Haas to Ms. Capiro and Mr. Nash of EPA. In a conference in EPA's offices on September 11, 2000, EPA requested certain modifications to the Proposal which Morton has included in the attachment. Morton and EPA agreed at that time that the Proposal

under paragraph 57 of the Order. In addition, this letter constitutes Morton's written response to certain other matters in the Order.

Parties Bound

In Section II of the Order EPA sets forth the parties it believes are bound by the Order. Under RCRA § 3013 EPA may only issue an order to an owner or operator of a facility. Therefore, the Order applies only to Morton. While Morton will provide a copy of the Order to third parties to the extent necessary to carry out the work required by Section VI of the Order, Morton's engagements with its consultants do not condition contracts on consultants' compliance with the Order because the Order is not binding upon such consultants.

Findings of Fact

Section III of the Order sets forth EPA's Findings of Fact which are based on existing data. Morton will submit a Current Conditions Report on October 2, 2000 that will summarize the most current and accurate data available to date with regard to environmental conditions at the facility. Thereafter, the work that Morton will perform pursuant to Section VI of the Order will refine the existing data and complete any data gaps.

However, Morton notes specifically one omission and one error in the Order.[1] Most importantly, the Order makes no mention of the impact of the Pristine Superfund Site which lies directly to the north of and adjacent to the facility. As we discussed at our September 11 meeting, Pristine has caused contamination of soil and groundwater, has been thoroughly studied, and is undergoing remediation pursuant to a ROD. The lower aquifer under the Morton facility has been contaminated by Pristine, and it is likely that the upper aquifer under the Morton facility has been impacted by Pristine as well. The Pristine groundwater pump-and-treat system captures and controls contamination in the lower aquifer across the entire Morton site. Several recovery and monitoring wells associated with Pristine are located on the Morton facility. Pristine is almost certainly the cause of the production well closures noted in paragraph 14 of the Order, and the other referenced production wells are monitored frequently. Since the contamination in the lower aquifer has been defined and is under active remediation, Morton's proposed investigation will focus initially on defining and characterizing the upper aquifer.

Facts recited in the Order regarding ownership of the public recreation areas are incorrect. The public recreation area consisting of the city park, public pool, and municipal stadium are not owned by Morton, but rather are owned by the City of Reading. The baseball fields are on property owned by Morton, but are outside the facility security fence, and are managed and maintained by the City of Reading.

Workplan for Mill Creek

[1] By noting specific errors and omissions, Morton does not admit any other Findings of Fact In the Order.

It is expected that any seeps of groundwater from the Morton facility into Mill Creek were stopped by the operation of the french drain system, although the efficacy of that system will be evaluated during the course of this investigation. Morton notes that Mill Creek has been impacted by many activities both up and down stream and the substances previously detected in the creek sediments are common to many operations and sources in the area. Morton will attempt to distinguish any impact it may have had on the creek.

Workplans for Other Study Areas

Several of the study areas addressed in the Order have already been assigned a "low" release potential in the 1998 Preliminary Assessment conducted by EPA's contractor, TechLaw, specifically the former neutralization tanks and the former sulfide waste treatment tank. Also, the sewer system is extensive, and of varying ages and materials of construction. Morton's workplans will propose investigations that are tailored to the release potential at each individual study area and take the recommendations of the PA/VSI into account. For example, the sewer system will be evaluated to determine which sections carried potentially contaminated water and which sections have the potential for significant releases in order to focus the investigation. In addition, review of groundwater data from early phases of the investigation may indicate which sections of the sewer may be a source of contamination, and which sections can be relieved of further investigation.

Review of Submissions

In order to fulfill the requirements of the Order by the deadline of June 1, 2002, Morton and EPA will need to work together in a cooperative manner and engage in quick communication and decision making. The completion deadline can not be met if EPA reviews and approves or disapproves each submission in the manner contemplated by Section VII of the Order. The amount of time available for Morton and EPA to review data and plan subsequent phases will be quite limited, and preparation of extensive reports between phases for formal EPA review and approval will be impossible. Instead, Morton has proposed a multi-phased, data-driven approach that relies on regular submission of data and event summaries followed quickly by face-to-face meetings. Morton will provide the EPA with detailed schedules for each phase of the project so that the EPA can make available the appropriate resources for review of the data. At the end of the investigation, a final, complete report will be prepared and submitted for EPA review and approval. In the event that EPA disapproves a submittal, the time limits set forth in the Order should be evaluated to allow provide sufficient time for review, resubmission, and implementation.

Access

The access provision set forth in paragraph 74 is not consistent with 40 CFR § 270.30(i). In addition, all visitors to the facility are required to receive a safety orientation and follow facility safety rules. Morton proposes the following alternative language:

> 74. Morton shall allow the U.S. EPA, or its authorized representatives, upon the presentation of credentials and other documents as may be required by law to:

(1) Enter at reasonable times upon the Morton premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Order;

(2) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order;

(3) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and

(4) Sample or monitor, at reasonable times, for the purpose of assuring compliance with this Order, any substances or parameters at this location.

(5) EPA and its contractors shall review and follow all facility safety rules while on Morton property.

Certification of Submissions

The certification required by paragraph 67 of the Order is not consistent with 40 CFR § 270.11(d). Morton will submit reports and other documents with the following certification by the Plant Manager, who is the responsible corporate official at this facility, or by the Project Manager, who has responsibility for the overall operation of the environmental investigation at the facility:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Closure Requirements Applicable to Certain Units

The Order states that closure certification was not completed for SWMUs 2, 3 and 5. During the September 11 meeting we discussed whether those units are subject to closure requirements. It was agreed that Morton will investigate the requirements regarding RCRA closure of SWMUs 2, 3, and 5, and will take all appropriate action required by the regulations.

Dispute Resolution

Morton requests that EPA modify the Order to include a dispute resolution provision so that the parties have a quick, clear procedure to resolve differences without resorting to litigation and without jeopardizing Morton's ability to meet the deadlines in the Order. The following paragraph would be acceptable to Morton:

> In the event the Respondent disagrees, in whole or in part, with the EPA's disapproval or approval with modification of a submittal, the Respondent may notify the EPA Project Manager in writing within fifteen (15) days of receipt of the EPA's disapproval or approval with modifications. Such notice shall set forth the specific matters in dispute, the position the Respondent asserts should be adopted, the basis for the Respondent's position, and any other matters that may be necessary for EPA's determination. Respondent shall thereafter have the opportunity to meet and confer with the EPA Region 5 Waste, Pesticides and Toxics Division Director. The Division Director will issue a written decision resolving the dispute, which shall include a response to Respondent's notice, and which shall constitute final agency action. During the dispute resolution process Respondent shall take any action that is required by those portions of the submission that are not substantially affected by the dispute.

Force Majeure

Morton requests that the Order be modified to include a force majeure provision. The following paragraph would be acceptable to Morton:

> Deadlines and schedules imposed by or pursuant to this Order shall be extended during the occurrence of a force majeure. Respondent shall immediately notify EPA of any force majeure, and shall have the burden of proving such force majeure. Force majeure is defined as any event arising from causes which are not reasonably foreseeable, are beyond the control of Respondent, which can not be overcome by due diligence and which delays or prevents performance in the manner or by a date required by or pursuant to this Order. Such events do not include increased costs of performance, changed economic circumstances, reasonably foreseeable weather conditions or weather conditions which could have been overcome by due diligence, or failure to obtain federal, state or local permits unless Respondent demonstrates that timely application for such permits had been made in accordance with applicable statutory and regulatory requirements and such application has been diligently pursued.

Reservation of Rights

Morton submits the Proposal with the current intention to comply with the Order and cooperate with EPA to complete a phased, data-driven investigation of the facility by June 1, 2002. However, Morton reserves all rights and defenses it may have in law or equity with regard to the Order. Specifically, and without being limited or bound thereby, Morton does not agree with EPA's conclusion in Section V of the Order. To the contrary, the facts set forth in the Order are not sufficient to establish that the presence or

release of hazardous wastes from the facility may present a substantial hazard to human health or the environment, as is required by RCRA § 3013. Moreover, the facility is not a permitted or interim status transportation, storage or disposal facility and therefore is not subject to RCRA § 3013.

Thank you for your consideration of these matters. We have confirmed a meeting in EPA's offices on October 16, 2000 at 9:00 a.m. to discuss the Description of Current Conditions report (to be submitted on October 2, 2000) and to discuss the scope of the Phase I investigative work in detail. Please call me if you have any questions or concerns.

Sincerely,

David Kurland
Senior Counsel

DCK/vjc

cc: Joseph M. Boyle, EPA
Harold O'Connell, OEPA

ATTACHMENT A
MORTON INTERNATIONAL INC.'S PROPOSAL FOR CARRYING OUT MONITORING, TESTING, ANALYSIS AND REPORTING

Morton Facility, Reading, Ohio

Date	Activity	Purpose (Paragraph of Order Satisfied)
September 11, 2000	Initial Meeting	Refine schedule, discuss broad objectives and key facts
September 15, 2000	Submit Proposal for Monitoring, Testing, Analysis and Reporting	Define and schedule tasks (Order, ¶ 57)
October 2, 2000	Submittal of Current Conditions Report	Provide basic description of setting, history, and operations, to allow for proper scoping and review of RFI Work Plan
October 16, 2000	Scoping Meeting	Discuss preliminary review of CCR, describe and discuss proposed scope of RFI, including detailed scope of Phase 1 activities
November 13, 2000	Submittal of RFI Work Plan	Describe procedures, methods, locations, depths, etc. for RFI, including strategy and triggers for successive phases (Order ¶ 57, 58) Develop QA/QC and health and safety protocols (Order ¶ 59)
November 2000 through January 2001	Agency Review of RFI Work Plan and CCR	Allow for on-going review, discussion, and modification of investigation approach
March 2001 through May 2001	<u>Phase 1 of RFI</u> • On-Site Upper Aquifer Wells • On-Site Upper Aquifer Stratigraphic Borings • P&A Obsolete On-Site Wells • Groundwater Sampling • Combined Sewer System Evaluation	• Characterize hydrogeology of shallow aquifer (Order ¶ 57A) • Evaluate effectiveness of groundwater collection system (Order ¶ 57A) • Delineate on-site impact to shallow aquifer (Order ¶ 57E, F) • Characterize potential releases from sewer system (Order ¶ 57B)

MORTON INTERNATIONAL INC.'S PROPOSAL FOR CARRYING OUT MONITORING, TESTING, ANALYSIS AND REPORTING
(Continued)

June 2001	Scoping of Phase 2	Discussion and meetings between Morton and USEPA to review Phase 1 findings and plan details of Phase 2
July 2001 through September 2001	<u>Phase 2 of RFI</u> • Install Supplemental Upper Aquifer Wells • Groundwater Sampling • Aquifer Testing • Mill Creek Sediment & Seep Testing • SWMU Soil Borings • Geophysical Survey of Former Swale • Ecological Survey	• Complete on-site and off-site assessment of shallow aquifer. (Order ¶ 57A, E, F) • Characterize hydraulics of shallow aquifer, and communication with deeper aquifer (Order ¶ 57A, E, F) • Characterize soil impact at potential release sites (Order ¶ 57C) • Characterize residual or on-going impact from facility to creek (Order ¶ 57D) • Evaluate possible historical waste disposal in this area (Order ¶ 57C) • Identify potential ecological receptors (Order ¶ 57 A - F)
October 2001	Scoping of Phase 3	Discussion and meetings between Morton and USEPA to review Phase 2 findings and plan details of Phase 3
November 2001	<u>Phase 3 of RFI</u> • Characterization of Any Identified Human Receptors • Final Upper Aquifer Well Installation • Trenching or Drilling at Swale	• Provide information for HHRA (Order ¶ 57 A - F) • Close any remaining data gaps (Order ¶ 57 A - F) • Evaluate detected anomalies in Swale (Order ¶ 57C)
December 2001 through February 2002	Data Evaluation and RFI Report Preparation	Tabulate and interpret RFI findings (Order ¶ 57 A - F)
March 2002 through May 2002	Agency Review and Morton Revision of RFI Report	Provide RFI findings in a form suitable for agency and public review (Order ¶ 57 A - F)

EXHIBIT 2

MORTON INTERNATIONAL, INC. PROPOSAL FOR CARRYING OUT MONITORING, TESTING, ANALYSIS AND REPORTING AND RESPONSE TO ORDER REQUIRING MONITORING, TESTING, ANALYSIS, AND REPORTING SEPTEMBER 18, 2000.

100 INDEPENDENCE MALL WEST, PHILADELPHIA, PA 19106-2399 USA
TELEPHONE (215) 592-3000 CENTRAL FAX (215) 592-3377

David C. Kurland, Esq.
Tele: (215) 592-3691
Fax: (215) 592-3227
E-mail: David_C_Kurland@RohmHaas.com

ROHM AND HAAS

September 18, 2000

Via Facsimile (312) 886-7160
and Overnight Courier
Airbill # 1009412 6453

✓Ms. Mirtha Capiro
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics DivisionU.S.
Environmental Protection Agency
Region 5 (DE-9F)
77 West Jackson Street
Chicago, Illinois 60604-3590

Mr. Thomas Nash
US Environmental Protection Agency
Region 57
7 West Jackson Boulevard C-14J
Chicago, IL 60604-3590

Re: RCRA Docket No. R3013-5-00-001

Morton International Inc.'s Proposal for Carrying Out Monitoring, Testing, Analysis and Reporting, and
Response to Order Requiring Monitoring, Testing, Analysis and Reporting

Morton hereby submits the attached Proposal for Carrying Out Monitoring, Testing, Analysis and Reporting ("Proposal"), as required by the Order Requiring Monitoring, Testing, Analysis and Reporting, RCRA Docket No. R3013-5-00-001 ("Order"). As agreed at our September 11, 2000 meeting, the Proposal sets forth a schedule by which Morton will submit a Current Conditions Report for the facility, and Workplans for the work required by Section VI of the Order, followed by the implementation of the Workplans and final reporting. The investigation is scheduled for completion by the June 1, 2002 date set forth in the Order, with input and cooperation of EPA. Morton presented a draft of the Proposal by letter dated August 31, 2000 from Mr. Kurland of Rohm and Haas to Ms. Capiro and Mr. Nash of EPA. In a conference in EPA's offices on September 11, 2000, EPA requested certain modifications to the Proposal which Morton has included in the attachment. Morton and EPA agreed at that time that the Proposal

under paragraph 57 of the Order. In addition, this letter constitutes Morton's written response to certain other matters in the Order.

Parties Bound

In Section II of the Order EPA sets forth the parties it believes are bound by the Order. Under RCRA § 3013 EPA may only issue an order to an owner or operator of a facility. Therefore, the Order applies only to Morton. While Morton will provide a copy of the Order to third parties to the extent necessary to carry out the work required by Section VI of the Order, Morton's engagements with its consultants do not condition contracts on consultants' compliance with the Order because the Order is not binding upon such consultants.

Findings of Fact

Section III of the Order sets forth EPA's Findings of Fact which are based on existing data. Morton will submit a Current Conditions Report on October 2, 2000 that will summarize the most current and accurate data available to date with regard to environmental conditions at the facility. Thereafter, the work that Morton will perform pursuant to Section VI of the Order will refine the existing data and complete any data gaps.

However, Morton notes specifically one omission and one error in the Order.[1] Most importantly, the Order makes no mention of the impact of the Pristine Superfund Site which lies directly to the north of and adjacent to the facility. As we discussed at our September 11 meeting, Pristine has caused contamination of soil and groundwater, has been thoroughly studied, and is undergoing remediation pursuant to a ROD. The lower aquifer under the Morton facility has been contaminated by Pristine, and it is likely that the upper aquifer under the Morton facility has been impacted by Pristine as well. The Pristine groundwater pump-and-treat system captures and controls contamination in the lower aquifer across the entire Morton site. Several recovery and monitoring wells associated with Pristine are located on the Morton facility. Pristine is almost certainly the cause of the production well closures noted in paragraph 14 of the Order, and the other referenced production wells are monitored frequently. Since the contamination in the lower aquifer has been defined and is under active remediation, Morton's proposed investigation will focus initially on defining and characterizing the upper aquifer.

Facts recited in the Order regarding ownership of the public recreation areas are incorrect. The public recreation area consisting of the city park, public pool, and municipal stadium are not owned by Morton, but rather are owned by the City of Reading. The baseball fields are on property owned by Morton, but are outside the facility security fence, and are managed and maintained by the City of Reading.

Workplan for Mill Creek

[1] By noting specific errors and omissions, Morton does not admit any other Findings of Fact In the Order.

It is expected that any seeps of groundwater from the Morton facility into Mill Creek were stopped by the operation of the french drain system, although the efficacy of that system will be evaluated during the course of this investigation. Morton notes that Mill Creek has been impacted by many activities both up and down stream and the substances previously detected in the creek sediments are common to many operations and sources in the area. Morton will attempt to distinguish any impact it may have had on the creek.

Workplans for Other Study Areas

Several of the study areas addressed in the Order have already been assigned a "low" release potential in the 1998 Preliminary Assessment conducted by EPA's contractor, TechLaw, specifically the former neutralization tanks and the former sulfide waste treatment tank. Also, the sewer system is extensive, and of varying ages and materials of construction. Morton's workplans will propose investigations that are tailored to the release potential at each individual study area and take the recommendations of the PA/VSI into account. For example, the sewer system will be evaluated to determine which sections carried potentially contaminated water and which sections have the potential for significant releases in order to focus the investigation. In addition, review of groundwater data from early phases of the investigation may indicate which sections of the sewer may be a source of contamination, and which sections can be relieved of further investigation.

Review of Submissions

In order to fulfill the requirements of the Order by the deadline of June 1, 2002, Morton and EPA will need to work together in a cooperative manner and engage in quick communication and decision making. The completion deadline can not be met if EPA reviews and approves or disapproves each submission in the manner contemplated by Section VII of the Order. The amount of time available for Morton and EPA to review data and plan subsequent phases will be quite limited, and preparation of extensive reports between phases for formal EPA review and approval will be impossible. Instead, Morton has proposed a multi-phased, data-driven approach that relies on regular submission of data and event summaries followed quickly by face-to-face meetings. Morton will provide the EPA with detailed schedules for each phase of the project so that the EPA can make available the appropriate resources for review of the data. At the end of the investigation, a final, complete report will be prepared and submitted for EPA review and approval. In the event that EPA disapproves a submittal, the time limits set forth in the Order should be evaluated to allow provide sufficient time for review, resubmission, and implementation.

Access

The access provision set forth in paragraph 74 is not consistent with 40 CFR § 270.30(i). In addition, all visitors to the facility are required to receive a safety orientation and follow facility safety rules. Morton proposes the following alternative language:

> 74. Morton shall allow the U.S. EPA, or its authorized representatives, upon the presentation of credentials and other documents as may be required by law to:

(1) Enter at reasonable times upon the Morton premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Order;

(2) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order;

(3) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and

(4) Sample or monitor, at reasonable times, for the purpose of assuring compliance with this Order, any substances or parameters at this location.

(5) EPA and its contractors shall review and follow all facility safety rules while on Morton property.

Certification of Submissions

The certification required by paragraph 67 of the Order is not consistent with 40 CFR § 270.11(d). Morton will submit reports and other documents with the following certification by the Plant Manager, who is the responsible corporate official at this facility, or by the Project Manager, who has responsibility for the overall operation of the environmental investigation at the facility:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Closure Requirements Applicable to Certain Units

The Order states that closure certification was not completed for SWMUs 2, 3 and 5. During the September 11 meeting we discussed whether those units are subject to closure requirements. It was agreed that Morton will investigate the requirements regarding RCRA closure of SWMUs 2, 3, and 5, and will take all appropriate action required by the regulations.

Dispute Resolution

Morton requests that EPA modify the Order to include a dispute resolution provision so that the parties have a quick, clear procedure to resolve differences without resorting to litigation and without jeopardizing Morton's ability to meet the deadlines in the Order. The following paragraph would be acceptable to Morton:

> In the event the Respondent disagrees, in whole or in part, with the EPA's disapproval or approval with modification of a submittal, the Respondent may notify the EPA Project Manager in writing within fifteen (15) days of receipt of the EPA's disapproval or approval with modifications. Such notice shall set forth the specific matters in dispute, the position the Respondent asserts should be adopted, the basis for the Respondent's position, and any other matters that may be necessary for EPA's determination. Respondent shall thereafter have the opportunity to meet and confer with the EPA Region 5 Waste, Pesticides and Toxics Division Director. The Division Director will issue a written decision resolving the dispute, which shall include a response to Respondent's notice, and which shall constitute final agency action. During the dispute resolution process Respondent shall take any action that is required by those portions of the submission that are not substantially affected by the dispute.

Force Majeure

Morton requests that the Order be modified to include a force majeure provision. The following paragraph would be acceptable to Morton:

> Deadlines and schedules imposed by or pursuant to this Order shall be extended during the occurrence of a force majeure. Respondent shall immediately notify EPA of any force majeure, and shall have the burden of proving such force majeure. Force majeure is defined as any event arising from causes which are not reasonably foreseeable, are beyond the control of Respondent, which can not be overcome by due diligence and which delays or prevents performance in the manner or by a date required by or pursuant to this Order. Such events do not include increased costs of performance, changed economic circumstances, reasonably foreseeable weather conditions or weather conditions which could have been overcome by due diligence, or failure to obtain federal, state or local permits unless Respondent demonstrates that timely application for such permits had been made in accordance with applicable statutory and regulatory requirements and such application has been diligently pursued.

Reservation of Rights

Morton submits the Proposal with the current intention to comply with the Order and cooperate with EPA to complete a phased, data-driven investigation of the facility by June 1, 2002. However, Morton reserves all rights and defenses it may have in law or equity with regard to the Order. Specifically, and without being limited or bound thereby, Morton does not agree with EPA's conclusion in Section V of the Order. To the contrary, the facts set forth in the Order are not sufficient to establish that the presence or

release of hazardous wastes from the facility may present a substantial hazard to human health or the environment, as is required by RCRA § 3013. Moreover, the facility is not a permitted or interim status transportation, storage or disposal facility and therefore is not subject to RCRA § 3013.

Thank you for your consideration of these matters. We have confirmed a meeting in EPA's offices on October 16, 2000 at 9:00 a.m. to discuss the Description of Current Conditions report (to be submitted on October 2, 2000) and to discuss the scope of the Phase I investigative work in detail. Please call me if you have any questions or concerns.

Sincerely,

David Kurland
Senior Counsel

DCK/vjc

cc: Joseph M. Boyle, EPA
Harold O'Connell, OEPA

ATTACHMENT A
MORTON INTERNATIONAL INC.'S PROPOSAL FOR CARRYING OUT MONITORING, TESTING, ANALYSIS AND REPORTING

Morton Facility, Reading, Ohio

Date	Activity	Purpose (Paragraph of Order Satisfied)
September 11, 2000	Initial Meeting	Refine schedule, discuss broad objectives and key facts
September 15, 2000	Submit Proposal for Monitoring, Testing, Analysis and Reporting	Define and schedule tasks (Order, ¶ 57)
October 2, 2000	Submittal of Current Conditions Report	Provide basic description of setting, history, and operations, to allow for proper scoping and review of RFI Work Plan
October 16, 2000	Scoping Meeting	Discuss preliminary review of CCR, describe and discuss proposed scope of RFI, including detailed scope of Phase 1 activities
November 13, 2000	Submittal of RFI Work Plan	Describe procedures, methods, locations, depths, etc. for RFI, including strategy and triggers for successive phases (Order ¶ 57, 58) Develop QA/QC and health and safety protocols (Order ¶ 59)
November 2000 through January 2001	Agency Review of RFI Work Plan and CCR	Allow for on-going review, discussion, and modification of investigation approach
March 2001 through May 2001	<u>Phase 1 of RFI</u> • On-Site Upper Aquifer Wells • On-Site Upper Aquifer Stratigraphic Borings • P&A Obsolete On-Site Wells • Groundwater Sampling • Combined Sewer System Evaluation	• Characterize hydrogeology of shallow aquifer (Order ¶ 57A) • Evaluate effectiveness of groundwater collection system (Order ¶ 57A) • Delineate on-site impact to shallow aquifer (Order ¶ 57E, F) • Characterize potential releases from sewer system (Order ¶ 57B)

MORTON INTERNATIONAL INC.'S PROPOSAL FOR CARRYING OUT MONITORING, TESTING, ANALYSIS AND REPORTING
(Continued)

June 2001	Scoping of Phase 2	Discussion and meetings between Morton and USEPA to review Phase 1 findings and plan details of Phase 2
July 2001 through September 2001	<u>Phase 2 of RFI</u> • Install Supplemental Upper Aquifer Wells • Groundwater Sampling • Aquifer Testing • Mill Creek Sediment & Seep Testing • SWMU Soil Borings • Geophysical Survey of Former Swale • Ecological Survey	• Complete on-site and off-site assessment of shallow aquifer. (Order ¶ 57A, E, F) • Characterize hydraulics of shallow aquifer, and communication with deeper aquifer (Order ¶ 57A, E, F) • Characterize soil impact at potential release sites (Order ¶ 57C) • Characterize residual or on-going impact from facility to creek (Order ¶ 57D) • Evaluate possible historical waste disposal in this area (Order ¶ 57C) • Identify potential ecological receptors (Order ¶ 57 A - F)
October 2001	Scoping of Phase 3	Discussion and meetings between Morton and USEPA to review Phase 2 findings and plan details of Phase 3
November 2001	<u>Phase 3 of RFI</u> • Characterization of Any Identified Human Receptors • Final Upper Aquifer Well Installation • Trenching or Drilling at Swale	• Provide information for HHRA (Order ¶ 57 A - F) • Close any remaining data gaps (Order ¶ 57 A - F) • Evaluate detected anomalies in Swale (Order ¶ 57C)
December 2001 through February 2002	Data Evaluation and RFI Report Preparation	Tabulate and interpret RFI findings (Order ¶ 57 A - F)
March 2002 through May 2002	Agency Review and Morton Revision of RFI Report	Provide RFI findings in a form suitable for agency and public review (Order ¶ 57 A - F)

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

Quality Assurance Project Plan
Facility Investigation
RCRA §3013 Administrative Order

Morton International, Inc. Facility
[EPA ID No. OHD 000 724 138]
Reading, Ohio

Prepared for:

The Rohm and Haas Co.
Bristol, Pennsylvania

November 2000

Project No. 6452

Quality Assurance Project Plan
Facility Investigation
RCRA §3013 Administrative Order

Morton International, Inc. Facility
[EPA ID No. OHD 000 724 138]
Reading, Ohio

Prepared for:

The Rohm and Haas Co.
Bristol, Pennsylvania

Prepared by:

Geomatrix Consultants, Inc.
1214 West 6th Street, Suite 201
Austin, Texas 78703

November 2000

Project No. 6452

Approvals

[Peter V. Palena – The Rohm and Haas Co. - Project Coordinator]	9 Mar 2001 Date
[Mark P. Hemingway - Geomatrix Consultants, Inc. - Project Manager]	3/14/01 Date
[Richard Frappa - Geomatrix Consultants, Inc. - Project Quality Assurance Officer]	3/06/01 Date
[Alesia Danford - STL Inc. - Laboratory Technical Manager]	3/7/01 Date
[Mirtha Capiro - USEPA Project Coordinator]	8/27/01 Date
[Brian Freeman - USEPA RCRA Quality Assurance Coordinator]	8/27/01 Date

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2 Field Operating Procedures
3 Laboratory Quality Assurance Documentation

ACRONYMS AND ABBREVIATIONS

ASTM - American Society for Testing and Materials

AO - Administrative Order

App. IX-TAL - Appendix IX Target Analyte List

ASTM - American Society for Testing and Materials

BTEX - benzene, ethylbenzene, toluene, and xylenes

CCV - continuing calibration verification

CEC - Cation Exchange Capacity

CFR - Code of Federal Regulations

CLP - Contract Laboratory Program

CLP-TAL - Contract Laboratory Program Target Analyte List

DNBP - Dinoseb

DQOs - Data quality objectives

EDQLs - Ecological Data Quality Levels

FI - Facility Investigation

FID - flame ionization detector

FOPs - Field Operating Procedures

HHRA - human health risk assessment

ICV - initial calibration verification

IDLs - instrument detection limits

LCS - laboratory control samples

LIMS - laboratory information management system

LQM - Laboratory Quality Manual

MS/MSD - matrix spike/matrix spike duplicate

MCLs - Maximum Contaminant Levels

MDLs - method detection limits

mg/kg - milligrams per kilogram

NIST - National Institute of Standards and Technology

OEPA - Ohio Environmental Protection Agency

%R - Percent recovery

PID - photoionization detector

PCBs - polychlorinated biphenyls

lb/ft^3 - pounds per cubic feet

QA - Quality Assurance

QA Officer - Quality Assurance Officer

QAO - Quality Assurance Officer

QAPP - Quality Assurance Project Plan

QA/QC - Quality Assurance/Quality Control

RPD - relative percent difference

RSD - relative standard deviations

RLs - reporting limits

RCRA - Resource Conservation and Recovery Act

SERA - screening-level ecological risk assessment

STL - Severn Trent Laboratories

SOPs - Standard Operating Procedures

SRM - standard reference materials

TALs - target analyte lists

TOC - Total Organic Carbon

TCLP - Toxicity Characteristics Leaching Procedure

USEPA - U.S. Environmental Protection Agency

RQAC - USEPA RCRA Quality Assurance Coordinator

A1.0 PROJECT DESCRIPTION

This Quality Assurance Project Plan, or QAPP, presents the organization, objectives, planned activities, and specific Quality Assurance/Quality Control (QA/QC) procedures for the Facility Investigation of the Morton International, Inc. facility (Morton Facility or "the facility") in Reading, Ohio. This Facility Investigation (FI) is being performed in response to an Administrative Order (AO) issued to Morton International, Inc. by the U.S. Environmental Protection Agency (USEPA) pursuant to §3013 of the Resource Conservation and Recovery Act (RCRA). This QAPP is Appendix A to the FI Work Plan prepared by Geomatrix Consultants, Inc. (Geomatrix) on behalf of the Rohm and Haas Co. (Rohm and Haas). Morton International, Inc. is a wholly-owned subsidiary of Rohm and Haas.

This QAPP has been prepared in accordance with the USEPA Region 5 QAPP policy as presented in *USEPA Region 5, RCRA QAPP Instructions (April 1998b)* ,and other relevant guidance documents, including *The Use of Field Methods to Support RFI Streamlining* (USEPA, Region 5 Memorandum, June 20, 1997a). In addition, the QAPP incorporates specific elements, procedures, and objectives discussed in a meeting between the USEPA, Rohm and Haas, and Geomatrix at the USEPA Region 5 offices in Chicago, Illinois, on September 11, 2000 and October 16, 2000. All QA/QC procedures will be structured in accordance with applicable technical standards, USEPA requirements, regulations, and guidance.

A1.1 INTRODUCTION

As discussed in Section 1.0 of the FI Work Plan, the stated basic objective of the AO is 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."

Therefore, the FI Work Plan and this QAPP are intended to address the following Decision Statements:

- The FI must quantify whether the migration of groundwater impact from the Morton Facility is stable or under control.
- The FI must quantify whether compounds derived from the Morton Facility and present in environmental media pose unacceptable ecological and human health risks.

As a part of the development of the FI Work Plan and this QAPP, the general objectives have been developed further, into site-specific objectives for data gathering. These site-specific objectives are discussed in Section 3.0 of the FI Work Plan. The anticipated schedule for the FI field investigation and related activities and document submittals is provided in Section 9.0 of the FI Work Plan.

In order to achieve these site-specific objectives, the FI will consist of a number of field tasks or elements. These tasks, and the specific objectives they fulfill, are discussed further in Section 4.0 of the FI Work Plan. In summary, they include:

- Soil borings—Characterization of subsurface geology/hydrogeology, collection of soil samples for geochemical analysis, installation of monitoring wells, and viewing of soils and buried materials.
- Groundwater monitoring wells—Collection of groundwater samples from targeted strata, measurement of hydraulic conditions relating to groundwater movement.
- Plugging and abandonment of obsolete monitoring wells—Removal of wells that may not be capable of providing representative groundwater samples, or that may provide conduits for fluid migration.
- Trenching—Viewing of soils and buried materials and collection of soil samples for geochemical analysis.
- Geophysical surveys—Location of buried objects, wastes, or materials.
- Visual reconnaissance—Identification and location of seeps, staining, stressed vegetation, and other indices of environmental impact.

- Media sampling and analysis—Characterization of chemical and physical conditions within groundwater, soil, sediment, and surface water (seeps) at locations of interest. With regard to characterization of chemical impact, two analyte lists will be used for media analysis:

  - Appendix IX Target Analyte List (App. IX-TAL)—the analyte list provided in 40 Code of Federal Regulations 264, Appendix IX, with slight modifications based on discussions and agreements between Rohm and Haas, Geomatrix, and the USEPA. The App IX-TAL (Table A1-2 of the QAPP in Appendix A) consists of the following analyte groups: volatile organics (VOCs), semivolatile organics (SVOCs), pesticides, polychlorinated biphenyls (PCBs), dioxins and furans, and metals and other inorganic parameters.

  - Contract Laboratory Program Target Analyte List (CLP-TAL)— the USEPA's target analyte and compound lists under its Contract Laboratory Program. The CLP-TAL (Table A1-1 of the QAPP in Appendix A) consists of the following analyte groups: VOCs, SVOCs, pesticides, PCBs, and metals and other inorganic parameters.

In addition, selected samples will be analyzed for geotechnical and general water quality parameters discussed in Sections 5.3 and 5.6 of the FI Work Plan, and in Table A1-3 of this QAPP.

- Sewer inventory and integrity testing—Identification of inputs to the Combined Sewer System, and of areas of gross integrity failures.

- Ecological receptor survey—Identification of possible ecological receptors for Morton Facility constituents.

- Human receptor survey—Identification of possible human receptors for Morton Facility constituents.

The site characterization data generated from these field activities will be utilized to develop hydrogeologic conceptual models for the site. They will also be incorporated into a human health risk assessment (HHRA) and a screening-level ecological risk assessment (SERA). These risk assessments are described in Sections 6.0 and 7.0 of the FI Work Plan.

Data from the FI will be evaluated with respect to the objectives described above and the site-specific objectives described in Section 3.0 of the FI Work Plan. It is anticipated that three phases of investigation will be necessary to meet the project objectives. As discussed in the FI Work Plan, certain elements of the FI cannot be scoped until the acquisition of data from Phase 1 and/or Phase 2 is complete. All investigation activities, however, will adhere to the requirements of this QAPP.

At the completion of the FI, the data will be presented and evaluated within the FI Report. Section 8.0 of the FI Work Plan discusses the contents of that submittal.

A1.2 Site Description

This section is intended to summarize pertinent information regarding the site setting and operational history. A more complete discussion of the setting, hydrogeology, and environmental character of the Morton Facility and its surroundings is provided in the Current Conditions Report (Geomatrix, 2000). Excerpted information from that report is included in Attachment 1 to this QAPP.

A1.2.1 Setting

The Morton Facility is located at 2000 West Street, Reading, Hamilton County, Ohio (Figure 2-1). The City of Reading is a northern suburb of Cincinnati, Ohio. The facility consists of a single tract of land totaling 34 acres. Of these, approximately 27 acres comprise the fenced, operational area of the facility. The remaining 7 acres contain baseball/soccer fields used by the City of Reading.

Land use in the area of the Morton Facility is mixed, with industrial, commercial, recreational, and residential all present within 0.5 miles of the facility boundary. The Morton Facility is bounded by various industrial, commercial, recreational, and hazardous waste disposal facilities. Mill Creek, a tributary of the Ohio River, lies to the west of the facility.

From a hydrogeologic standpoint, the Morton Facility is underlain by interbedded sand, gravel, silt, and clay outwash 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 sides of the buried valley.

Historic investigations and remediations in the site vicinity have divided the outwash deposits into two aquifers: the Upper and the Lower. The degree of communication between the two aquifers probably varies locally, depending primarily on the thickness and character of a confining layer separating them.

The Upper Aquifer consists of transmissive interbeds within the shallow lacustrine deposits above the till. For any given location within the Morton Facility, from one to three sand or gravelly sand interbeds may be present. A portion of the Upper Aquifer crops out in the Mill Creek bank west of the facility. Given that local Upper Aquifer groundwater flow is predominantly to the west, 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 is believed to be interrupting the groundwater flow.

The Lower Aquifer consists primarily of silty sands, sands, and gravels. The City of Reading formerly utilized local wells screened in the Lower Aquifer to produce their municipal water supply. Use of these wells has been discontinued, however, due to environmental impact to Lower Aquifer groundwater. Lower Aquifer groundwater continues to be used, however, by cities within three miles of the Morton Facility. Regional groundwater flow within the Lower Aquifer is generally to the south, but local flow directions are strongly affected by pumping. In the vicinity of the Morton Facility, the gradient is predominantly controlled by the pumping of remediation wells for the Pristine Superfund Site. The capture zone from these wells encompasses the entire Morton Facility property.

A1.2.2 Historical Background

The site has operated as an active chemical blending and manufacturing facility since 1950. Since that time, it has operated as Carlisle Chemical Works, Cincinnati Milling Machine Co., Inc., Cincinnati Milacron Chemicals, Inc., the Carstab Division of Thiokol, Inc., Morton Thiokol, and Morton International, Inc. During this period, it has been used primarily for the manufacture of synthetic waxes, asphalt additives, antioxidants, organic phosphates, and plastic stabilizers. Prior to 1950, most of the area later occupied by the facility was used as a dairy farm. Other operations included a small fireworks manufacturing facility, a winery or wine distillery, and a smokehouse.

A1.3 CHARACTER AND EXTENT OF ENVIRONMENTAL IMPACT

A number of investigations have been performed at the Morton Facility and at neighboring areas since the late 1970s. The scope and findings of these various investigations have been summarized in the Current Conditions Report, and the various investigation reports are also identified in that document. In general terms, however, these investigations have consistently identified the presence of chlorinated and non-chlorinated organics, primarily volatile organic compounds (VOCs), in soils and groundwater at the site. The distribution of these compounds is depicted in Figures 4-1 and 4-2 of the Current Conditions Report.

A1.3.1 Soils

Organic constituents detected in surface soils consist primarily of pervasively distributed PAHs and pesticides, and isolated detections of toluene and methylene chloride; apparently elevated metals include tin, vanadium, and magnesium. In the subsurface, the pattern of detection tends to mirror the impact to shallow groundwater (see Section A1.3.2), consisting notably of toluene, chlorobenzene, 1,2-dichlorobenzene, chlorinated aliphatics, and ethers. Concentrations are typically less than 10 milligrams per kilogram (mg/kg) total organics.

Organic impact to subsurface soils has been observed primarily in the north portion of the facility. Concentrations of some organics in subsurface soils were relatively high, ranging into the hundreds or thousands of mg/kg. In addition, a layer of dark staining, interpreted to represent chemical saturation, was observed across the west-central and northwest portion of the facility.

A1.3.2 Groundwater

Chemical impact to groundwater by volatile and semivolatile organics, and by inorganics (possibly including metals) has been identified throughout the northern and western portions of the facility. Drilling during various environmental and geotechnical investigations has identified dark staining interpreted to represent chemical saturation. This condition is identified within the uppermost saturated zone, at a typical depth range of 10 to 15 feet below grade.

Primary organic constituents in groundwater include benzene, ethylbenzene, toluene, and xylenes (BTEX), chloroform, methylene chloride, chlorobenzenes, acetone, chlorinated aliphatics (e.g., PCE, TCE, 1,1-DCE, 1,1-DCA, 1,1,1-TCA, vinyl chloride), phenols, phthalates, amines, ketones, PAHs, and pesticides. Apparently elevated metals include arsenic, chromium, lead, and possibly tin.

In addition, Pristine assessment and monitoring has documented the presence of a number of VOCs in the Lower Aquifer underlying most or all of the Morton Facility. These include 1,2-DCA and chloroform.

A1.3.3 Seeps and Sediment

Groundwater seeping to the surface along Mill Creek has historically exhibited field evidence of impact, including discoloration and odor. It has also been documented to contain a wide range of VOCs, SVOCs, pesticides, and other organics, although the suite of organics

observed varied somewhat through time. Routinely observed organics include chlorobenzenes, amines, phthalates, BTEX, and ketones.

Mill Creek sediment samples, including those from upstream of the facility, have been documented to contain PAHs and pesticides. Other constituents identified in sediments include tin, chlorobenzenes, chlorinated aliphatics, BTEX compounds, and carbon disulfide. Mill Creek has been documented to be pervasively contaminated along much of its length.

A1.3.4 Air

Air emissions from the Morton Facility occur in association with process and storage operations. These emissions are permitted, and are believed to be routinely within permitted limits. Given the age of the facility, however, it is possible that some impact to surface soils has occurred due to air emissions. In addition, air emissions from off-site operations may also have contributed to surface soil impact. Current data is not sufficient to evaluate the likelihood or significance of this mechanism.

A1.4 Project Objectives and Intended Data Usage

The basic objective for the FI is discussed in Section A1.1, above. Based on scoping discussions between Rohm and Haas, Geomatrix, and the USEPA, this basic objectives translates into two investigation goals, with related information needs. These are described below.

Goal 1—Evaluate whether the migration of impacted groundwater is under control. Primary information needs:

- The character and extent of impact to the Upper Aquifer.
- The effectiveness of the french drain and the slurry wall.
- The nature of horizontal and vertical groundwater flow within the Upper Aquifer system.
- The nature of flow between the Upper Aquifer and the Lower Aquifer.
- The identification of any continuing releases to groundwater and soils from Morton Facility sources.

Goal 2—Evaluate whether current risks to human health and the environment are within acceptable limits. Primary information needs:

- The character and extent of impact to seeps and sediments in the east bank of Mill Creek.
- The character and extent of impact to on-site shallow (<15') soils.
- The character and extent of buried wastes.
- The presence, location and character of human and ecological receptors.

If additional information needs are identified during the course of the investigative effort, the USEPA and Rohm and Haas will evaluate the need for their inclusion from the standpoint of the basic AO objective and the two FI goals.

Sampling and analysis of soil, groundwater, sediment and seeps for key analytical parameters is critical to assess potential human health and ecological risks. The proposed analyses and sampling program are detailed in the following sections.

A1.4.1 Project Target Parameters

The lists of analytical parameters and methods proposed for the various phases of this project are provided in Tables A1-1 through A1-4. Tables A1-1 and A1-2 list the geochemical parameters. Table A1-3 lists the geotechnical and general water quality analyses. Table A1-4 summarizes the field analyses.

A1.4.1.1 Geochemical Parameters

Two target analyte lists (TALs) have been established for geochemical analysis. In general, both TAL parameter lists consist of volatile organic compounds, semivolatile organic compounds, organochlorine pesticides, PCBs, and metals. The majority of the soil and groundwater samples will be analyzed for a target analyte list utilized by the USEPA Superfund Contract Laboratory Program; this TAL is herein referred to as the Contract Laboratory Program TAL or CLP-TAL. The CLP-TAL is provided in Table A1-1.

Selected soil and groundwater samples collected in the vicinity of the Former Surface Impoundments and the Former Swale Area will be analyzed for target compounds identified in Appendix IX of Title 40 of the Code of Federal Regulations (CFR), Part 264, herein referred to as the App. IX-TAL. The App. IX-TAL is provided in Table A1-2.

Based on agreements reached between Rohm and Haas, Geomatrix, and the USEPA, there are a small number compounds listed in 40 CFR Part 264, Appendix IX that are not included on the App. IX-TAL for the FI. These compounds, and the rationale for their exclusion are as follows:

Excluded Compounds: Pentachloroethane
Hexachlorophene

Rationale: The analytical laboratory designated for use in this FI does not have developed Method Detection Limits for these compounds. Given pentachloroethane's instability and very low persistence in environmental media, and the low toxicity of hexachlorophene, the exclusion of these compounds was not considered to affect the completion of FI goals or data quality objectives.

Excluded Compounds: Methyl Parathion
Parathion
2,4-D
Dinoseb (DNBP)
2,4,5-TP (Silvex)

Rationale: The Morton Facility is not and has not been involved in the manufacture, blending, or compounding of pesticides or herbicides. These compounds, if present, would therefore most likely have been derived from activities pre-dating chemical manufacture, i.e., activities associated with dairy farming. All of these compounds were either first manufactured, or first marketed widely in the U.S., either after or about the time the facility was being constructed. These dates, and the sources of information being relied upon, are summarized as follows:

COMPOUND (category)	DATE OF INITIAL MANUFACTURE/USE IN UNITED STATES	USE	REFERENCES
Parathion (ethyl parathion has same CAS No. 56-38-2) (organophosphate pesticide)	1946/1947	Insecticide, miticide. Still available as restricted-use pesticide.	American Bird Conservatory http://www.abcbirds.org/profiles/ethyl_parathion.htm
Methyl Parathion (organophosphate pesticide)	1952/1954	Insecticide used on farm crops, esp. cotton. Still available as restricted-use pesticide.	Agency for Toxic Substances and Disease Registry http://www.atsdr.cdc.gov/tfacts48.html USEPA product manager
2,4-D (herbicide)	1946	Herbicide Still third most widely used herbicide in US.	Industry Task Force II http://www.24d.org/
Dinoseb or DNBP (herbicide)	Dow Chemical marketed in 1948	Herbicide for broadleaf weeds Banned in 1986	Agrichemical and Environmental News Index, June 1998 http://www.tricity.wsu.edu/aenews/June98AENews /
2,4,5-TP or Silvex (herbicide)	1948/1956	Herbicide for broadleaf weeds and woody plants. Banned in 1985.	Pesticide hotline 800-858-7378 USEPA product manager

The exclusion of these compounds will eliminate the requirement for an analytical method used only for them, and is not considered to affect the completion of FI goals or data quality objectives.

A1.4.1.2 Geotechnical/General Water Quality Parameters

In addition, selected samples (soil, groundwater, sediment, and/or seeps) will be analyzed for the Geotechnical/General Water Quality Parameters listed in Table A1-3. These parameters will

assist in evaluating the effectiveness of potential corrective measures, and in evaluating the overall character of the groundwater within various areas and strata.

A1.4.1.3 Field Parameters

Field measured parameters are listed in Table A1-4. These include turbidity, specific conductance, dissolved oxygen, temperature, and pH, and are used primarily to assess groundwater stabilization prior to and during sampling. Water level measurements at each new and existing monitoring well will be collected and used to assess groundwater flow directions and in some instances, in-situ hydraulic conductivity (i.e., pump or slug test analysis). These field parameters will also provide supporting information regarding fate and transport, well construction, and differences in natural water chemistry.

A1.4.2 Soil

The presence of TAL parameters in on-site soil will be determined during the FI. Soil sampling activities are discussed further in Sections 4.0 and 5.0 of the FI Work Plan, in the Field Sampling Plan (Section A4.0) and related tables, and in the Field Operating Procedures (FOPs) (Attachment 2). Soil samples will be analyzed for either the CLP-TAL or the App. IX-TAL parameters listed on Table A1-5.

To assist in the selection of soil sample collection for laboratory analysis, each soil sample will be field screened for the presence of volatile organic compounds using a photoionization detector (PID) or flame-ionization detector (FID). Field screening procedures are described in the FOPs, included as Attachment 2 to this QAPP.

Specific individual parameter estimated reporting limits (RLs), method detection limits (MDLs) and human health/ecological screening levels have been compiled on Table A1-5. More detailed definitions for RL and MDL are provided in Section A7.1.4. Sections 6.0 and 7.0 of the FI Work

Plan describe how the ecological and human health screening levels will be used in the performance of the SERA and HHRA, respectively.

Background concentrations of both organics and inorganics in soils are not assumed to be non-detect. In fact, given historic data and the nature of the Morton Facility's setting, Geomatrix anticipates that detectable background concentrations for many of the TAL compounds will be present.

Background concentrations for organic and inorganic soil constituents will be developed based on sampling performed outside areas of Morton Facility impact or operations. If necessary, the soil background development will be supplemented using literature values for national or regional background concentrations. References used as sources for background concentration data are anticipated to include, but are not limited to, the following:

- Environmental Chemistry of the Elements (Bowen, 1979)
- Elemental Composition of Surficial Materials in the Conterminous United States (Shacklette et al., 1971)
- Elemental Concentrations in Soils and Other Surficial Materials of the Conterminous United States (Shacklette and Boerngen, 1984)
- Background Geochemistry of Some Rocks, Soils, Plants, and Vegetables in the Conterminous United States (Connor and Shacklette, 1975)

In developing background concentrations for soils, Geomatrix will utilize statistical methods accepted by the USEPA.

A1.4.3 Groundwater

The nature and extent of chemical constituents in groundwater will be evaluated based on the analysis of samples collected during the FI (two sampling events anticipated per well). Samples shall be collected from monitoring wells according to procedures specified in the FOPs (Attachment 2).

Samples will be analyzed in the field for parameters listed in Table A1-4. Samples for laboratory analysis will be analyzed for the either the CLP-TAL or the App. IX-TAL parameters listed in Table A1-6 and the General Water Quality Parameters listed in Table A1-3. RLs, MDLs, Federal Maximum Contaminant Levels (MCLs) and Region 9 Preliminary Remediation Goals for individual parameters have been compiled on Table A1-6. More detailed definitions of RL and MDL are provided in Section A7.1.4. Section 7.0 of the FI Work Plan describes how the human health screening levels will be used in the performance of the HHRA.

Background concentrations of both organics and inorganics in groundwater are not assumed to be non-detect. In fact, given historic data and the nature of the Morton Facility's setting, Geomatrix anticipates that detectable background concentrations for many of the TAL compounds will be present. Background concentrations for organic and inorganic groundwater constituents will be developed based on groundwater data upgradient of the facility, including data from the upgradient margin of the facility. In developing background concentrations for groundwater, Geomatrix will utilize statistical methods accepted by the USEPA.

A1.4.4 Sediment and Seeps

Sediment and seep sampling along the east bank of Mill Creek adjacent to the Morton Facility will be conducted according to procedures presented in Sections 4.0 and 5.0 of the FI Work Plan, in the Field Sampling Plan (Section A4.0) and related tables, and in the Field Operating Procedures (FOPs) (Attachment 2).

Because Mill Creek has been documented to be locally and pervasively impacted from a number of different sources, sediment and seep samples for this FI will be analyzed only for constituents identified in Phase 1 groundwater sampling. For the purposes of this QAPP, all of these constituents are assumed to fall within the CLP-TAL provided in Tables A1-7 for sediment and A1-8 for surface water. Individual parameter RLs, MDLs, and human health/ecological risk levels have also been compiled in those tables. Sections 6.0 and 7.0 of the FI Work Plan describe how the ecological and human health screening levels will be used in the performance of the SERA and the HHRA. More detailed definitions for RL and MDL are provided in Section A7.1.4.

A1.4.5 Sampling Locations

As discussed in the FI Work Plan, three phases of field operations will be necessary to achieve the FI objectives; the tasks within these three phases are also summarized on Figures 4-1, 4-2, and 4-3 of the FI Work Plan. As noted on those figures, all locations are subject to adjustment based on access, physical obstructions, and other factors. The Project Manager will approve all required adjustments. Project Manager responsibilities are described in Section A2.0 of this QAPP. The USEPA Project Coordinator will be notified of any changes in this sampling approach.

A1.4.6 Risk Related Issues

As discussed above, data acquired through the FI process will be used to support human health and ecological risk assessments. Tables A1-5 through A1-8 identify the MDLs and estimated reporting limits RLs for all TAL compounds. These tables also include the concentrations anticipated to be used in the calculation of a Hazard Quotient for the SERA, and for screening COPCs in the HHRA. For the SERA, these are the EDQLs. For the HHRA, these are the MCLs, PRGs, and RBSLs. The use of the various screening levels in the SERA and HHRA is described in Sections 6.0 and 7.0, respectively, of the FI Work Plan.

A2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The various quality assurance, field, laboratory, and management responsibilities of key project personnel are defined below. In the event that a change in key project personnel is necessary, the Project Coordinator representing the team making the change will notify his or her counterpart.

A2.1 MANAGEMENT RESPONSIBILITIES

USEPA Project Coordinator

Name: Mirtha Capiro

The USEPA Project Coordinator is the agency's primary point of contact for communications between the Rohm and Haas Co. and the USEPA, and has the overall responsibility of regulatory agency review for all phases of the investigation. The USEPA Project Coordinator is point of contact for USEPA review, comment, and approval of project submittals identified in the AO.

Rohm and Haas Project Coordinator

Name: Peter V. Palena, Jr.

The Rohm and Haas Co. Project Coordinator is the primary point of contact for communications between the Morton Facility and the USEPA. The Rohm and Haas Co. Project Coordinator also directs the work of all FI contractors and consultants.

Geomatrix Consultants, Inc., Project Manager

Name: Mark P. Hemingway

The Geomatrix Project Manager has the responsibility for ensuring the project meets Rohm and Haas Co. and USEPA objectives, as defined in the AO. The Project Manager will report directly to the Rohm and Haas Project Coordinator, but may interface as needed directly with the USEPA Project Coordinator. The Project Manager will:

- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints;
- Approve all reports (deliverables) before their submission to USEPA Region 5;
- Define specific objectives and develop work schedules;
- Orient all field leaders and support staff concerning the project's special considerations;
- Monitor and direct the field leaders;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;
- Ultimately be responsible for the preparation and quality of interim and final reports; and
- Represent the project team at meetings and public hearings.

A2.2 QUALITY ASSURANCE (QA) RESPONSIBILITIES

USEPA RCRA Quality Assurance Coordinator (RQAC)

Name: Brian P. Freeman

The USEPA RQAC has the responsibility to review and approve all QAPPs. Additional USEPA responsibilities for the project may include:

- Conducting external performance and system audits of Severn Trent Laboratories, Inc., or other laboratories identified through the course of AO activities;

- Evaluating results of performance evaluation sample data; and
- Reviewing and evaluating analytical field and laboratory procedures.

Geomatrix Consultants, Inc., Project Quality Assurance Officer (QAO)

Name: Richard Frappa

The Geomatrix Project QAO will remain independent of direct job involvement and day-to-day operations, and have direct access to Geomatrix executive staff, including the Project Manager, as necessary to resolve any QA dispute. He is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, Geomatrix Consultants, Inc. policies, and USEPA requirements. The Geomatrix Project QA Officer has sufficient authority to stop work on the investigation as deemed necessary in the event of serious QA/QC infractions. Specific function and duties include:

- Performing QA audits on various phases of the field operations;
- Reviewing and approving QA plans and procedures;
- Providing QA technical assistance to project staff;
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the Project Director/Project Manager and the Morton Project Coordinator for technical operations; and
- Oversight of data validation of selected sample results from the analytical laboratory.

Environmental Standards Inc., Data Validation

Name: Rock Vitale, CPC

The services of Environmental Standards, Inc. will be utilized as an independent third-party to provide data validation services. He is responsible for review of analytical laboratory data with the objective of identifying compliance with the SW-846 and USEPA's Contract Laboratory Program (CLP) National Functional Guidelines for Organic and Inorganic Data Review

USEPA's and assessing the validity and defensibility of the data. Specific functions include:

- Reviewing raw analytical data and extracting usable data from sample results;
- Preparing a comprehensive data validation report in compliance with project data quality objectives and the USEPA functional guidelines for data validation; and
- Communicating with the Geomatrix QAO or Geomatrix Project Manager regarding the review of the analytical data.

A2.3 FIELD RESPONSIBILITIES

Geomatrix Consultants, Inc., Field Team Leader

Name: Timothy Jennings

The Field Team Leader will be present at the Morton Facility to support the Project Manager. This person will be responsible for leading and coordinating the day-to-day activities of the various resource specialists and subcontractors under his/her supervision. The Geomatrix field team leader will be demonstrably experienced in the supervision of multitask field operations, and will report directly to the Geomatrix PM. Specific field team leader responsibilities include:

- Provision of day-to-day coordination with the Project Manager on technical issues in specific areas of expertise;
- Implementing field-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements;
- Coordinating and managing field staff including sampling and drilling personnel;
- Implementing QC for technical data provided by the field staff including field measurement data;
- Adhering to work schedules provided by the Project Manager;
- Overseeing documentation and data control activities required for field team efforts;
- Coordinating and overseeing of subcontractors assisting the field team;

- Identifying problems at the field team level, resolving difficulties in consultation with the Project Manager, implementing and documenting corrective action procedures, and provision of communication between team and upper management; and

- Participating in preparation of the final report.

Geomatrix Consultants, Inc., Field Technical Staff

Staff to be determined and identified to USEPA prior to commencement of field activities.

The field technical staff for this project will be drawn from Geomatrix Consultants, Inc. pool of corporate resources and/or subcontractors. The technical staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical team members will be experienced professionals with adequate specialization and technical competence to effectively perform the required work.

A2.4 LABORATORY RESPONSIBILITIES

The laboratory assigned with responsibility for analytical work is Severn Trent Laboratories (STL) located at 4101 Shuffel Drive NW, North Canton, Ohio 44720. The majority of the analytical work will be performed at STL-North Canton, with support from other STL laboratories as needed, i.e., on special or non-routine analyses.

Severn Trent Laboratories, Inc., Technical Manager

Name: Alesia Danford

The STL Technical Manager will report directly to the Geomatrix Project Manager and will be responsible for:

- Ensuring all resources of the laboratory are available on an as-required basis;
- Overseeing production and final review of analytical reports;
- Coordinating laboratory analyses;
- Supervising in-house chain-of-custody;
- Scheduling sample analyses;

- Overseeing data review;
- Overseeing preparation of analytical reports; and
- Approving final analytical reports prior to submission to Geomatrix.

Severn Trent Laboratories, Inc., Quality Assurance Officer (QA Officer)

Name: Opal Johnson

The STL QA Officer has the overall responsibility for data quality activities within the laboratory. The STL QA Officer will be independent of the laboratory performing the analysis, but will communicate data issues through the STL Technical Manager. In addition, the STL QA Officer will:

- Oversee laboratory QA;
- Oversee QA/QC documentation;
- Conduct detailed data review;
- Determine whether to implement laboratory corrective actions, if required;
- Define appropriate laboratory QA procedures; and
- Prepare laboratory standard operating procedures.

Independent QA will be provided by the STL Technical Manager and QA Officer prior to release of all data to Geomatrix Consultants, Inc.

Severn Trent Laboratories, Inc., Sample Custodian

Name: Lois Ezzo

The Sample Custodian or designee will report to the STL Technical Manager. Responsibilities of the Sample Custodian will include:

- Receiving and inspecting the incoming sample containers;
- Recording the condition of the incoming sample containers;
- Signing appropriate documents;
- Verifying chain-of-custody content and completeness;
- Notifying laboratory manager and laboratory supervisor of sample receipt and inspection;

- Assigning a unique identification number and customer number, and entering each into the sample receiving log;
- With the help of the laboratory manager, initiating transfer of the samples to appropriate lab sections;
- Controlling and monitoring access/storage of samples and extracts; and
- Communicating with field staff to anticipate the shipment and confirm the timely receipt of shipped samples.

Severn Trent Laboratories, Inc., Technical Staff

Staff to be determined and identified to USEPA prior to commencement of field activities

The STL Technical Staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to the STL Technical Manager.

A2.5 PROJECT ORGANIZATION CHART

The lines of authority specific to this investigation are presented in Figure A2-1. This chart includes all individuals discussed in previous sections of Section A2.0 of this QAPP. In addition, names, addresses, and phone numbers for all management personnel are provided in Figure A2-2.

A2.6 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATIONS

The purpose of this section is to address any specialized or non-routine training requirements necessary for completion of the subject investigation. Sufficient information shall be provided to ensure that special training skills can be verified, documented and updated as necessary.

A2.6.1 Training

Requirements for specialized training for non-routine field sampling techniques, field analyses, laboratory analyses, and data validation are specified below.

Non-routine field sampling techniques: Currently, there are no non-routine field sampling techniques that require specialized training.

Non-routine field analyses: Currently, there are no non-routine field analyses that require specialized training.

Non-routine laboratory analyses: Currently, there are no non-routine laboratory analyses techniques that require specialized training.

A3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall quality assurance objective for this FI are to develop and implement field and laboratory procedures in order to generate data suitable to meet the goals and objectives detailed in Section A1.4. To this end, analytical methods specified in this QAPP will be utilized to achieve the specified detection limits and other specified targets. Sufficient data will be acquired to adequately representative and complete to characterize the various conditions and media being addressed by the FI. The guidelines established in this section will be used to review the completeness of the data generated, adherence to quality control (QC) requirements, and to evaluate data usability.

FI data acquisition will involve the collection of a variety of environmental samples from different matrices. A summary of laboratory- and field-measured parameters is included in Table A3-1. Quality assurance for FI field activities is managed through the implementation of Field Operating Procedures (FOPs). FOPs are presented in Attachment 2, and are referenced in Section A4.0, the Field Sampling Plan. Quality assurance (QA) goals for laboratory data are presented in the Laboratory Quality Manual for North Canton (STL-LQM) (STL, 2000) located in Attachment 3.

A3.1 PRECISION OBJECTIVES

Precision is an expression of the degree to which two or more measurements are in agreement, which is quantitatively assessed based on the standard deviation. Precision in the laboratory is assessed through the calculation of relative percent difference (RPD) and relative calculation of relative standard deviations (RSD) for three or more replicate samples. The equations to be used to verify precision during FI data analysis are included in Section A12.1 of this QAPP. General precision goals are provided in Table A3-2. Detailed precision goals are provided in the STL-LQM.

Laboratory precision will be assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) and field duplicate samples for organic parameters. For inorganic parameters, precision will be assessed through the analysis of a sample/sample duplicate pair and field duplicate pairs.

Precision for field measured parameters, including pH, turbidity, specific conductance, temperature, and dissolved oxygen, will be determined through duplicate analysis of 1 in every 20 samples. Precision control limits for field measured parameters are provided in Table A3-3.

Precision goals for critical geochemical parameters (e.g., VOCs, SVOCs, metals) will not apply to geotechnical parameters. The nature and relatively small number of geotechnical analyses for this project reduce the effectiveness of such a precision evaluation. The standard methods used for these analyses are widely recognized, and generated by the American Society for Testing and Materials (ASTM). This agency provides information on precision objectives that are achievable and expected for the various methods. The standard methods to be used, the entity responsible for the issuance of the standard, and the anticipated precision for each, are described below.

Atterberg Limits (ASTM D4318):

Precision—Criteria for judging the acceptability of liquid limit and plastic limit test results obtained by this test method on material are given in ASTM Method D4318 (Table 2). The estimates of precision are based on the results of an inter-laboratory study that included eleven laboratories performing the multipoint test (Method A) on three replicate samples of soil having a liquid limit of 64 and a plastic limit of 22.

Bias—There is no acceptable reference value for this test method; therefore, bias cannot be determined.

Bulk Density (ASTM D2937):

Precision—The precision of this test method is operator dependent and a function of the care exercised in performing the steps of the procedure, giving particular attention to careful control and systematic repetition of the procedure used. While no standard soils exist, limited studies running repetitive adjacent tests have indicated standard deviations of 1.98 for soils with an average wet density of 134 pounds per cubic feet (lb/ft^3) (ranging from 131.5 to 137.1 lb/ft^3), using a 5.125 inch diameter cylinder, and standard deviations of 1.62 for soils with an average wet density of 119.9 lb/ft^3 (ranging from 117.1 to 122.2 lb/ft^3) using a 3- inch diameter cylinder.

Bias—There are no absolute values of in-place density for soils against which this test method can be compared. Therefore this test method has no determinable bias since the values obtained can only be defined in terms of the test method.

Grain Size Distribution (ASTM D421-85, 422-63): According to ASTM, there are no precision and bias statements associated with this test method.

Moisture Content (ASTM D2216):

Precision—The single-operator coefficient of variation has been found to be 2.7 percent. The multilaboratory coefficient of variation has been found to be 5.0 percent.

Bias—There is no accepted reference value for this test method; therefore, bias cannot be determined.

pH (ASTM D2976):

Precision—Due to the nature of the soil or rock materials tested by this method it is either not feasible or too costly at this time to produce multiple specimens which have uniform physical properties. Any variation observed in the data is just as likely to be due to specimen variation as to operator or laboratory testing variation.

Bias—There is no accepted reference value for this test method; therefore, bias cannot be determined.

Total Organic Carbon (TOC) (ASTM D2974): According to ASTM, the precision and bias of these test methods have not been determined. Data are being sought for use in developing a precision and bias statement.

Cation Exchange Capacity (CEC) (SW-846 9081)

The precision and bias of the test method have not been determined based on the Method of Soil Analysis, Part 2.

A3.2 ACCURACY OBJECTIVES

Accuracy is the degree of agreement between an observed value and an accepted reference or true value. Accuracy in the field is assessed through the use of field blanks and trip blanks and through the adherence to all sample handling, preservation and holding times. One trip blank will accompany each batch of sample containers shipped to the laboratory. Laboratory accuracy is assessed through the analysis of a matrix spike/matrix spike duplicate (MS/MSD), standard reference materials (SRM), laboratory control samples (LCS), and surrogate compounds, and the determination of percent recoveries. The equation to be used for accuracy for this FI is found in Section A12.2 of this QAPP. Accuracy control limits are given Table A3-2.

Accuracy for field parameters including pH, turbidity, specific conductance, temperature, and dissolved oxygen will be assessed through instrument calibration standards discussed in field instrument calibration and maintenance FOPs (Attachment 2). Accuracy control limits for field parameters are provided in Table A3-3.

Laboratory accuracy for geotechnical parameters is assessed through the strict adherence to ASTM or other standard methods or guidelines for each parameter, as described for precision in the previous section.

A3.3 COMPLETENESS OBJECTIVES

Data completeness is a measurement of the amount of valid data obtained from a prescribed measurement system, compared with that expected and required to meet the project goals. Analytical and field completeness will be addressed by applying data quality checks and assessments described in Section A3.1 and A3.2 and Section A9.0 to ensure that the data collected are valid and significant.

As shown on Table A3-3, the laboratory completeness objective for the FI will be 90 percent or greater. A third-party data validator will follow procedures described in Section A9.2.2 to assess the completeness and validity of laboratory data deliverables. **For the FI, at least 10 percent of all laboratory analytical results will undergo data validation.** The completeness of an analysis will be documented by including sufficient information in the report to allow the data validator to assess the quality of the results. The information delivered may include such items as chromatograms, spectra, QC data, and summaries of results. Additional information, such as the laboratory worksheets and notes, will be stored with the sample results in the laboratory. The raw data will be archived for at least seven years by the laboratory. The laboratory will retain all analytical information regardless of whether Geomatrix requests the substantiation of results.

A3.4 DATA REPRESENTATIVENESS

Data representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. All proposed field testing and measurement procedures were selected to maximize the degree to which the field data will represent the conditions at the site, and the matrix being sampled or analyzed.

As described in Section A10.0, Performance System Audits and the proper execution of field activities are the main mechanism for ensuring that data are representative. Representativeness

in the laboratory is ensured through the use of the proper analytical procedures, appropriate methods, compliance with sample holding times, and analyzing and assessing field duplicate samples.

A3.5 DECISION RULES

A Decision Rule is a statement that describes the course of action to be taken based on particular findings, results, or occurrences. In the context of this FI, two basic types of decision rules have been identified.

- Decision rules relating to the adequacy of field investigation activities in meeting the site-specific objectives described in Section A1.6 of the QAPP and Section 3.0 of the FI Work Plan. These generally address the intent of the investigation to describe the character and extent of environmental impact in various media.

- Decision rules relating to evaluations of FI and historical data. These address the human health and ecological risk assessments, where initial conclusions must be the basis for continuing or advancing the risk assessment process.

The first category of decision rule is addressed under Section 4.0 of the FI Work Plan, under the subject of the phased investigation approach. Rohm and Haas, Geomatrix, and the USEPA will be working together to develop the specific scope of Phase 2 and 3, based on the data acquired previously. This will allow multiple opportunities to close critical data gaps, helping to ensure that investigation objectives and goals are met. The second category is addressed under the risk assessment discussions in Sections 6.0 and 7.0 of the FI Work Plan.

A3.6 COMPARABILITY

Data comparability expresses the confidence with which one data set can be compared to another data set. Procedures for field measurements, contained in the FOPs included as Attachment 2, will ensure that tests performed at various locations across the site are conducted using accepted procedures, in a consistent manner between locations and over time, and include appropriate QA/QC procedures to ensure the validity of the data. Sampling procedures for environmental

matrices are provided in the FOPs (Attachment 2) to ensure that samples are collected using accepted field techniques.

Environmental samples will be analyzed by STL using consistent protocols for sample preservation, holding times, sample preparation, analytical methodology, and QC as described in USEPA SW-846 and laboratory SOPs.

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. Comparability is also dependent on similar QA objectives. Parameters to be measured for this FI are listed in Table A3-4.

A3.7 Level Of QC Effort for Analytical Samples

Field blank, method blank, trip blank, field duplicate, laboratory duplicate, laboratory control, standard reference materials (SRM), and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. The frequency of QC sample collection is discussed below:

- Field and trip blanks consisting of laboratory deionized water will be submitted to the analytical laboratory to assess the quality of the data resulting from the field sampling program.
- Field blank samples will be used to assess contamination resulting from field procedures or ambient conditions (i.e., airborne contamination).
- Trip blanks will be used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage.
- Method blank samples will be generated within the laboratory and used to assess contamination resulting from laboratory procedures.
- Duplicate samples will be analyzed to check for sampling and analytical reproducibility.

- MS/MSD samples will be analyzed to provide information about the effect of the sample matrix on the digestion and measurement methodology. MS/MSD samples are designated/collected for organic analyses only.

The general level of QC effort will be:

- One field duplicate and one field blank for every set of 20 or fewer investigative samples. Field blanks will consist of equipment rinsates.
- One trip blank consisting of deionized water included along with each shipment of aqueous VOC samples.
- One MS/MSD for every 20 or fewer investigative samples of a given matrix.

Sampling activities are discussed further in Sections 4.0 and 5.0 of the FI Work Plan, in the Field Sampling Plan (Section A4.0) and related tables, and in the Field Operating Procedures (FOPs).

A4.0 FIELD SAMPLING PLAN

The selection and rationale for FI sampling is discussed in Section A1.0 of this QAPP and in the FI Work Plan. Sample container requirements for each matrix (i.e., soil, groundwater, surface water, and sediment) are presented in Table A4-2. The sampling and analysis program for each matrix of interest is presented in Table A4-3. Methods to be used to collect soil, groundwater, sediment and seep (surface water) samples for this investigation are described in the Field Operating Procedures (FOPs) included as Attachment 2 of this QAPP. Table A4-1 summarizes the FOPs selected as applicable to FI activities. The FOPs have been divided into categories A through J as follows:

A - Field Instrument Calibration & Maintenance
B - Drilling & Excavation
C - Monitoring Wells
D - Soil Sampling
E - Groundwater Sampling
F - Surface Water & Sediment Sampling
G - Decontamination
H - Aquifer Testing
I - Geophysical
J - Other Procedures

A5.0 CUSTODY PROCEDURES

Sample custody is controlled and maintained through the chain-of-custody procedures. These procedures track and control the possession of samples from their source, in the field, to their final disposition, at the laboratory. Laboratory chain-of-custody procedures further track the custody of samples during their tenure at the laboratory. This section discusses procedures to be used to adequately control and document sample custody.

A5.1 FIELD CUSTODY PROCEDURES

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain-of-custody intact. The procedure for sample numbering is included in FOPs in Attachment 2 of this QAPP. Descriptions of custody procedures and examples of field custody documents are also included in Attachment 2 of this QAPP. In addition, the basic chain-of-custody sequence is presented in Figure A5-1.

The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. All bottles will be identified by the use of sample tags with sample labels with unique sample numbers. The sample numbering system is presented in the FOP for sample labeling, storage, and shipment.

Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to the laboratory, or to/from a secure storage area.

Whenever split samples are collected with the USEPA or their representative, a separate sample receipt will be prepared for those samples and marked to indicate with whom the samples are being collected. The person relinquishing the samples to the USEPA will request the USEPA representative's signature acknowledging sample receipt. If the representative is unavailable or refuses to sign, this will be noted in the "Received By" space.

A5.2 LABORATORY CUSTODY PROCEDURES

Laboratory custody procedures for sample receiving and log-in; sample storage and numbering; tracking during sample preparation and analysis; and storage of data are described in Attachment 3 of this QAPP, Laboratory QA/QC Procedures. An example of a laboratory chain-of-custody traffic report, including instructions for completion, is also included in Attachment 3. The laboratory custody sequence is presented in Figure A5-2.

A5.2.1 Sample Receipt

A sample custodian will be responsible for receiving samples, completing chain-of-custody records, determining and documenting the condition of samples received, logging samples into the laboratory information management system (LIMS), and storing samples in appropriate limited-access storage areas. Chain-of-custody documentation will be also maintained for the transfer of samples between STL laboratories, and for shipment of samples to subcontracted laboratories.

Upon sample receipt, an inventory of shipment contents will be compared with the chain-of-custody record, and any discrepancies will be documented and communicated to the appropriate project manager. Discrepancies may include broken containers, inappropriate container materials or preservatives, headspace in volatile organics samples, and incorrect or unclear sample identification.

The temperature of samples shipped under refrigeration will be measured using an infrared measuring gun, a thermometer inserted in a temperature blank bottle, if included in the cooler, or a thermometer placed in the cooler adjacent to sample containers. Any deviations from a range of $4 \pm 2°$ C, or the range required by the applicable program, will be documented and communicated to the appropriate project manager.

The pH of each acid- or base-preserved sample will be measured and documented upon sample receipt, with the exception of volatile organics samples, which will be tested for pH at the time of analysis. If sample pH is not within method-specified limits, the pH of the sample is adjusted, documented, and the project manager contacted.

After completion of the sample shipment inspection, temperature and pH verifications, and resolution of any discrepancies, samples will be logged into LIMS by the sample custodian for a specific project task created by the appropriate project manager. The LIMS sample login procedure records pertinent information for each sample, including:

- Client name
- Project number
- Task number
- Purchase order number
- Chain-of-custody number
- Number of samples
- Sample matrix type
- Date and time of sampling
- Date and time of receipt by lab
- Client sample identification
- Any comments regarding special instructions or discrepancies

LIMS will then assign a unique laboratory identification number to each sample, which will become the primary means of tracking each sample within the laboratory. Each sample container will be labeled with the lab identification number and client identification and placed into a secure storage area.

A5.2.2 Sample Storage

Samples will be stored in secure limited-access areas. Walk-in coolers or refrigerators will be maintained at 4 ± 2° C or as required by the applicable regulatory program. The temperatures of all refrigerated storage areas will be monitored and recorded a minimum of once per day, using a thermometer verified for accuracy against an National Institute of Standards and Technology (NIST) traceable calibrated thermometer. Deviations of temperature from the applicable range will require corrective action, possibly including moving samples to another storage location.

A5.2.3 Sample Custody

Sample custody, as defined by this document, exists when samples are in:

- An authorized person's actual possession,
- An authorized person's view after being in their physical possession,
- A cooler or other portable container that is locked, sealed, or secured in a manner that prevents unsuspected tampering, or
- A designated and secured area.

Samples will be removed from storage areas by the sample custodian or analysts and transported to secure laboratory areas for analysis. Access to the laboratory and sample storage areas will be restricted to laboratory personnel and escorted visitors only; all areas of the laboratory will be therefore considered secure. If required by the applicable regulatory program, internal chain-of-custody will be documented in a log by the person moving the samples between laboratory and storage areas.

Laboratory documentation used to establish or maintain the chain-of-custody and sample identification may include the following:

- Field custody forms or other paperwork that arrives with the sample.
- The laboratory chain-of-custody.

- Sample labels or tags attached to each sample container.
- Sample custody seals.
- Sample preparation logs (i.e., extraction and digestion information) recorded in hardbound or electronic laboratory books that are filled out in legible handwriting, and signed and dated by the analyst.
- Sample analysis logs (e.g., metals, GC/MS, etc.) information recorded in hardbound or electronic laboratory books that are filled out in legible handwriting, and signed and dated by the analyst.
- Sample storage log.
- Sample disposition log, which documents sample disposal by a contracted waste disposal company.

Errors in all documentation will be deleted with one line through the error, and the appropriate correction will be made, then initialed and dated by the person making the correction. All documentation/logs will be signed/initialed by appropriate personnel.

A5.2.4 Sample Tracking

All samples will be maintained in the appropriate coolers prior to and after analysis. The analysts will remove and return their samples as needed. The sample custodian will relinquish samples that require internal chain-of-custody to the analysts by the sample custodians. Sample custody is tracked via electronic system. The analyst signs the printed electronic custody form indicating transfer from sample coolers. All sample bottles (even empty ones) are returned to the sample custodian so they may account for every sample bottle and either properly dispose of the bottle or shelve the bottle back into sample custody. Sample extracts will be relinquished to the instrumentation analysts by the preparatory analysts. Each preparation department will track internal chain-of-custody through their electronic system. Any change in the sample during the time of custody will be noted in the electronic custody form (i.e., sample breakage or depletion).

A5.2.5 Sample Disposal

A minimum of thirty days following completion of the project, or after a period of time specified by any applicable project requirements, sample disposal will be performed in compliance with federal, state, and local regulations. Alternatively, samples may be returned to the Morton Facility by mutual agreement. All available data for each sample, including laboratory analysis results and any information provided by Rohm and Haas or Geomatrix, will be reviewed before sample disposal.

It is anticipated that solid samples will be composited in a separate drum, the contents of which will be analyzed for Toxicity Characteristics Leaching Procedure (TCLP) parameters and reactivity, corrosivity, and ignitability characteristics, in order to classify the waste as hazardous or non-hazardous.

Liquid samples known or suspected of being hazardous will be removed from the containers and composited in appropriate waste drums. Aqueous samples determined to be non-hazardous may be disposed of through the laboratory sewer system unless prohibited by Rohm and Haas or the applicable project plan.

Solid samples may be removed from the containers or sample containers may be crushed and composited along with the samples. Liquid sample containers are typically emptied and disposed of separately from the samples.

After each sample waste drum has been categorized as non-hazardous or hazardous waste, the waste will be disposed of accordingly, using an appropriate waste contractor for each waste type. The laboratory will maintain all records of sample waste disposal, including manifests.

A5.2.6 Project File

The project file will be the central repository for all documents that relate to sampling and analysis activities as described in this QAPP. Geomatrix is the custodian of the project file and will maintain its contents for the investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports and data reviews in a secured, limited access area. The final project file will include, at a minimum:

- Field logbooks
- Field data and data deliverables
- Photographs
- Drawings
- Soil boring logs
- Laboratory data deliverables
- Data validation reports
- Data Assessment reports
- Progress reports, QA reports, interim project reports, etc.
- All custody documentation (tags, forms, air bills, etc.)

A6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

A6.1 LABORATORY INSTRUMENT CALIBRATION

Laboratory instrument calibration is performed using stable, homogeneous standards, which are certified for accuracy by the manufacturer. Whenever possible, the laboratories will use standard materials which are traceable to NIST Standard Reference Materials. For inorganic test methods, calibration is verified by analyzing a second-source initial calibration verification (ICV) standard at the beginning of the run and a continuing calibration verification (CCV) standard after every ten samples and at the end of the run. For organic test methods, calibration verification is performed daily, every twelve hours, or after every ten samples, as required by the test method. Only standards inside their expiration dates may be used for calibration. A summary of instrument calibration is addressed in Section 8.5-4 and in Tables 8.5-6, 8.5-7, and 8.5-8 of the STL-LQM (STL, 2000) (Attachment 3).

A6.2 FIELD INSTRUMENT CALIBRATION

Qualitative field data to be obtained during soil sampling include screening soil samples for the presence of VOCs. This screening will include headspace evaluations using either a photoionization detector (PID) or a flame ionization detector (FID). Quantitative field data to be obtained during groundwater and surface water sampling include pH, turbidity, specific conductance, temperature, dissolved oxygen, and depth to groundwater. Quantitative water level measurements will be obtained with an electronic sounder or steel tape.

FOPs located in Attachment 2 describe the calibration and use of instruments typically used to measure field parameters, and the calibration methods, standards, and frequency requirements for each instrument. Calibration results will be recorded in the Project Field Book.

A7.0 ANALYTICAL PROCEDURES

Groundwater, surface water, soil, and sediment samples collected during FI field activities investigation will be analyzed by Severn Trent Laboratories, Inc.

A7.1 LABORATORY ANALYTICAL PROCEDURES

This section describes the analytical procedures to be followed in the laboratory. Laboratory analytical procedures will follow USEPA methods contained in SW-846 and 40 Code of Federal Regulations (CFR) Part 136. Analytical methods selected for this FI are listed in Table A1-1 and A1-2 of this QAPP. In addition, Table A4-3 lists the number of samples to be collected during the FI. STL will either provide or coordinate all analytical services. General laboratory analytical procedures and sample handling procedures are presented in STL-LQM in Attachment 3.

A7.1.1 List of Project Target Compounds and Laboratory Detection Limits

A complete listing of project target compounds, estimated quantitation limits, and current laboratory determined detection limits for each analyte group is provided in Tables A1-5, -6, -7, and -8. Method detection limits (MDLs) shown have been experimentally determined.

A7.1.2 Associated Quality Control Samples

Table A4-3 of this QAPP contains an estimate of the associated QC samples for each analyte group and matrix.

A7.1.3 Sample Preparation and Analytical Methods

STL will implement the appropriate method procedures. The laboratory Standard Operating Procedures (SOPs) for sample preparation, cleanup and analysis are based on SW-846 Update III, ASTM and USEPA procedures.

A7.1.4 Confirmation Analysis Methods

Laboratory SOPs identify the confirmatory analysis appropriate for this project. The basis for these SOPs are SW-846 Update III, ASTM, and USEPA procedures. These protocols include second column confirmation for the gas chromatography methods.

In addition, confirmatory analysis may be performed by the evaluation of field duplicates and or split samples analysis with the USEPA. Although analyte concentrations between duplicates analyses and split samples may vary, the target analytes present should be the same. This can be considered confirmation analysis.

A7.1.5 Method Validation

In order to demonstrate that the laboratory is capable of detecting and quantitating analytes at specific levels required by regulatory agencies or clients, each laboratory establishes method detection limits (MDLs), instrument detection limits (IDLs), and reporting limits (RLs), as required by the specific method protocols. These limits, along with other related detection or quantitation limits, are defined as follows:

- *Method Detection Limit* (MDL)—the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The MDL is a theoretical, statistically-derived value determined by preparing at least seven replicates of a low-level spiked matrix, which are taken through the entire sample preparation and analysis procedure; the standard deviation of the results is multiplied by the appropriate student's T value at the 99 percent confidence level to obtain the MDL. STL's laboratories perform MDL studies using the procedure defined in 40 CFR Part 136, Appendix B, *Definition and Procedure for the Determination of the Method Detection Limit* - Revision 1.11. MDLs are determined for each method and instrument annually, at a minimum, or when significant modifications to the procedure or instrumentation have been made, as determined by laboratory manager.

- *Instrument Detection Limit* (IDL) - an estimate of the lowest concentration of a substance that can be reliably detected above background noise on an instrument. The IDL is a theoretical, statistically derived value, which is determined by analyzing seven replicates of a low-level standard on each of three non-consecutive days; the standard deviation of the

results is multiplied by three to obtain the IDL. For USEPA Contract Laboratory Program (CLP) work, IDLs are determined quarterly for each instrument used for CLP metals analysis.

- *Reporting Limit (RL)* - the minimum level of quantitation, for an individual substance that appears in the final report. When the laboratory detects a substance at a concentration between the MDL and the RL, the concentration cannot be reliably quantified and the laboratory will qualify the data as "estimated" (typically with a "J").

A8.0 INTERNAL QUALITY CONTROL CHECKS

A8.1 FIELD QUALITY CONTROL CHECKS

The QC criteria for each measurement are provided in Tables A3-2 and A3-3 of this QAPP. Assessment of field sampling precision and bias will be determined by collecting field duplicates and field blanks for laboratory analysis and by performing replicate analysis of field measured parameters. Collection of the samples will be in accordance with the procedures described in Sections 4.0 and 5.0 of the FI Work Plan, and with the FOPs referenced in Section A4.0 and included as Attachment 2 of this QAPP.

A8.2 LABORATORY QUALITY CONTROL CHECKS

Laboratory analytical internal QA/QC will be conducted in accordance with USEPA SW-846. The checks include internal QC methods covering surrogate spikes, duplicates, preparation blanks, calibration, laboratory quality control samples and reagent checks. An MS/MSD sample will be analyzed as a further QC check. The MS/MSD samples will be analyzed at the same frequency as the duplicate samples. The MS/MSD samples will allow accuracy to be determined by using the percent recovery of the spiked compounds. The purpose of the MS/MSD samples is to monitor any possible matrix effects specific to samples collected from the site. Acceptable QC limits for the MS/MSD samples are found in SW-846. The Project Manager, Site Coordinator, or Project QA Officer will select the specific location for the MS/MSD sample.

A9.0 DATA REDUCTION, VALIDATION, AND REPORTING

All data generated through field activities or by the laboratory operation shall be reduced and validated prior to reporting. The laboratory shall not disseminate data until it has been subjected to the procedures summarized below.

A9.1 DATA REDUCTION

A9.1.1 Laboratory Reduction Procedures

Results of laboratory analyses will be reported in units of final use, as discussed in Section A3.6 of this QAPP and listed in Table A3-4. Laboratory calculations will be performed as prescribed for a given analytical method or in conformance with acceptable laboratory standards at the time the calculation is performed.

The laboratory will retain QA/QC records for at least five years. Original laboratory reports will be stored in the Geomatrix project files. Copies of raw data will be transmitted electronically. For this project, Geomatrix has requested a data package appropriate for third-party data validation discussed in Section A.9.2, which includes the following information:

- Comments on relevant analytical problems or observations.
- Analytical methods used.
- Dates when extractions and analyses were performed.
- Detection and/or reporting limits and dilution factors used.
- Analytical data sheets (results) for all samples and method blanks.
- Surrogate recovery results.
- Matrix spike/matrix spike duplicate results and recovery sheets.
- Laboratory duplicate results and relative percent differences. Note: laboratory duplicates should be run at one per 20 samples or once per batch.
- Daily and/or continuing calibration check results.
- Copies of representative sample chromatograms.
- Chain of custody forms.
- System monitoring compound recovery results.
- GC/MS instrument performance checks.

- Internal standards.
- Field duplicates results.
- Compound quantitation and reported detection limits.
- System performance.
- Holding times.
- Spiked sample recovery.
- Laboratory control sample results.

The STL Technical Manager, STL QA Officer, or their designee will review the laboratory data. Section A12.0 of this QAPP outlines the procedures for evaluating the accuracy and precision of data. If comparison of data to previous measurements or known conditions at the site indicates anomalies, the laboratory will be instructed to review the submitted data while Geomatrix reviews the methods used to obtain the data. If anomalies remain, the laboratory may be asked to re-analyze selected samples.

A9.1.2 Field Data Reduction Procedures

Field measurements of pH, turbidity, temperature, specific conductance, dissolved oxygen, and water level are read directly in the units of final use, as discussed in the FOPs included as Attachment 2 of this QAPP and listed in Table A3.4. Field personnel are responsible for monitoring the collection and reporting of field data. Field personnel will review field measurements at the time of measurement and will re-measure a parameter as necessary to assure quality and accuracy are maintained.

Field data will be recorded on appropriate field data record forms as they are collected and will be maintained in Geomatrix's office project file. The Project Director or Project QA Officer will review field procedures and compare field data to previous measurements to assess comparability and accuracy of the field data measurements.

A9.2 DATA VALIDATION

Data validation procedures will be performed for both field and laboratory operations as described below.

A9.2.1 Procedures Used to Validate Field Data

The procedures to evaluate field data for this investigation include checking for transcription errors and review of field logbooks, on the part of field crewmembers. This task will be the responsibility of the Field Team Leader.

A9.2.2 Procedures Used to Validate Laboratory Data

Data validation will be performed using the most current methods and quality control criteria from SW-846 and the USEPA's Contract Laboratory Program (CLP) National Functional Guidelines for Organic and Inorganic Data Review. The CLP data review guidance will be used only to the extent that it is applicable to the SW-846 methods; SW-846 methodologies will be followed primarily and given preference over CLP when differences occur. Essentially, all technical holding times shall be reviewed, instrument performance check sample results shall be evaluated, results of initial and continuing calibration will be reviewed and evaluated by trained reviewers independent of the laboratory. The role of the data validator is indicated in Section A2.0 of this QAPP. Also, results of blanks, surrogate spikes, MS/MSDs, laboratory control samples, and target compound identification and quantitation will be reviewed/evaluated by the data validator. Ten percent of the sample analytical data for each sample matrix shall be validated.

The data validator will also evaluate the overall completeness of the data package. Completeness checks will be administered on all data to determine whether deliverables specified in the QAPP are present. At a minimum, deliverables will include sample chain-of-custody forms, analytical results, QC summaries, and supporting raw data from instrument printouts. The reviewer will determine whether all required items are present and request copies of missing deliverables.

A9.3 DATA REPORTING

Data reporting procedures shall be carried out for field and laboratory operations as indicated below.

A9.3.1 Field Data Reporting

All FI field documents will be accounted for when they are completed. Accountable documents include items such as field notebooks, sample logs, field data records, photographs, data packages, computer disks, and reports.

A9.3.2 Laboratory Data Reporting

Analytical data will be summarized in tabular format with such information as sample identification, sample matrix description, parameters analyzed and their corresponding detected concentrations, and the detection limit. Analytical results will be incorporated into reports as data tables, maps showing sampling locations and analytical results, and supporting text. All laboratory analytical reports shall be submitted to the USEPA in electronic format.

A9.4 USEFULNESS OF HISTORICAL DATA

Previous investigations of the site have included collection and analysis of soil and groundwater samples. This report must rely on these data to draw tentative conclusions about the extent of affected soils and groundwater. In general, investigations were carried out using protocols and techniques which were most accepted at the time of their performance. Accepted quality assurance/quality control (QA/QC) practices, such as blanks and duplicates, were used for many of these sampling events.

In the case of groundwater samples collected from permanent monitoring wells, the current quality of groundwater at these wells can be determined by sampling and analysis. Although the groundwater quality may change over time because of natural flow and degradation of

certain constituents, current conditions can be measured, and these data can be reliably used to make decisions about future action.

In the case of soil samples, it is recognized that all soil samples targeting volatile constituents are subject to inherent limitations in sample handling, both in the field and in the laboratory, that result in some losses of the target compounds. Historical detections in such samples would be useful indicators of chemical presence, but their absence could not be considered conclusive. Such samples may be useful for screening purposes, but will not be used for quantitative risk assessment.

In addition, it should be noted that the multiple investigations of the Morton Facility and its surroundings have generated a history of analyses, particularly with respect to groundwater. Successive sampling events at particular locations, even when performed by different parties, have generally obtained similar results. This suggests that those results are representative of actual conditions.

Investigation performed to meet AO objectives will meet data quality objectives (DQOs) identified within an approved Quality Assurance Project Plan (QAPP). These DQOs and the methods to achieve them will meet current USEPA criteria for data useability. As this new data is generated, it will be compared to previously acquired data to evaluate the latter's reliability.

A10.0 PERFORMANCE SYSTEM AUDITS AND FREQUENCY

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the QAPP. Audits of field and laboratory activities include two independent parts; internal and external.

A10.1 FIELD PERFORMANCE AND SYSTEM AUDITS

A10.1.1 Internal Field Audits

The Geomatrix QA Officer will conduct internal audits of field activities including sampling and field measurements. These audits will verify that all established procedures are being followed. Internal field audits will be conducted at least once at the beginning of the site sample collection activities. Depending on project duration, subsequent audits will be performed at least once every three months during field activities.

The audit program consists of the following:

- Observe field activities to confirm that procedures are performed in accordance with project protocols and standard accepted methods, as detailed in the FOPs in Attachment 2; and

- Review daily field records, monitoring well sampling records, and any other data collection sheets during and after field measurements.

A10.1.2 External Field Audits

The USEPA Project Coordinator may conduct external field audits. External field audits may be conducted any time during the field operations. These audits may or may not be announced, and are at the discretion of the USEPA. External field audits will be conducted according to the field activity information presented in the QAPP.

A10.2 LABORATORY PERFORMANCE AND SYSTEMS AUDITS

The adequacy and implementation of STL's quality plan are assessed on an ongoing basis through systems and performance audits. Systems audits evaluate practice against established quality system objectives and requirements. Performance audits measure the comparability and accuracy of laboratory data through the analysis of reference materials for which the true value is unknown to the analyst. Audits may be performed by STL (internal), or by Rohm and Haas, Geomatrix, USEPA, or accreditation bodies (external).

A10.2.1 Internal Laboratory Audits

The STL Quality Assurance (QA) Officer schedules internal systems audits such that the laboratory's quality system and range of test capabilities are audited annually. The audits are conducted to:

- Determine whether the procedures defined in the quality system are being followed;
- Determine whether the objectives defined in the quality system are being achieved; and
- Identify opportunities for improvement.

The STL QA Officer will conduct the laboratory audit. The QA Officer will prepare a plan for each audit that defines its scope, requirements, and techniques (observation, record review, and/or interview). Areas of concern should be targeted in the audit, along with other areas selected at random.

The internal system audits will be done on an annual basis while the internal performance audits will be conducted on a quarterly basis. These performance audits are alternating quarters of drinking water and wastewater matrices.

The analytical laboratory is required to audit its operations in accordance with the STL-LQM located in Attachment 3. An audit may be conducted by the local STL QA officer, by the QA officer from a sister laboratory, or by an individual outside the quality assurance department who is

independent of the activity to be audited. The auditor will follow the audit plan, documenting objective evidence from observation, interviews, and review of records.

The auditor will prepare a written report summarizing the scope of the audit, areas of strength and weakness, and other findings. The report is issued to the local laboratory manager, responsible department supervisor(s), and corporate quality assurance. The QA Officer will initiate the corrective action process for each finding. The laboratory manager is responsible for ensuring timely corrective action.

A10.2.2 External Laboratory Audits

Upon client, regulatory agency, or accreditation body notification of intent to audit, the QA Officer notifies laboratory personnel and corporate quality assurance. During the audit, the QA Officer or a designee provides escort for the auditors, and participates in the pre-audit and post-audit conferences. Additional laboratory personnel are called upon as necessary during the course of the audit. An external audit will be conducted as considered appropriate by USEPA Region 5.

External audits may include any or all of the following:

- Review of laboratory analytical procedures,
- Laboratory on-site visits, and/or
- Submission of performance evaluation samples to the laboratory for analysis.

An external on-site visit may include:

- Sample receipt procedures,
- Custody and sample security and log in procedures,
- Calibration records,
- Instrument logs and statistics (number and type),
- Review of QA procedures,
- Review of logbooks,
- Review of sample prep procedures,
- Sample analytical SOP review,

- Instrument (normal or extends quantitation report) reviews,
- Personnel interviews,
- Review of deadlines and glassware prep, and
- A close out to offer potential corrective action.

It is common practice when conducting an external laboratory audit to review one or more data packages from sample lots recently analyzed by the laboratory. This review may include:

- Comparison of resulting data to the SOP or method, including coding for deviations.
- Verification of initial and continuing calibrations within control limits.
- Verification of surrogate recoveries and instrument timing results where applicable.
- Review of extended quantitation reports for comparisons of library spectra to instrument spectra, where applicable.
- Recoveries on control standard runs.
- Review of run logs with run times, ensuring proper order of runs.
- Review of spike recoveries/QC sample data.
- Review of suspected manually integrated GC data and its cause (where applicable).
- Assurance that samples are run within holding times.

All data will be reviewed while on the premises, so that any data called into question can be discussed with the staff.

Following the audit, the QA Officer provides a written summary of the audit to the laboratory manager, department supervisors, and corporate quality assurance. The summary includes the areas reviewed, and strengths and deficiencies identified during the audit.

The QA Officer initiates the corrective action process for each finding. The laboratory manager is responsible for ensuring timely corrective action. The QA Officer coordinates the preparation of the audit report response, and prepares any follow-up responses as corrective actions are completed. The audit report and laboratory responses are copied to corporate QA personnel.

A10.3 PERFORMANCE AUDITS

A10.3.1 Internal Performance Audit

Internal performance audit samples are submitted at the discretion of the local QA Officer as a supplement to the quality control checks run on a daily basis. The QA Officer maintains a log of blind sample preparation in which the reference material used, preparation, and true value(s) are documented. The reference materials submitted should be independent of the laboratory's initial calibration standards.

Acceptance criteria for internal performance audit sample results are those provided with the reference material. If no criteria are provided, performance criteria listed in the reference method are used. Internal performance audit results are scored and corrective action is initiated in the same manner as external samples. The laboratory manager is responsible for ensuring timely corrective action.

A10.3.2 External Performance Audit

External performance audit samples are run at the frequency required to obtain and maintain desired certifications, accreditations, and approvals. Additional studies may be run at the discretion of corporate QA Officer or the local laboratory manager.

The QA Officer initiates the corrective action process for each performance audit result scored as "fail." The laboratory manager is responsible for ensuring timely corrective action. The audit report and laboratory responses are copied to corporate QA.

A11.0 PREVENTATIVE MAINTENANCE

A11.1 FIELD INSTRUMENT PREVENTATIVE MAINTENANCE

Each piece of field equipment will be checked according to its routine maintenance schedule and before field activities begin. Equipment that may be used in the field for this FI includes:

- Flame ionization detector (FID) organic vapor meter
- Photoionization detector (PID) organic vapor meter
- Water quality meters (includes pH, turbidity, temperature, specific conductance, and dissolved oxygen)
- Electronic water level indicator

Field personnel will report all equipment maintenance and/or replacement needs to the Project QA Officer and will record the information on the daily field record. Preventative maintenance and calibration for field instruments are described in instrument specific FOPs in Attachment 2.

A11.2 LABORATORY INSTRUMENT PREVENTATIVE MAINTENANCE

As part of the QA Program Plan, a routine preventative maintenance program will be conducted by STL to minimize the occurrence of instrument failure and other system malfunctions. The analysts regularly perform routine instrument maintenance tasks (or coordinate with the vendor). All maintenance that is performed will be in accordance with the manufacturer's specifications and documented in the laboratory's maintenance logbooks.

Each analytical instrument will be assigned an instrument maintenance logbook. All maintenance activities will be recorded in the maintenance log. The information entered in the maintenance log will include:

- Date of service or maintenance.
- Person performing service or maintenance.
- Type of service performed and reason for service.
- Replacement parts installed (if appropriate).

- Documentation of the re-establishment of working order.
- Miscellaneous information.

If service is performed by the manufacturer, a copy of the service record (when available) is affixed to the notebook page, or cross-referenced in the notebook to a separate maintenance file. The service record should include sufficient detail to describe the service performed (e.g., not just "service call," but "replaced pump motor gear"). If the service record does not spell out this information, it must be written separately into the maintenance log. There must also be a reference to the file number, notebook page, etc., that substantiates re-establishment of working order.

Preventative maintenance and repairs that cannot be performed by laboratory staff are contracted to the manufacturer's service section or to an authorized maintenance vendor. Laboratory service agreements provide for preventive maintenance, emergency service, and emergency shipping of spare parts. Annual service of the laboratory balances is an example of contracted preventive maintenance.

Instrument specific maintenance procedures and frequencies are summarized in the STL-LQM (STL, 2000) (Attachment 3).

A12.0 SPECIFIC ROUTINE PROCEDURES USED TO EVALUATE DATA PRECISION, ACCURACY, AND COMPLETENESS

The purpose of this section is to indicate the methods used to ensure that the FI data falls in line with the data quality objectives (DQOs) for the site. Factors considered in this FI include:

- The risk assessment parameters chosen based on conditions and possible receptors involved in a project (i.e., ecological data quality levels, human health screening levels, soil screening guidance, etc.).
- The chemical constituents known and/or suspected to be of concern as they relate to the selected data quality level parameters.
- The selection of analytical and sample preparation methods with method detection limits that will meet or exceed the data quality level concentrations for contaminants of concern.

Once these goals and objectives are evaluated and chosen, analytical data quality will be assessed to determine if the objectives have been met. In addition, the data will be reviewed for indications of interference to results caused by sample matrices, cross contamination during sampling, cross contamination in the laboratory, and sample preservation and storage anomalies (i.e., sample holding time or analytical instrument problems).

As discussed in Section A3.0, the validity of data will be measured in terms of precision, accuracy, and completeness. These three parameters will be evaluated as described below. Evaluations will be performed upon completion of the FI field activities.

A12.1 PRECISION ASSESSMENT

Precision - For data generated by the laboratory, data precision is estimated by comparing analytical results from duplicate samples. The comparison is made by calculating the relative percent difference (RPD) given by:

$$RPD = \frac{2(S_1 - S_2)}{S_1 + S_2} \times 100$$

where S_1 = sample result
S_2 = duplicate result

This information is calculated and reviewed periodically by the Project Director and/or Project QA Officer. The goals for data precision for duplicate samples are presented in Table A3-2. This table also summarizes general precision goals for data generated in the field instrumentation.

A12.2 ACCURACY ASSESSMENT

Accuracy - Data accuracy, which is assessed for laboratory data only, is based on recoveries, expressed as the percentage of the true (known) concentration, from laboratory-spiked samples and QA/QC samples generated by the analytical laboratory.

Percent recovery (%R) for MS/MSD results is determined according to the following equation:

$$R\% = \frac{(A-B)}{T} \times 100$$

Where:
A = measured concentration after spiking
B = background concentration
T = known true value of spike

Percent recovery (%R) for LCS and surrogate compound results is determined according to the following equation:

$$R\% = \frac{\text{Experimental concentration}}{\text{Known amount added}} \times 100$$

This information is reviewed periodically by the Project Manager or Project QA Officer. The goals for the recovery of any constituent in a spiked or QA/QC sample are presented in Table A3.2.

A12.3 COMPLETENESS ASSESSMENT

Completeness - Data completeness will be evaluated by comparing the objectives of the FI efforts with the data obtained and determining whether there are any shortcomings in needed information. A series of protocols described below will be used to evaluate data completeness. The purpose is to accomplish the following:

- Rigorously assess the quality and adequacy of data collected during the FI.
- Review data collected during the FI to evaluate if the study's objectives are being addressed and met.
- Ensure that the data collected are valid by applying the quality checks described in this and other sections of the QAPP.

Data generated during groundwater assessment and monitoring programs will be evaluated for completeness; that is, the amount of data meeting project QA/QC goals. If data generated during field operations or during analytical procedures appear to deviate significantly from previous trends, the Project Director or Project QA Officer will review field or laboratory procedures with the appropriate personnel to evaluate the cause of such deviations. Where data anomalies cannot be explained, resampling may be performed. Completeness is defined as the percentage of valid results according to the equation below:

$$\%COMPLETENESS = \frac{A}{B} \times 100$$

Where: A = number of valid results;
B = total number of possible results

The goals for data completeness for laboratory measurements were presented previously in Table A3-2.

A12.4 ASSESSMENT OF DATA

Laboratory analytical data and field data will be reviewed by the Geomatrix Project Manager and QA Officer in accordance with procedures and protocols outlined in this QAPP to assess the integrity of the data generated during this FI. At that time, an assessment will be made to determine if the project objectives described in Section A1.0 have been achieved. Corrective Action described in Section A13.0 will be implemented, if necessary, to meet project objectives for data integrity.

A13.0 CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. All corrective action proposed and implemented should be documented in the regular quality assurance reports to management. Corrective action should be implemented only after approval by the Project Manager or STL Technical Manager, as appropriate. If immediate corrective action is required, approvals secured by telephone from the Project Manager and/or the STL Technical Manager should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. In the field, the person who identifies the problem is responsible for notifying the Field Team Leader, who will notify the Project Manager, who in turn will notify the Rohm and Haas Project Coordinator, who will notify the USEPA Project Coordinator. If the problem is analytical in nature, information will be promptly communicated to the USEPA Project Coordinator via e-mail, facsimile, or telephone. Implementation of corrective action will be confirmed in writing through the same channels. If noncompliance is observed in the laboratory or during data validation, the analyst or data validator will notify the STL Technical Director or Project Manager, as appropriate, and communication will continue in the same manner as described above.

A13.1 FIELD CORRECTIVE ACTION

If errors in field procedures are found during the observation or review of field activities by Geomatrix's Project QA Officer or his designee, corrective action will be initiated. Nonconformance to the QA/QC requirements of the field procedures will be identified by field audits or immediately by project staff who know or suspect that a procedure is not being performed in accordance with the requirements. The Geomatrix Project QA Officer or his designee will be informed immediately upon discovery of all deficiencies. Timely action will be taken if corrective action is necessary.

Corrective action in the field may be needed when the sample network is changed or when sampling procedures and/or field analytical procedures require modification, due to unexpected conditions. In general, the Field Team leader, Project Manager, and QA Officer may identify the need for corrective action. The Project Manager will approve the corrective measure that will be implemented by the field team, and it will be the responsibility of the Project Manager to ensure that corrective action has been implemented.

If the corrective action will supplement the existing sampling plan (i.e., additional soil borings) using existing and approved procedures in the QAPP, corrective action approved by the Project Manager will be documented. If the corrective actions result in fewer samples (or analytical fractions), alternate locations, etc., which may result in non-achievement of project QA objectives, it will be necessary that all levels of project management, including the USEPA Project Coordinator, concur with the proposed action.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The QA Officer will identify deficiencies and recommend corrective action to the Project Manager. The Field Team Leader and field team will implement corrective actions. Corrective action will be documented in QA reports from the QA Officer to the entire project management team.

Corrective actions will be documented in the Project Field Book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the USEPA Project Coordinator.

If at any time a corrective action issue is identified which directly impacts project DQOs, the USEPA Project Coordinator will be notified immediately.

A13.2 LABORATORY CORRECTIVE ACTION

Corrective actions may be initiated if the quality assurance goals are not achieved. The initial step in a corrective action is to instruct the analytical laboratory to examine its procedures to assess whether analytical or computational errors caused the anomalous result. Sample collection and handling procedures will be concurrently reviewed to assess whether they could have contributed to the anomalous result. If no error in laboratory procedures or sample collection and handling procedures can be identified, then the Project Manager will assess whether reanalysis or re-sampling is required, or whether any protocol should be modified for future sampling events.

A13.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

The need for corrective action may be identified during the data validation or assessment processes. Potential types of corrective action may include re-sampling by the field team, or re-injection/reanalysis of samples by STL.

These actions are dependent upon the ability to mobilize the field team and whether the data to be collected is necessary to meet the QA objectives (e.g., the holding time for samples is not exceeded). If the data validator identifies a corrective action situation, the Project Manager will be responsible for approving the corrective action implementation. All required corrective actions will be documented by the STL Technical Manager or his/her designee.

A14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Progress Reports described in Section 8.3 of the FI Work Plan will periodically contain separate QA sections in which data quality information collected during the task is summarized. Those reports will be the responsibility of the Project Manager, and will include the QA officer's report on the accuracy, precision, and completeness of the data, as well as the results of the performance and system audits, and any corrective action needed or taken during the project.

A14.1 CONTENTS OF PROJECT QA REPORTS

The QA reports will contain, on a routine basis, all results of field and laboratory audits, all information generated during the reporting period reflecting on the achievement of specific DQOs, and a summary of corrective action that was implemented, and its immediate results on the project. Whenever necessary, updates on training provided, changes in key personnel, anticipated problems in the field or laboratory that could bear on data quality along with proposed solutions, will be reported. Detailed references to QAPP modifications will also be highlighted. All QA reports will be prepared in written, final format by the Project Manager or his/her designee. To the extent possible, assessment of the project should also be performed on the basis of available QC data and overall results in relation to originally targeted objectives.

In the event of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the Project organization and Corrective Action sections of this QAPP. However, these events, and their resolution would be addressed thoroughly in the next QA report.

A14.2 FREQUENCY OF QA REPORTS

The QA Reports will be prepared on a quarterly basis and will be incorporated into the first monthly Progress Report of each calendar quarter (i.e., January, April, July, October). The schedule for these Progress Reports is discussed further in Section 8.3 of the FI Work Plan.

The QA Reports will be terminated concurrently with the Progress Reports. The frequency of any emergency reports that must be delivered verbally cannot be estimated at the present time.

A14.3 INDIVIDUALS RECEIVING/REVIEWING QA REPORTS

All individuals designated to receive Progress Reports will receive QA Reports. Progress Reports will be distributed to the following personnel:

- USEPA Project Coordinator,
- Rohm and Haas Project Coordinator, and
- Geomatrix Project Manager.

A15.0 BIBLIOGRAPHY

Agency for Toxic Substances and Disease Registry, On line: http://www.atsdr.cdc.gov/tfacts48.html.

Agrichemical and Environmental News Index, June 1998, On line: http://www.tricity.wsu.edu/aenews/June98AENews /.

American Bird Conservatory, http://www.abcbirds.org/profiles/ethyl_parathion.htm.

American Society for Testing and Materials (ASTM) 1998, Annual Book of ASTM Standards, Soil and Rock (1), ASTM Volumes 04.08 and 04.09.

Bowen, 1979, Environmental Chemistry of the Elements, Academic Press, New York.

Code of Federal Regulations, 1999, Title 40.

Connor, J.J. and Shacklette H.T., 1975, Background Geochemistry of Some Rocks, Soils, Plants, and Vegetables in the Conterminous United States, United States Geological Survey Professional Paper 574-F, 168 pp.

Geomatrix Consultants, Inc., 2000, Current Conditions Report, Morton International Inc., Facility, Reading, Ohio, September 2000.

Industry Task Force II, On line: http://www.24d.org/.

Ohio Administrative Code, 1999, 3745-1-01, Water Quality Criteria for Ohio River Basin Aquatic Life, On-line: http://www.state.oh.us/ohio/ohiolaws.htm, May 11.

Ohio Environmental Protection Agency (OEPA), 1990, Guidelines and Specifications for Preparing Quality Assurance Project Plans, DERR-00-RR-008, dated March 5, 1990.

Severn Trent Laboratories (STL), 2000, Laboratory Control Manual for STL North Canton (STL-LQM), September.

Shacklette, H.T. et al., 1971, Elemental Composition of Surficial Materials in the Conterminous United States.

Shacklette, H.T. and J.G. Boerngen, 1984, Elemental Concentrations in Soils and Other Surficial Materials of the Conterminous United States.

U.S. Environmental Protection Agency (USEPA), 1980, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, Office of Research and Development, December 29, 1980.

U.S. Environmental Protection Agency (USEPA), 1992, Methods for the Determination of Organic Compounds in Drinking Water. Supplement 2, Environmental Monitoring Systems Laboratory, Cincinnati, OH, EPA/600/9-92/129.

U.S. Environmental Protection Agency (USEPA), 1994a, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February.

U.S. Environmental Protection Agency (USEPA), 1994b, Contract Laboratory Program National Functional Guidelines for Organic Data Review, February.

U.S. Environmental Protection Agency (USEPA), 1997a, The Use of Field Methods to Support RFI Streamlining (USEPA, Region 5 Memorandum), June 20.

U.S. Environmental Protection Agency (USEPA), 1997b, Test Methods for Evaluating Solid Waste - Physical/Chemical Methods - SW-846, Third Edition, Final Rule revised June 1997.

U.S. Environmental Protection Agency (USEPA), 1998, Region 5 RCRA QAPP Instructions, April.

U.S. Environmental Protection Agency (USEPA), 1999a, Region 5 Ecological Data Quality Levels (EDQLs), April 23.

U.S. Environmental Protection Agency (USEPA), 1999b, Region 9 Preliminary Remediation Goals, On-line: http://www.epa.gov/region09.

U.S. Environmental Protection Agency (USEPA), 2000, Contract Laboratory Program Target Analyte List developed from the USEPA Superfund Contract Laboratory Program, On line: http://www.epa.gov/superfund/programs/clp/target.htm.

TABLE A1-1
CONTRACT LABORATORY PROGRAM (CLP)
TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Inorganic Constituents		
Aluminum	(Total)	6010B
Antimony	(Total)	6010B
Arsenic	(Total)	6010B
Barium	(Total)	6010B
Beryllium	(Total)	6010B
Cadmium	(Total)	6010B
Calcium	(Total)	6010B
Chromium	(Total)	6010B
Cobalt	(Total)	6010B
Copper	(Total)	6010B
Cyanide	57-12-5	9012A
Iron	(Total)	6010B
Lead	(Total)	6010B
Magnesium	(Total)	6010B
Manganese	(Total)	6010B
Mercury	(Total)	7471A/7470A
Nickel	(Total)	6010B
Potassium	(Total)	6010B
Selenium	(Total)	6010B
Silver	(Total)	6010B
Sodium	(Total)	6010B
Sulfide	18496-25-8	376.1
Thallium	(Total)	6010B
Vanadium	(Total)	6010B
Zinc	(Total)	6010B
Volatile Organic Constituents		
Acetone	67-64-1	8260B
Benzene	71-43-2	8260B
Bromochloromethane	74-97-5	8260B
Bromodichloromethane	75-27-4	8260B
Bromoform; Tribromomethane	75-25-2	8260B
Bromomethane; Methyl bromide	74-83-9	8260B
Carbon disulfide	75-15-0	8260B
Carbon tetrachloride	56-23-5	8260B
Chlorobenzene	108-90-7	8260B
Chloroethane; Ethyl chloride	75-00-3	8260B
Chloroform	67-66-3	8260B
Cyclohexane	110-82-7	8260B
Dibromochloromethane; Chlorodibromomethane	124-48-1	8260B
1,2-Dibromo-3-chloropropane; DBCP	96-12-8	8260B
1,2-Dibromoethane; Ethylene dibromide (EDB)	106-93-4	8260B
Dichlorodifluoromethane	75-71-8	8260B
1,1-Dichloroethane (1,1-DCA)	75-34-3	8260B
1,2-Dichloroethane; Ethylene dichloride	107-06-2	8260B
1,1-Dichloroethene; 1,1-Dichloroethylene; Vinylidene chloride	75-35-4	8260B

TABLE A1-1
CONTRACT LABORATORY PROGRAM (CLP)
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Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2	8260B
trans-1,2-Dichloroethene; trans-1,2-Dichloroethylene	156-60-5	8260B
1,2-Dichloropropane	78-87-5	8260B
cis-1,3-Dichloropropene	10061-01-5	8260B
trans-1,3-Dichloropropene	10061-02-6	8260B
Ethylbenzene	100-41-4	8260B
2-Hexanone	591-78-6	8260B
Isopropylbenzene; cumene	98-82-8	8260B
Methyl acetate	79-20-9	8260B
Methyl chloride; Chloromethane	74-87-3	8260B
Methyl cyclohexane	108-87-2	8260B
Methylene chloride; Dichloromethane	75-09-2	8260B
Methyl ethyl ketone; 2-Butanone; MEK	78-93-3	8260B
4-Methyl-2-pentanone; Methyl isobutyl ketone (MIBK)	108-10-1	8260B
Methyl tert-butyl ether	1634-04-4	8260B
Styrene	100-42-5	8260B
1,1,2,2-Tetrachloroethane	79-34-5	8260B
Tetrachloroethylene; Perchloroethylene; Tetrachlorethene (PCE)	127-18-4	8260B
Toluene	108-88-3	8260B
1,1,1-Trichloroethane; Methylchloroform	71-55-6	8260B
1,1,2-Trichloroethane	79-00-5	8260B
Trichloroethylene; Trichloroethene	79-01-6	8260B
Trichlorofluoromethane	75-69-4	8260B
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	8260B
Vinyl chloride	75-01-4	8260B
Xylene (total)	1330-20-7	8260B
Semivolatile Organic Constituents		
Acenaphthene	83-32-9	8270C
Acenaphthylene	208-96-8	8270C
Acetophenone	98-86-2	8270C
Anthracene	120-12-7	8270C
Atrazine	1912-24-9	8270C
Benzaldehyde	100-52-7	8270C
Benzo[a]anthracene; Benzanthracene	56-55-3	8270C
Benzo[b]fluoranthene	205-99-2	8270C
Benzo[k]fluoranthene	207-08-9	8270C
Benzo[ghi]perylene	191-24-2	8270C
Benzo[a]pyrene	50-32-8	8270C
1,1'-Biphenyl	92-52-4	8270C
Bis(2-chloroethoxy)methane	111-91-1	8270C
Bis(2-chloroethyl)ether	111-44-4	8270C
Bis(2-ethylhexyl) phthalate	117-81-7	8270C
4-Bromophenyl phenyl ether	101-55-3	8270C
Butyl benzyl phthalate; Benzyl butyl phthalate	85-68-7	8270C
Caprolactam	105-60-2	8270C
Carbazole	86-74-8	8270C

TABLE A1-1
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TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
4-Chloroaniline; p-Chloroaniline	106-47-8	8270C
4-Chloro-3-methylphenol; p-Chloro-m-cresol	59-50-7	8270C
2-Chloronaphthalene	91-58-7	8270C
2-Chlorophenol	95-57-8	8270C
4-Chlorophenyl phenyl ether	7005-72-3	8270C
Chrysene	218-01-9	8270C
o-Cresol; 2-Methylphenol	95-48-7	8270C
p-Cresol; 4-Methylphenol	106-44-5	8270C
Dibenz[a,h]anthracene	53-70-3	8270C
Dibenzofuran	132-64-9	8270C
Di-n-butyl phthalate	84-74-2	8270C
1,2-Dichlorobenzene; o-Dichlorobenzene	95-50-1	8270C
1,3-Dichlorobenzene; m-Dichlorobenzene	541-73-1	8270C
1,4-Dichlorobenzene; p-Dichlorobenzene	106-46-7	8270C
3,3'-Dichlorobenzidine	91-94-1	8270C
2,4-Dichlorophenol	120-83-2	8270C
Diethyl phthalate	84-66-2	8270C
2,4-Dimethylphenol	105-67-9	8270C
Dimethyl phthalate	131-11-3	8270C
4,6-Dinitro-2-methylphenol; 4,6-Dinitro-o-cresol	534-52-1	8270C
2,4-Dinitrophenol	51-28-5	8270C
2,4-Dinitrotoluene	121-14-2	8270C
2,6-Dinitrotoluene	606-20-2	8270C
Di-n-octyl phthalate	117-84-0	8270C
Fluoranthene	206-44-0	8270C
Fluorene	86-73-7	8270C
Hexachlorobenzene	118-74-1	8270C
Hexachlorobutadiene	87-68-3	8270C
Hexachlorocyclopentadiene	77-47-4	8270C
Hexachloroethane	67-72-1	8270C
Indeno(1,2,3-cd)pyrene	193-39-5	8270C
Isophorone	78-59-1	8270C
2-Methylnaphthalene	91-57-6	8270C
Naphthalene	91-20-3	8270C
2-Nitroaniline; o-Nitroaniline	88-74-4	8270C
3-Nitroaniline; m-Nitroaniline	99-09-2	8270C
4-Nitroaniline; p-Nitroaniline	100-01-6	8270C
Nitrobenzene	98-95-3	8270C
2-Nitrophenol; o-Nitrophenol	88-75-5	8270C
4-Nitrophenol; p-Nitrophenol	100-02-7	8270C
N-Nitrosodiphenylamine	86-30-6	8270C
N-Nitrosodi-n-propylamine; N-Nitrosodipropylamine; Di-n-propylnitrosamine	621-64-7	8270C
2,2'-Oxybis(1-chloropropane)	108-60-1	8270C
Pentachlorophenol	87-86-5	8270C
Phenanthrene	85-01-8	8270C
Phenol	108-95-2	8270C

TABLE A1-1
CONTRACT LABORATORY PROGRAM (CLP)
TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Pyrene	129-00-0	8270C
1,2,4-Trichlorobenzene	120-82-1	8270C
2,4,5-Trichlorophenol	95-95-4	8270C
2,4,6-Trichlorophenol	88-06-2	8270C
Polychlorinated Biphenyl Aroclors		
Aroclor 1016	12674-11-2	8082
Aroclor 1221	11104-28-2	8082
Aroclor 1232	11141-16-5	8082
Aroclor 1242	53469-21-9	8082
Aroclor 1248	12672-29-6	8082
Aroclor 1254	11097-69-1	8082
Aroclor 1260	11096-82-5	8082
Organochlorine Pesticides		
Aldrin	309-00-2	8081A
alpha-BHC	319-84-6	8081A
beta-BHC	319-85-7	8081A
delta-BHC	319-86-8	8081A
gamma-BHC (Lindane)	58-89-9	8081A
alpha-Chlordane	5103-71-9	8081A
gamma-Chlordane	5103-74-2	8081A
4,4'-DDD	72-54-8	8081A
4,4'-DDE	72-55-9	8081A
4,4'-DDT	50-29-3	8081A
Dieldrin	60-57-1	8081A
Endosulfan I	959-98-8	8081A
Endosulfan II	33213-65-9	8081A
Endosulfan sulfate	1031-07-8	8081A
Endrin	72-20-8	8081A
Endrin aldehyde	7421-93-4	8081A
Endrin ketone	53494-70-5	8081A
Heptachlor	76-44-8	8081A
Heptachlor epoxide	1024-57-3	8081A
Methoxychlor	72-43-5	8081A
Toxaphene	8001-35-2	8081A

Notes:

1 Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2 Chemical Abstracts Service registry number (CAS RN). Where "Total" is entered, all species that contain this element are included.

3 Analytical methods refer to analytical procedure numbers used in the U.S. Environmental Protection Agency (USEPA) publication, SW-846, "Test Methods for Evaluating Solid Waste," Current Edition.

Contract Laboratory Program Target Analyte List developed from the USEPA Superfund Contract Laboratory Program. Available from Internet url: http://www.epa.gov/superfund/programs/clp/target.htm

TABLE A1-2
APPENDIX IX TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Inorganic Constituents		
Antimony	(Total)	6010B
Arsenic	(Total)	6010B
Barium	(Total)	6010B
Beryllium	(Total)	6010B
Cadmium	(Total)	6010B
Chromium	(Total)	6010B
Cobalt	(Total)	6010B
Copper	(Total)	6010B
Cyanide	57-12-5	9012A
Lead	(Total)	6010B
Mercury	(Total)	7471A/7470A
Nickel	(Total)	6010B
Selenium	(Total)	6010B
Silver	(Total)	6010B
Sulfide	18496-25-8	376.1
Thallium	(Total)	6010B
Vanadium	(Total)	6010B
Zinc	(Total)	6010B
Volatile Organic Constituents		
Acetone	67-64-1	8260B
Acetonitrile; Methyl cyanide	75-05-8	8260B
Acrolein	107-02-8	8260B
Acrylonitrile	107-13-1	8260B
Benzene	71-43-2	8260B
Bromodichloromethane	75-27-4	8260B
Bromoform; Tribromomethane	75-25-2	8260B
Bromomethane; Methyl bromide	74-83-9	8260B
Carbon disulfide	75-15-0	8260B
Carbon tetrachloride	56-23-5	8260B
Chlorobenzene	108-90-7	8260B
Chloroethane; Ethyl chloride	75-00-3	8260B
Chloroform	67-66-3	8260B
Chloroprene	126-99-8	8260B
3-Chloropropene; 3-Chloro-1-propene; Allyl chloride	107-05-1	8260B
Dibromochloromethane; Chlorodibromomethane	124-48-1	8260B
1,2-Dibromo-3-chloropropane; DBCP	96-12-8	8260B
1,2-Dibromoethane; Ethylene dibromide (EDB)	106-93-4	8260B
Dibromomethane; Methylene bromide	74-95-3	8260B
trans-1,4-Dichloro-2-butene	110-57-6	8260B
Dichlorodifluoromethane	75-71-8	8260B
1,1-Dichloroethane (1,1-DCA)	75-34-3	8260B
1,2-Dichloroethane; Ethylene dichloride	107-06-2	8260B
1,1-Dichloroethene; 1,1-Dichloroethylene; Vinylidene chloride	75-35-4	8260B
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2	8260B

TABLE A1-2
APPENDIX IX TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
trans-1,2-Dichloroethene; trans-1,2-Dichloroethylene	156-60-5	8260B
1,2-Dichloropropane	78-87-5	8260B
cis-1,3-Dichloropropene	10061-01-5	8260B
trans-1,3-Dichloropropene	10061-02-6	8260B
Ethylbenzene	100-41-4	8260B
Ethyl methacrylate	97-63-2	8260B
2-Hexanone	591-78-6	8260B
Isobutyl alcohol	78-83-1	8260B
Methacrylonitrile	126-98-7	8260B
Methyl chloride; Chloromethane	74-87-3	8260B
Methylene chloride; Dichloromethane	75-09-2	8260B
Methyl ethyl ketone; 2-Butanone; MEK	78-93-3	8260B
Methyl iodide; Iodomethane	74-88-4	8260B
Methyl methacrylate	80-62-6	8260B
4-Methyl-2-pentanone; Methyl isobutyl ketone (MIBK)	108-10-1	8260B
Propionitrile; Ethyl cyanide	107-12-0	8260B
Styrene	100-42-5	8260B
1,1,1,2-Tetrachloroethane	630-20-6	8260B
Tetrachloroethylene; Perchloroethylene; Tetrachlorethene (PCE)	127-18-4	8260B
Toluene	108-88-3	8260B
1,1,1-Trichloroethane; Methylchloroform	71-55-6	8260B
1,1,2-Trichloroethane	79-00-5	8260B
Trichloroethylene; Trichloroethene	79-01-6	8260B
Trichlorofluoromethane	75-69-4	8260B
1,2,3-Trichloropropane	96-18-4	8260B
Vinyl acetate	108-05-4	8260B
Vinyl chloride	75-01-4	8260B
Xylene (total)	1330-20-7	8260B
Semivolatile Organic Constituents		
Acenaphthene	83-32-9	8270C
Acenaphthylene	208-96-8	8270C
Acetophenone	98-86-2	8270C
2-Acetylaminofluorene; 2-AAF	53-96-3	8270C
4-Aminobiphenyl	92-67-1	8270C
Aniline	62-53-3	8270C
Anthracene	120-12-7	8270C
Aramite	140-57-8	8270C
Benzo[a]anthracene; Benzanthracene	56-55-3	8270C
Benzo[b]fluoranthene	205-99-2	8270C
Benzo[k]fluoranthene	207-08-9	8270C
Benzo[ghi]perylene	191-24-2	8270C
Benzo[a]pyrene	50-32-8	8270C
Benzyl alcohol	100-51-6	8270C
Bis(2-chloroethoxy)methane	111-91-1	8270C
Bis(2-chloroethyl)ether	111-44-4	8270C

TABLE A1-2
APPENDIX IX TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Bis(2-chloro-1-methylethyl) ether; 2,2-Di-chlorodiisopropyl ether	108-60-1	8270C
Bis(2-ethylhexyl) phthalate	117-81-7	8270C
4-Bromophenyl phenyl ether	101-55-3	8270C
Butyl benzyl phthalate; Benzyl butyl phthalate	85-68-7	8270C
4-Chloroaniline; p-Chloroaniline	106-47-8	8270C
Chlorobenzilate	510-15-6	8270C
4-Chloro-3-methylphenol; p-Chloro-m-cresol	59-50-7	8270C
2-Chloronaphthalene	91-58-7	8270C
2-Chlorophenol	95-57-8	8270C
4-Chlorophenyl phenyl ether	7005-72-3	8270C
Chrysene	218-01-9	8270C
m-Cresol; 3-Methylphenol	108-39-4	8270C
o-Cresol; 2-Methylphenol	95-48-7	8270C
p-Cresol; 4-Methylphenol	106-44-5	8270C
Dibenz[a,h]anthracene	53-70-3	8270C
Dibenzofuran	132-64-9	8270C
Di-n-butyl phthalate	84-74-2	8270C
1,2-Dichlorobenzene; o-Dichlorobenzene	95-50-1	8270C
1,3-Dichlorobenzene; m-Dichlorobenzene	541-73-1	8270C
1,4-Dichlorobenzene; p-Dichlorobenzene	106-46-7	8270C
3,3'-Dichlorobenzidine	91-94-1	8270C
2,4-Dichlorophenol	120-83-2	8270C
2,6-Dichlorophenol	87-65-0	8270C
Diethyl phthalate	84-66-2	8270C
O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	297-97-2	8270C
Dimethoate	60-51-5	8270C
p-(Dimethylamino)azobenzene	60-11-7	8270C
7,12-Dimethylbenz[a]anthracene	57-97-6	8270C
3,3-Dimethylbenzidine	119-93-7	8270C
alpha, alpha-Dimethylphenethylamine	122-09-8	8270C
2,4-Dimethylphenol	105-67-9	8270C
Dimethyl phthalate	131-11-3	8270C
1,2-Dinitrobenzene; o-Dinitrobenzene	528-29-0	8270C
m-Dinitrobenzene; 1,3-Dinitrobenzene	99-65-0	8270C
4,6-Dinitro-2-methylphenol; 4,6-Dinitro-o-cresol	534-52-1	8270C
2,4-Dinitrophenol	51-28-5	8270C
2,4-Dinitrotoluene	121-14-2	8270C
2,6-Dinitrotoluene	606-20-2	8270C
Di-n-octyl phthalate	117-84-0	8270C
1,4-Dioxane	123-91-1	8270C
Diphenylamine	122-39-4	8270C
Disulfoton	298-04-4	8270C
Ethyl methanesulfonate	62-50-0	8270C
Famphur	52-85-7	8270C
Fluoranthene	206-44-0	8270C

TABLE A1-2
APPENDIX IX TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Fluorene	86-73-7	8270C
Hexachlorobenzene	118-74-1	8270C
Hexachlorobutadiene	87-68-3	8270C
Hexachlorocyclopentadiene	77-47-4	8270C
Hexachloroethane	67-72-1	8270C
Hexachloropropene	1888-71-7	8270C
Indeno(1,2,3-cd)pyrene	193-39-5	8270C
Isophorone	78-59-1	8270C
Isosafrole	120-58-1	8270C
Methapyrilene	91-80-5	8270C
3-Methylcholanthrene	56-49-5	8270C
Methyl methanesulfonate	66-27-3	8270C
2-Methylnaphthalene	91-57-6	8270C
Naphthalene	91-20-3	8270C
1,4-Naphthoquinone	130-15-4	8270C
1-Naphthylamine	134-32-7	8270C
2-Naphthylamine	91-59-8	8270C
2-Nitroaniline; o-Nitroaniline	88-74-4	8270C
3-Nitroaniline; m-Nitroaniline	99-09-2	8270C
4-Nitroaniline; p-Nitroaniline	100-01-6	8270C
Nitrobenzene	98-95-3	8270C
2-Nitrophenol; o-Nitrophenol	88-75-5	8270C
4-Nitrophenol; p-Nitrophenol	100-02-7	8270C
4-Nitroquinoline 1-oxide	56-57-5	8270C
N-Nitrosodi-n-butylamine	924-16-3	8270C
N-Nitrosodiethylamine	55-18-5	8270C
N-Nitrosodimethylamine	62-75-9	8270C
N-Nitrosodiphenylamine	86-30-6	8270C
N-Nitrosodi-n-propylamine; N-Nitrosodipropylamine; Di-n-propylnitrosamine	621-64-7	8270C
N-Nitrosomethylethylamine	10595-95-6	8270C
N-Nitrosomorpholine	59-89-2	8270C
N-Nitrosopiperidine	100-75-4	8270C
N-Nitrosopyrrolidine	930-55-2	8270C
5-Nitro-o-toluidine	99-55-8	8270C
Pentachlorobenzene	608-93-5	8270C
Pentachloronitrobenzene	82-68-8	8270C
Pentachlorophenol	87-86-5	8270C
Phenacetin	62-44-2	8270C
Phenanthrene	85-01-8	8270C
Phenol	108-95-2	8270C
p-Phenylenediamine	106-50-3	8270C
Phorate	298-02-2	8270C
2-Picoline	109-06-8	8270C
Pronamide	23950-58-5	8270C
Pyrene	129-00-0	8270C

TABLE A1-2
APPENDIX IX TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Pyridine	110-86-1	8270C
Safrole	94-59-7	8270C
Sulfotepp; Tetraethyl dithiopyrophosphate	3689-24-5	8270C
1,2,4,5-Tetrachlorobenzene	95-94-3	8270C
2,3,4,6-Tetrachlorophenol	58-90-2	8270C
o-Toluidine	95-53-4	8270C
1,2,4-Trichlorobenzene	120-82-1	8270C
2,4,5-Trichlorophenol	95-95-4	8270C
2,4,6-Trichlorophenol	88-06-2	8270C
O,O,O-Triethyl phosphorothioate	126-68-1	8270C
1,3,5-Trinitrobenzene; sym-Trinitrobenzene	99-35-4	8270C
Polychlorinated Biphenyl Aroclors		
Aroclor 1016	12674-11-2	8082
Aroclor 1221	11104-28-2	8082
Aroclor 1232	11141-16-5	8082
Aroclor 1242	53469-21-9	8082
Aroclor 1248	12672-29-6	8082
Aroclor 1254	11097-69-1	8082
Aroclor 1260	11096-82-5	8082
Organochlorine Pesticides		
Aldrin	309-00-2	8081A
alpha-BHC	319-84-6	8081A
beta-BHC	319-85-7	8081A
delta-BHC	319-86-8	8081A
gamma-BHC (Lindane)	58-89-9	8081A
Chlordane	57-74-9	8081A
Chlorobenzilate	510-15-6	8081A
4,4'-DDD	72-54-8	8081A
4,4'-DDE	72-55-9	8081A
4,4'-DDT	50-29-3	8081A
Diallate	2303-16-4	8081A
Dieldrin	60-57-1	8081A
Endosulfan I	959-98-8	8081A
Endosulfan II	33213-65-9	8081A
Endosulfan sulfate	1031-07-8	8081A
Endrin	72-20-8	8081A
Endrin aldehyde	7421-93-4	8081A
Heptachlor	76-44-8	8081A
Heptachlor epoxide	1024-57-3	8081A
Isodrin	465-73-6	8081A
Kepone	143-50-0	8081A
Methoxychlor	72-43-5	8081A
Toxaphene	8001-35-2	8081A

TABLE A1-2
APPENDIX IX TARGET ANALYTE LIST
Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]
Dioxins/Furans		
Total Hexachlorodibenzo-*p*-dioxin; HxCDD	34465-46-8	8280A
Total Hexachlorodibenzofuran; HxCDF	55684-94-1	8280A
Total Pentachlorodibenzo-*p*-dioxin; PeCDD	36088-22-9	8280A
Total Pentachlorodibenzofuran; PeCDF	30402-15-4	8280A
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin; TCDD	1746-01-6	8280A
Total Tetrachlorodibenzo-*p*-dioxin; TCDD	41903-57-5	8280A
Total Tetrachlorodibenzofuran; TCDF	55722-27-5	8280A

Notes:

1 Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2 Chemical Abstracts Service registry number (CAS RN). Where "Total" is entered, all species that contain this element are included.

3 Analytical methods refer to analytical procedure numbers used in the U.S. Environmental Protection Agency (USEPA) publication, SW-846, "Test Methods for Evaluating Solid Waste," Current Edition.

Appendix IX Target Analyte List developed from Title 40 of the Code of Federal Regulations, Part 264, Appendix IX.

TABLE A1-3
GEOTECHNICAL AND GENERAL WATER QUALITY PARAMETERS
Morton Facility
Reading, Ohio

PARAMETER	METHOD REFERENCE	MATRICES
GEOTECHNICAL		
Atterberg Limits	ASTM D4318	Soil
Moisture content	ASTM D2216	Soil
Cation Exchange Capcity (CEC)	SW-846 9081	Soil/Sediment
pH	ASTM D2976	Soil/Sediment
Grain size distribution (Sieve Analysis)	ASTM D421, 422	Soil/Sediment
Total Organic Carbon (TOC)	Walkley Black	Soil/Sediment
GENERAL WATER QUALITY		
Total Suspended Solids (TSS)	40 CFR Part 136 160.2	Surface Water
Alkalinity/Bi-carbonate/Carbonate	40 CFR Part 136 310.1	Surface Water / Groundwater
Ammonia-Nitrogen (NH_3^-)	40 CFR Part 136 350.1	Surface Water / Groundwater
Nitrate/Nitrite (NO_3^- / NO_2^-)	40 CFR Part 136 353.2	Surface Water / Groundwater
Phosphate (PO_4^{-3})	40 CFR Part 136 365.2	Surface Water / Groundwater
Phosphorous	40 CFR Part 136 365.2	Surface Water / Groundwater
Total Dissolved Solids (TDS)	40 CFR Part 136 160.1	Surface Water / Groundwater
Calcium (total and dissolved)	SW-846 6010B	Surface Water / Groundwater
Chloride	40 CFR Part 325.3 or 300.0	Surface Water / Groundwater
Ferric Iron (Fe^{+2})	SM SW-846 3500 FE-D	Surface Water / Groundwater
Ferrous Iron (Fe^{+3})	SM SW-846 3500 D	Surface Water / Groundwater
Iron (total and dissolved)	SW-846 6010B	Surface Water / Groundwater
Magnesium (total and dissolved)	SW-846 6010B	Surface Water / Groundwater
Potassium (total and dissolved)	SW-846 6010B	Surface Water / Groundwater
Sodium (total and dissolved)	SW-846 6010B	Surface Water / Groundwater
Total Organic Carbon (TOC)	40 CFR Part 136 415.1 / ASTM D2974	Surface Water / Groundwater

Notes:
ASTM = American Society of Testing and Materials.
CFR = Code of Federal Regulations.
Analytical methods refer to analytical procedure numbers used in the U.S. Environmental Protection Agency (USEPA) publication, SW-846, "Test Methods for Evaluating Solid Waste," Current Edition.

TABLE A1-4
FIELD PARAMETERS
Morton Facility
Reading, Ohio

Common name	Analytical Method	Matrix Type
Dissolved Oxygen	Field Meter	Groundwater / Surface water
pH	Field Meter	Groundwater / Surface water
Specific Conductance	Field Meter	Groundwater / Surface water
Temperature	Field Meter	Groundwater / Surface water
Turbidity	Field Meter	Groundwater
Water Levels	Field Meter	Groundwater
Total Organic Vapors (Headspace)	Field Organic Vapor Meter	Soil

TABLE A1-5
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SOIL MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
Aluminum	(Total)	6010B	--	CLP	20	1.1	NE	76000
Antimony	(Total)	6010B	IX	CLP	1	0.49	0.1423	5
Arsenic	(Total)	6010B	IX	CLP	1	0.3	5.7	2.7
Barium	(Total)	6010B	IX	CLP	20	0.13	1.04	1600
Beryllium	(Total)	6010B	IX	CLP	0.5	0.046	1.06	63
Cadmium	(Total)	6010B	IX	CLP	0.2	0.043	0.00222	8
Calcium	(Total)	6010B	--	CLP	500	37	NE	NE
Chromium	(Total)	6010B	IX	CLP	0.5	0.38	0.4	38
Cobalt	(Total)	6010B	IX	CLP	5	0.15	0.14433	100000
Copper	(Total)	6010B	IX	CLP	2.5	0.27	0.3132	76000
Cyanide	57-12-5	9012A	IX	CLP	0.5	0.17	1.33	40
Iron	(Total)	6010B	--	CLP	10	6.6	NE	23000
Lead	(Total)	6010B	IX	CLP	0.3	0.24	0.05373	1000
Magnesium	(Total)	6010B	--	CLP	500	12	NE	NE
Manganese	(Total)	6010B	--	CLP	1.5	0.15	NE	1800
Mercury	(Total)	7471A	IX	CLP	0.1	0.0084	0.1	2
Nickel	(Total)	6010B	IX	CLP	4	0.27	13.6	130
Potassium	(Total)	6010B	--	CLP	500	5.1	NE	NE
Selenium	(Total)	6010B	IX	CLP	0.5	0.31	0.02765	5
Silver	(Total)	6010B	IX	CLP	0.5	0.15	4.04	34
Sodium	(Total)	6010B	--	CLP	500	50	NE	NE
Sulfide	18496-25-8	376.1	IX	CLP	50	21.5	0.00358	NE
Thallium	(Total)	6010B	IX	CLP	1	0.5	0.05692	0.7
Tin	(Total)	6010B	IX	--	10	0.66	1.59	100000
Vanadium	(Total)	6010B	IX	CLP	5	0.13	7.62	6000
Zinc	(Total)	6010B	IX	CLP	2	1.2	6.62	12000
Acetone	67-64-1	8260B	IX	CLP	0.02	0.0016	2.5	16
Acetonitrile; Methyl cyanide	75-05-8	8260B	IX	--	0.1	0.01	1.37	1700
Acrolein	107-02-8	8260B	IX	--	0.1	0.0076	5.27	0.34
Acrylonitrile	107-13-1	8260B	IX	--	0.1	0.0057	0.0239	0.51
Benzene	71-43-2	8260B	IX	CLP	0.005	0.0001	0.114	0.03
Bromochloromethane	74-97-5	8260B	--	CLP	0.005	0.00063	NE	NE
Bromodichloromethane	75-27-4	8260B	IX	CLP	0.005	0.000079	NE	0.6
Bromoform; Tribromomethane	75-25-2	8260B	IX	CLP	0.005	0.00051	0.466	0.8
Bromomethane; Methyl bromide	74-83-9	8260B	IX	CLP	0.01	0.00013	NE	13
Carbon disulfide	75-15-0	8260B	IX	CLP	0.005	0.000083	0.0841	32
Carbon tetrachloride	56-23-5	8260B	IX	CLP	0.005	0.0001	0.0059	0.07
Chlorobenzene	108-90-7	8260B	IX	CLP	0.005	0.00087	0.01	1
Chloroethane; Ethyl chloride	75-00-3	8260B	IX	CLP	0.01	0.00019	230	6.5
Chloroform	67-66-3	8260B	IX	CLP	0.005	0.000062	0.079	0.52
Chloroprene	126-99-8	8260B	IX	--	0.005	0.005	0.0029	12
3-Chloropropene; 3-Chloro-1-propene; Allyl chloride	107-05-1	8260B	IX	--	0.01	0.01	NE	43000
Cyclohexane	110-82-7	8260B	--	CLP	0.01	0.0011	NE	NE

TABLE A1-5
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SOIL MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN[2]	Analytical Method[3]	Target Analyte List[4]		RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
Dibromochloromethane; Chlorodibromomethane	124-48-1	8260B	IX	CLP	0.005	0.00024	6.4	0.4
1,2-Dibromo-3-chloropropane; DBCP	96-12-8	8260B	IX	CLP	0.01	0.00038	0.0112	4.0
1,2-Dibromoethane; Ethylene dibromide (EDB)	106-93-4	8260B	IX	CLP	0.005	0.0018	0.0225	0.048
Dibromomethane; Methylene bromide	74-95-3	8260B	IX	--	0.005	0.000065	NE	240
trans-1,4-Dichloro-2-butene	110-57-6	8260B	IX	--	0.005	0.00087	NE	NE
Dichlorodifluoromethane	75-71-8	8260B	IX	CLP	0.01	0.00015	39.5	310
1,1-Dichloroethane (1,1-DCA)	75-34-3	8260B	IX	CLP	0.005	0.0001	0.047	23
1,2-Dichloroethane; Ethylene dichloride	107-06-2	8260B	IX	CLP	0.005	0.000088	21.2	0.02
1,1-Dichloroethene; 1,1-Dichloroethylene; Vinylidene chloride	75-35-4	8260B	IX	CLP	0.005	0.0002	8.28	0.06
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2	8260B	IX	CLP	0.0025	0.00024	NE	150
trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	156-60-5	8260B	IX	CLP	0.0025	0.00021	0.78373	0.7
1,2-Dichloropropane	78-87-5	8260B	IX	CLP	0.005	0.00013	0.327	0.03
cis-1,3-Dichloropropene	10061-01-5	8260B	IX	CLP	0.005	0.00046	0.39786	0.004
trans-1,3-Dichloropropene	10061-02-6	8260B	IX	CLP	0.005	0.0001	0.39786	0.004
Ethylbenzene	100-41-4	8260B	IX	CLP	0.005	0.00099	5.16	13
Ethyl methacrylate	97-63-2	8260B	IX	--	0.005	0.0005	30	140
2-Hexanone	591-78-6	8260B	IX	CLP	0.02	0.0014	12.6	NE
Isopropylbenzene; cumene	98-82-8	8260B	--	CLP	0.005	0.0067	NE	520
Isobutyl alcohol	78-83-1	8260B	IX	--	0.2	0.2	20.8	4000
Methacrylonitrile	126-98-7	8260B	IX	--	0.005	0.005	0.05705	8.8
Methyl acetate	79-20-9	8260B	--	CLP	0.01	0.0025	NE	96000
Methyl chloride; Chloromethane	74-87-3	8260B	IX	CLP	0.01	0.00066	10.4	2.7
Methyl cyclohexane	108-87-2	8260B	--	CLP	0.01	0.00098	NE	8800
Methylene chloride; Dichloromethane	75-09-2	8260B	IX	CLP	0.005	0.0007	4.05	0.02
Methyl ethyl ketone; 2-Butanone; MEK	78-93-3	8260B	IX	CLP	0.02	0.0017	89.6	28000
Methyl iodide; Iodomethane	74-88-4	8260B	IX	--	0.005	0.000054	1.23	NE
Methyl methacrylate	80-62-6	8260B	IX	--	0.005	0.005	984	2700
4-Methyl-2-pentanone; Methyl isobutyl ketone (MIBK)	108-10-1	8260B	IX	CLP	0.02	0.00079	443	2900
Methyl tert-butyl ether	1634-04-4	8260B	--	CLP	0.02	0.00044	NE	NE
Propionitrile; Ethyl cyanide	107-12-0	8260B	IX	--	0.02	0.02	0.04893	NE
Styrene	100-42-5	8260B	IX	CLP	0.005	0.001	4.69	4
1,1,1,2-Tetrachloroethane	630-20-6	8260B	IX	--	0.005	0.00023	225	7.0
1,1,2,2-Tetrachloroethane	79-34-5	8260B	--	CLP	0.005	0.00061	0.12722	0.003
Tetrachloroethylene; Perchloroethylene; Tetrachlorethene (PCE)	127-18-4	8260B	IX	CLP	0.005	0.0007	9.92	0.06

TABLE A1-5
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SOIL MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN[2]	Analytical Method[3]	Target Analyte List[4]		RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
Toluene	108-88-3	8260B	IX	CLP	0.005	0.00067	5.45	12
1,1,1-Trichloroethane; Methylchloroform	71-55-6	8260B	IX	CLP	0.005	0.000062	29.8	2
1,1,2-Trichloroethane	79-00-5	8260B	IX	CLP	0.005	0.0012	28.6	0.02
Trichloroethylene; Trichloroethene	79-01-6	8260B	IX	CLP	0.005	0.0001	12.4	0.06
Trichlorofluoromethane	75-69-4	8260B	IX	CLP	0.01	0.0001	16.4	2000
1,2,3-Trichloropropane	96-18-4	8260B	IX	--	0.005	0.00069	3.36	0.0031
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	8260B	--	CLP	0.005	0.0013	NE	5600
Vinyl acetate	108-05-4	8260B	IX	--	0.01	0.00061	12.7	170
Vinyl chloride	75-01-4	8260B	IX	CLP	0.01	0.0005	0.64614	0.01
Xylenes (total)	1330-20-7	8260B	IX	CLP	0.01	0.0029	10	190
Acenaphthene	83-32-9	8270C	IX	CLP	0.33	0.035	682	570
Acenaphthylene	208-96-8	8270C	IX	CLP	0.33	0.035	682	570[6]
Acetophenone	98-86-2	8270C	IX	CLP	0.33	0.028	300	1.6
2-Acetylaminofluorene; 2-AAF	53-96-3	8270C	IX	--	3.3	0.029	0.596	NE
4-Aminobiphenyl	92-67-1	8270C	IX	--	1.6	0.27	0.00305	NE
Aniline	62-53-3	8270C	IX	--	0.33	0.038	0.05678	430
Anthracene	120-12-7	8270C	IX	CLP	0.33	0.037	1480	12000
Aramite	140-57-8	8270C	IX	--	0.66	0.025	166	99
Atrazine	1912-24-9	8270C	--	CLP	0.33	0.024	NE	11
Benzaldehyde	100-52-7	8270C	--	CLP	0.33	0.098	NE	88000
Benzo[a]anthracene; Benzanthracene	56-55-3	8270C	IX	CLP	0.33	0.035	5.21	2
Benzo[b]fluoranthene	205-99-2	8270C	IX	CLP	0.33	0.035	59.8	2.9
Benzo[k]fluoranthene	207-08-9	8270C	IX	CLP	0.33	0.041	148	29
Benzo[ghi]perylene	191-24-2	8270C	IX	CLP	0.33	0.045	119	4300[6]
Benzo[a]pyrene	50-32-8	8270C	IX	CLP	0.33	0.033	1.52	0.29
Benzyl alcohol	100-51-6	8270C	IX	--	0.33	0.036	65.8	100000
1,1'-Biphenyl	92-52-4	8270C	--	CLP	0.33	0.017	NE	350
Bis(2-chloroethoxy)methane	111-91-1	8270C	IX	CLP	0.33	0.035	NE	NE
Bis(2-chloroethyl)ether	111-44-4	8270C	IX	CLP	0.33	0.033	23.7	0.0004
Bis(2-chloro-1-methylethyl) ether; 2,2-Di-chlorodiisopropyl ether	108-60-1	8270C	IX	--	0.33	0.093	19.9	35
Bis(2-ethylhexyl) phthalate	117-81-7	8270C	IX	CLP	0.33	0.065	0.92594	180
4-Bromophenyl phenyl ether	101-55-3	8270C	IX	CLP	0.33	0.035	NE	NE
Butyl benzyl phthalate; Benzyl butyl phthalate	85-68-7	8270C	IX	CLP	0.33	0.044	0.23889	930
Caprolactam	105-60-2	8270C	--	CLP	0.33	0.044	NE	100000
Carbazole	86-74-8	8270C	--	CLP	0.33	0.042	NE	120
4-Chloroaniline; p-Chloroaniline	106-47-8	8270C	IX	CLP	0.33	0.033	1.1	0.7
Chlorobenzilate	510-15-6	8270C	IX	--	0.33	0.15	5.05	9.1
4-Chloro-3-methylphenol; p-Chloro-m-cresol	59-50-7	8270C	IX	CLP	0.33	0.031	7.95	NE
2-Chloronaphthalene	91-58-7	8270C	IX	CLP	0.33	0.032	0.01218	27000
2-Chlorophenol	95-57-8	8270C	IX	CLP	0.33	0.028	0.24266	4

TABLE A1-5
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Morton Facility
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Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
4-Chlorophenyl phenyl ether	7005-72-3	8270C	IX	CLP	0.33	0.036	NE	NE
Chrysene	218-01-9	8270C	IX	CLP	0.33	0.05	4.73	160
m-Cresol; 3-Methylphenol	108-39-4	8270C	IX	--	0.33	0.16	3.49	44000
o-Cresol; 2-Methylphenol	95-48-7	8270C	IX	CLP	0.33	0.037	40.4	15
p-Cresol; 4-Methylphenol	106-44-5	8270C	IX	CLP	0.33	0.027	163	4400
Dibenz[a,h]anthracene	53-70-3	8270C	IX	CLP	0.33	0.038	18.4	0.29
Dibenzofuran	132-64-9	8270C	IX	CLP	0.33	0.036	NE	5100
Di-n-butyl phthalate	84-74-2	8270C	IX	CLP	0.33	0.059	0.14979	2300
1,2-Dichlorobenzene; o-Dichlorobenzene	95-50-1	8270C	IX	CLP	0.33	0.029	2.96	17
1,3-Dichlorobenzene; m-Dichlorobenzene	541-73-1	8270C	IX	CLP	0.33	0.032	37.7	52
1,4-Dichlorobenzene; p-Dichlorobenzene	106-46-7	8270C	IX	CLP	0.33	0.036	0.54559	2
3,3'-Dichlorobenzidine	91-94-1	8270C	IX	CLP	1.6	0.14	0.64636	0.007
2,4-Dichlorophenol	120-83-2	8270C	IX	CLP	0.33	0.045	87.5	1
2,6-Dichlorophenol	87-65-0	8270C	IX	--	0.33	0.16	1.17	NE
Diethyl phthalate	84-66-2	8270C	IX	CLP	0.33	0.038	24.8	470
O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	297-97-2	8270C	IX	--	1.6	0.026	0.7994	NE
Dimethoate	60-51-5	8270C	IX	--	0.66	0.026	0.21802	180
p-(Dimethylamino)azobenzene	60-11-7	8270C	IX	--	0.66	0.16	NE	NE
7,12-Dimethylbenz[a]anthracene	57-97-6	8270C	IX	--	0.66	0.067	16.3	NE
3,3-Dimethylbenzidine	119-93-7	8270C	IX	--	1.6	0.4	0.1042	0.27
alpha, alpha-Dimethylphenethylamine	122-09-8	8270C	IX	--	1.6	0.53	0.30016	880
2,4-Dimethylphenol	105-67-9	8270C	IX	CLP	0.33	0.057	0.01	9
Dimethyl phthalate	131-11-3	8270C	IX	CLP	0.33	0.036	734	100000
1,2-Dinitrobenzene; o-Dinitrobenzene	528-29-0	8270C	IX	--	0.33	0.07	NE	350
m-Dinitrobenzene; 1,3-Dinitrobenzene	99-65-0	8270C	IX	--	0.33	0.14	0.6547	88
4,6-Dinitro-2-methylphenol; 4,6-Dinitro-o-cresol	534-52-1	8270C	IX	CLP	1.6	0.18	NE	NE
2,4-Dinitrophenol	51-28-5	8270C	IX	CLP	1.6	0.15	0.06086	0.3
2,4-Dinitrotoluene	121-14-2	8270C	IX	CLP	0.33	0.041	1.28	0.0008
2,6-Dinitrotoluene	606-20-2	8270C	IX	CLP	0.33	0.03	0.03283	0.0007
Di-n-octyl phthalate	117-84-0	8270C	IX	CLP	0.33	0.05	709	10000
1,4-Dioxane	123-91-1	8270C	IX	--	0.33	0.027	2.05	220
Diphenylamine	122-39-4	8270C	IX	--	0.33	0.037	1.01	22000
Disulfoton	298-04-4	8270C	IX	--	1.6	0.03	0.01988	35
Ethyl methanesulfonate	62-50-0	8270C	IX	--	0.33	0.15	NE	NE
Famphur	52-85-7	8270C	IX	--	3.3	0.048	0.0497	NE
Fluoranthene	206-44-0	8270C	IX	CLP	0.33	0.038	122	4300
Fluorene	86-73-7	8270C	IX	CLP	0.33	0.029	122	560

TABLE A1-5
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Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
Hexachlorobenzene	118-74-1	8270C	IX	CLP	0.33	0.041	0.19878	1.5
Hexachlorobutadiene	87-68-3	8270C	IX	CLP	0.33	0.031	0.03976	2
Hexachlorocyclopentadiene	77-47-4	8270C	IX	CLP	1.6	0.15	0.75537	400
Hexachloroethane	67-72-1	8270C	IX	CLP	0.33	0.04	0.59634	0.5
Hexachloropropene	1888-71-7	8270C	IX	--	3.3	0.14	0.19878	NE
Indeno(1,2,3-cd)pyrene	193-39-5	8270C	IX	CLP	0.33	0.042	109	2.9
Isophorone	78-59-1	8270C	IX	CLP	0.33	0.032	139	0.5
Isosafrole	120-58-1	8270C	IX	--	0.66	0.17	99.4	NE
Methapyrilene	91-80-5	8270C	IX	--	1.6	0.33	2.78	NE
3-Methylcholanthrene	56-49-5	8270C	IX	--	0.66	0.095	NE	NE
Methyl methanesulfonate	66-27-3	8270C	IX	--	0.33	0.027	0.31549	NE
2-Methylnaphthalene	91-57-6	8270C	IX	CLP	0.33	0.033	3.24	84 [6]
Naphthalene	91-20-3	8270C	IX	CLP	0.33	0.035	0.09939	84
1,4-Naphthoquinone	130-15-4	8270C	IX	--	1.6	0.16	1.67	NE
1-Naphthylamine	134-32-7	8270C	IX	--	0.33	0.16	9.34	NE
2-Naphthylamine	91-59-8	8270C	IX	--	0.33	0.14	3.03	NE
2-Nitroaniline; o-Nitroaniline	88-74-4	8270C	IX	CLP	1.6	0.033	74.1	50
3-Nitroaniline; m-Nitroaniline	99-09-2	8270C	IX	CLP	1.6	0.033	3.16	NE
4-Nitroaniline; p-Nitroaniline	100-01-6	8270C	IX	CLP	1.6	0.047	21.9	NE
Nitrobenzene	98-95-3	8270C	IX	CLP	0.33	0.032	1.31	0.1
2-Nitrophenol; o-Nitrophenol	88-75-5	8270C	IX	CLP	0.33	0.044	1.6	NE
4-Nitrophenol; p-Nitrophenol	100-02-7	8270C	IX	CLP	1.6	0.35	5.12	7000
4-Nitroquinoline 1-oxide	56-57-5	8270C	IX	--	3.3	0.2	0.12222	NE
N-Nitrosodi-n-butylamine	924-16-3	8270C	IX	--	0.33	0.15	NE	0.06
N-Nitrosodiethylamine	55-18-5	8270C	IX	--	0.33	0.03	0.06933	0.016
N-Nitrosodimethylamine	62-75-9	8270C	IX	--	0.33	0.035	0.0000321	0.048
N-Nitrosodiphenylamine	86-30-6	8270C	IX	CLP	0.33	0.037	0.54514	1
N-Nitrosodi-n-propylamine; N-Nitrosodipropylamine; Di-n-propylnitrosamine	621-64-7	8270C	IX	CLP	0.33	0.031	NE	0.00005
N-Nitrosomethylethylamine	10595-95-6	8270C	IX	--	0.33	0.096	0.00166	0.11
N-Nitrosomorpholine	59-89-2	8270C	IX	--	0.33	0.14	0.07057	NE
N-Nitrosopiperidine	100-75-4	8270C	IX	--	0.33	0.14	0.00665	NE
N-Nitrosopyrrolidine	930-55-2	8270C	IX	--	0.33	0.14	0.01256	1.2
5-Nitro-o-toluidine	99-55-8	8270C	IX	--	0.66	0.026	NE	75
2,2'-Oxybis(1-chloropropane)	108-60-1	8270C	--	CLP	0.33	0.093	NE	8.1
Pentachlorobenzene	608-93-5	8270C	IX	--	0.33	0.024	0.49695	700
Pentachloronitrobenzene	82-68-8	8270C	IX	--	1.6	0.18	7.09	9.5
Pentachlorophenol	87-86-5	8270C	IX	CLP	0.33	0.034	0.11927	0.03
Phenacetin	62-44-2	8270C	IX	--	0.66	0.024	117	NE
Phenanthrene	85-01-8	8270C	IX	CLP	0.33	0.043	45.7	12000 [6]
Phenol	108-95-2	8270C	IX	CLP	0.33	0.035	120	100
p-Phenylenediamine	106-50-3	8270C	IX	--	3.3	0.17	1.61	100000
Phorate	298-02-2	8270C	IX	--	1.6	0.026	0.496	180

TABLE A1-5
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SOIL MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
2-Picoline	109-06-8	8270C	IX	--	0.66	0.15	9.9	NE
Pronamide	23950-58-5	8270C	IX	--	0.66	0.16	0.0136	66000
Pyrene	129-00-0	8270C	IX	CLP	0.33	0.057	78.5	4200
Pyridine	110-86-1	8270C	IX	--	0.66	0.049	1.03	880
Safrole	94-59-7	8270C	IX	--	0.66	0.027	0.40398	NE
Sulfotepp; Tetraethyl dithiopyrophosphate	3689-24-5	8270C	IX	--	1.6	0.031	0.59634	440
1,2,4,5-Tetrachlorobenzene	95-94-3	8270C	IX	--	0.33	0.17	2.02	260
2,3,4,6-Tetrachlorophenol	58-90-2	8270C	IX	--	1.6	0.029	0.19878	26000
o-Toluidine	95-53-4	8270C	IX	--	0.66	0.095	2.97	10
1,2,4-Trichlorobenzene	120-82-1	8270C	IX	CLP	0.33	0.038	11.1	5
2,4,5-Trichlorophenol	95-95-4	8270C	IX	CLP	0.33	0.069	14.1	270
2,4,6-Trichlorophenol	88-06-2	8270C	IX	CLP	0.33	0.057	9.94	0.2
O,O,O-Triethyl phosphorothioate	126-68-1	8270C	IX	--	1.6	0.15	0.81757	NE
1,3,5-Trinitrobenzene; sym-Trinitrobenzene	99-35-4	8270C	IX	--	1.6	0.16	0.37615	26000
Aroclor 1016	12674-11-2	8082	IX	CLP	0.033	0.0053	0.000332 [7]	29
Aroclor 1221	11104-28-2	8082	IX	CLP	0.033	0.019	0.000332 [7]	1.00
Aroclor 1232	11141-16-5	8082	IX	CLP	0.033	0.011	0.000332 [7]	1.00
Aroclor 1242	53469-21-9	8082	IX	CLP	0.033	0.018	0.000332 [7]	1.00
Aroclor 1248	12672-29-6	8082	IX	CLP	0.033	0.0046	0.000332 [7]	1.00
Aroclor 1254	11097-69-1	8082	IX	CLP	0.033	0.02	0.000332 [7]	1.00
Aroclor 1260	11096-82-5	8082	IX	CLP	0.033	0.0074	0.000332 [7]	1.00
Aldrin	309-00-2	8081A	IX	CLP	0.0017	0.00055	NE	0.15
alpha-BHC	319-84-6	8081A	IX	CLP	0.0017	0.00046	0.09939	0.0005
beta-BHC	319-85-7	8081A	IX	CLP	0.0017	0.00046	0.00396	0.003
delta-BHC	319-86-8	8081A	IX	CLP	0.0017	0.00048	9.94	NE
gamma-BHC (Lindane)	58-89-9	8081A	IX	CLP	0.0017	0.00057	0.005	0.009
alpha-Chlordane	5103-71-9	8081A	--	CLP	0.0017	0.00059	NE [8]	NE
gamma-Chlordane	5103-74-2	8081A	--	CLP	0.0017	0.00057	NE [8]	NE
Chlordane	57-74-9	8081A	IX	--	0.017	0.0048	0.224 [8]	10
Chlorobenzilate	510-15-6	8081A	IX	--	0.0033	0.0033	5.05	9.1
4,4'-DDD	72-54-8	8081A	IX	CLP	0.0017	0.00079	0.75815	16
4,4'-DDE	72-55-9	8081A	IX	CLP	0.0017	0.00057	0.59587	12
4,4'-DDT	50-29-3	8081A	IX	CLP	0.0017	0.0013	0.0175	12
Diallate	2303-16-4	8081A	IX	--	0.033	0.033	0.45214	40
Dieldrin	60-57-1	8081A	IX	CLP	0.0017	0.0015	0.00238	0.004
Endosulfan I	959-98-8	8081A	IX	CLP	0.0017	0.00067	0.11927	NE
Endosulfan II	33213-65-9	8081A	IX	CLP	0.0017	0.00038	0.11927	NE
Endosulfan sulfate	1031-07-8	8081A	IX	CLP	0.0017	0.00028	0.03578	NE
Endrin	72-20-8	8081A	IX	CLP	0.0017	0.00061	0.0101	1
Endrin aldehyde	7421-93-4	8081A	IX	CLP	0.0017	0.0015	0.0105	NE

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Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
Endrin ketone	53494-70-5	8081A	--	CLP	0.0017	0.00026	NE	NE
Heptachlor	76-44-8	8081A	IX	CLP	0.0017	0.00061	0.00598	0.55
Heptachlor epoxide	1024-57-3	8081A	IX	CLP	0.0017	0.00066	0.15188	0.27
Isodrin	465-73-6	8081A	IX	--	0.0033	0.00076	0.00332	NE
Kepone	143-50-0	8081A	IX	--	0.033	0.016	0.03272	0.14
Methoxychlor	72-43-5	8081A	IX	CLP	0.0033	0.00082	0.01988	160
Toxaphene	8001-35-2	8081A	IX	CLP	0.067	0.0069	0.11927	2.2
Total Hexachlorodibenzo-*p*-dioxin (HxCDD)	34465-46-8	8280A	IX	--	0.0025	0.00048	0.000000199 [9]	0.0004
Total Hexachlorodibenzofuran (HxCDF)	55684-94-1	8280A	IX	--	0.0025	0.00028	0.000000199 [9]	0.000027
Total Pentachlorodibenzo-*p*-dioxin (PeCDD)	36088-22-9	8280A	IX	--	0.0025	0.00029	0.000000199 [9]	0.000027
Total Pentachlorodibenzofuran (PeCDF)	30402-15-4	8280A	IX	--	0.0025	0.00032	0.000000199 [9]	0.000027
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD)	1746-01-6	8280A	IX	--	0.001	0.0001	0.000000199 [9]	0.000027
Total Tetrachlorodibenzo-*p*-dioxin (TCDD)	41903-57-5	8280A	IX	--	0.001	0.0001	0.000000199 [9]	0.000027
Total Tetrachlorodibenzofuran (TCDF)	55722-27-5	8280A	IX	--	0.001	0.00013	0.000000199 [9]	0.000027

Notes:

1 Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2 Chemical Abstracts Service registry number (CAS RN). Where "Total" is entered, all species that contain this element are included.

3 Analytical methods refer to analytical procedure numbers used in the U.S. Environmental Protection Agency (USEPA) publication, SW-846, "Test Methods for Evaluating Solid Waste", Current Edition.

4 Target Analyte List (TAL) indicates whether a chemical is included on the Appendix IX (IX) - TAL or Contract Laboratory Program (CLP) - TAL.

5 Human Health Screening Level -- Lowest value reported between the Region 5 Risk Based Soil Screening Level for groundwater protection (USEPA, 1998) and the Region 9 Preliminary Remediation Goal Industrial Screening Level (USEPA, 1999b).

6 Screening criteria were not available. Based on similarities in chemical and physical structure, the following surrogate screening criteria are proposed:

acenaphthylene= acenaphthene *2-methylnaphthalene= naphthalene*

benzo(ghi)perylene= fluoranthene *phenanthrene= anthracene*

7 EDQL is for total PCBs, the sum of Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

8 EDQL is for total chlordanes.

9 EDQL is for total dioxins/furans.

mg/kg = milligrams per kilogram.
RL = Reporting Limit.
MDL = Method Detection Limit. (MDLs are updated periodically and values are subject to change).
EDQL = Ecological Data Quality Limit (USEPA, 1999a).
NE = No Level Established.

TABLE A1-6
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR GROUNDWATER MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (µg/L)	MDL (µg/L)	Human Health Screening Levels[5]	
							MCL (µg/L)	Region 9 PRG (µg/L)
Aluminum	(Total)	6010B	--	CLP	200	28	50 to 200	36000
Antimony	(Total)	6010B	IX	CLP	10	2.2	6	15
Arsenic	(Total)	6010B	IX	CLP	10	4.1	50	0.045
Barium	(Total)	6010B	IX	CLP	200	3	2000	2600
Beryllium	(Total)	6010B	IX	CLP	5	0.54	4	73
Cadmium	(Total)	6010B	IX	CLP	2	0.28	5	18
Calcium	(Total)	6010B	--	CLP	5000	250	NE	NE
Chromium	(Total)	6010B	IX	CLP	5	1.4	100	NE
Cobalt	(Total)	6010B	IX	CLP	7	1.3	NE	2200
Copper	(Total)	6010B	IX	CLP	25	4.2	1000	1400
Cyanide	57-12-5	9012A	IX	CLP	10	3.3	200	730
Iron	(Total)	6010B	--	CLP	100	88	300	11000
Lead	(Total)	6010B	IX	CLP	3	2.5	15[6]	NE
Magnesium	(Total)	6010B	--	CLP	5000	30	NE	NE
Manganese	(Total)	6010B	--	CLP	15	0.9	50	880
Mercury	(Total)	7471A	IX	CLP	0.2	0.13	2	11
Nickel	(Total)	6010B	IX	CLP	40	2.2	NE	730
Potassium	(Total)	6010B	--	CLP	5000	41	NE	NE
Selenium	(Total)	6010B	IX	CLP	5	4.5	50	180
Silver	(Total)	6010B	IX	CLP	5	1.5	100	180
Sodium	(Total)	6010B	--	CLP	5000	630	NE	NE
Sulfide	18496-25-8	376.1	IX	CLP	1000	920	NE	NE
Thallium	(Total)	6010B	IX	CLP	10	5	2	2.9
Tin	(Total)	6010B	IX	--	100	8	NE	22000
Vanadium	(Total)	6010B	IX	CLP	7	0.82	NE	260
Zinc	(Total)	6010B	IX	CLP	20	12	5000	11000
Acetone	67-64-1	8260B	IX	CLP	10	0.49	NE	610
Acetonitrile; Methyl cyanide	75-05-8	8260B	IX	--	20	2	NE	79
Acrolein	107-02-8	8260B	IX	--	20	2	NE	0.042
Acrylonitrile	107-13-1	8260B	IX	--	20	1.5	NE	0.039
Benzene	71-43-2	8260B	IX	CLP	1	0.096	5	0.41
Bromochloromethane	74-97-5	8260B	--	CLP	1	0.23	100[8]	NE
Bromodichloromethane	75-27-4	8260B	IX	CLP	1	0.21	80[9]	0.18
Bromoform; Tribromomethane	75-25-2	8260B	IX	CLP	1	0.2	80[9]	8.5
Bromomethane; Methyl bromide	74-83-9	8260B	IX	CLP	2	0.22	100[8]	8.7
Carbon disulfide	75-15-0	8260B	IX	CLP	1	0.18	NE	1000
Carbon tetrachloride	56-23-5	8260B	IX	CLP	1	0.12	5	0.17
Chlorobenzene	108-90-7	8260B	IX	CLP	1	0.15	100	110
Chloroethane; Ethyl chloride	75-00-3	8260B	IX	CLP	2	0.25	NE	4.6
Chloroform	67-66-3	8260B	IX	CLP	1	0.13	80[9]	0.16
Chloroprene	126-99-8	8260B	IX	--	2	0.079	NE	NE
3-Chloropropene; 3-Chloro-1-propene; Allyl chloride	107-05-1	8260B	IX	--	2	0.036	NE	1800

TABLE A1-6
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR GROUNDWATER MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (µg/L)	MDL (µg/L)	Human Health Screening Levels[5]	
							MCL (µg/L)	Region 9 PRG (µg/L)
Cyclohexane	110-82-7	8260B	--	CLP	1	0.16	NE	NE
Dibromochloromethane; Chlorodibromomethane	124-48-1	8260B	IX	CLP	1	0.1	80 [9]	0.13
1,2-Dibromo-3-chloropropane; DBCP	96-12-8	8260B	IX	CLP	2	0.26	0.2	0.048
1,2-Dibromoethane; Ethylene dibromide (EDB)	106-93-4	8260B	IX	CLP	1	0.16	0.05	0.00076
Dibromomethane; Methylene bromide	74-95-3	8260B	IX	--	1	0.1	NE	61
trans-1,4-Dichloro-2-butene	110-57-6	8260B	IX	--	1	0.35	NE	NE
Dichlorodifluoromethane	75-71-8	8260B	IX	CLP	2	0.23	NE	390
1,1-Dichloroethane (1,1-DCA)	75-34-3	8260B	IX	CLP	1	0.12	NE	810
1,2-Dichloroethane (1,2, DCA); Ethylene dichloride	107-06-2	8260B	IX	CLP	1	0.11	5	0.12
1,1-Dichloroethene; 1,1-Dichloroethylene; Vinylidene chloride	75-35-4	8260B	IX	CLP	1	0.3	7	0.046
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2	8260B	IX	CLP	0.5	0.059	70	61
trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	156-60-5	8260B	IX	CLP	0.5	0.11	100	120
1,2-Dichloropropane	78-87-5	8260B	IX	CLP	1	0.13	5	0.16
cis-1,3-Dichloropropene	10061-01-5	8260B	IX	CLP	1	0.15	NE	0.081
trans-1,3-Dichloropropene	10061-02-6	8260B	IX	CLP	1	0.12	NE	0.081
Ethylbenzene	100-41-4	8260B	IX	CLP	1	0.22	700	1330
Ethyl methacrylate	97-63-2	8260B	IX	--	1	0.083	NE	550
2-Hexanone	591-78-6	8260B	IX	CLP	10	0.18	NE	NE
Isopropylbenzene; cumene	98-82-8	8260B	--	CLP	1	0.15	NE	660
Isobutyl alcohol	78-83-1	8260B	IX	--	50	13	NE	1800
Methacrylonitrile	126-98-7	8260B	IX	--	2	0.35	NE	1.0
Methyl acetate	79-20-9	8260B	--	CLP	10	0.81	NE	6100
Methyl chloride; Chloromethane	74-87-3	8260B	IX	CLP	2	0.17	NE	1.5
Methyl cyclohexane	108-87-2	8260B	--	CLP	1	0.11	NE	5200
Methylene chloride; Dichloromethane	75-09-2	8260B	IX	CLP	5	.34	5	4.3
Methyl ethyl ketone; 2-Butanone; MEK	78-93-3	8260B	IX	CLP	10	0.39	NE	1900
Methyl iodide; Iodomethane	74-88-4	8260B	IX	--	1	0.15	100 [8]	NE
Methyl methacrylate	80-62-6	8260B	IX	--	2	0.23	NE	1400
4-Methyl-2-pentanone; Methyl isobutyl ketone (MIBK)	108-10-1	8260B	IX	CLP	10	0.33	NE	160
Methyl tert-butyl ether	1634-04-4	8260B	--	CLP	5	0.11	NE	20
Propionitrile; Ethyl cyanide	107-12-0	8260B	IX	--	4	0.49	NE	NE
Styrene	100-42-5	8260B	IX	CLP	1	0.19	100	1600
1,1,1,2-Tetrachloroethane	630-20-6	8260B	IX	--	1	0.12	NE	0.43
1,1,2,2-Tetrachloroethane	79-34-5	8260B	--	CLP	1	0.12	NE	0.055

TABLE A1-6
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Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (µg/L)	MDL (µg/L)	Human Health Screening Levels[5]	
							MCL (µg/L)	Region 9 PRG (µg/L)
Tetrachloroethylene; Perchloroethylene; Tetrachlorethene (PCE)	127-18-4	8260B	IX	CLP	1	0.21	5	1.1
Toluene	108-88-3	8260B	IX	CLP	1	0.13	1000	720
1,1,1-Trichloroethane; Methylchloroform	71-55-6	8260B	IX	CLP	1	0.16	200	790
1,1,2-Trichloroethane	79-00-5	8260B	IX	CLP	1	0.21	5	0.2
Trichloroethylene; Trichloroethene	79-01-6	8260B	IX	CLP	1	0.18	5	1.6
Trichlorofluoromethane	75-69-4	8260B	IX	CLP	2	0.21	NE	1300
1,2,3-Trichloropropane	96-18-4	8260B	IX	--	1	0.32	NE	0.0016
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	8260B	--	CLP	1	0.18	NE	59000
Vinyl acetate	108-05-4	8260B	IX	--	2	0.23	NE	410
Vinyl chloride	75-01-4	8260B	IX	CLP	2	0.097	2	0.02
Xylenes (total)	1330-20-7	8260B	IX	CLP	1	0.58	10000	1400
Acenaphthene	83-32-9	8270C	IX	CLP	10	2.7	NE	370
Acenaphthylene	208-96-8	8270C	IX	CLP	10	2.7	NE	370 [7]
Acetophenone	98-86-2	8270C	IX	CLP	10	3.7	NE	0.042
2-Acetylaminofluorene; 2-AAF	53-96-3	8270C	IX	--	100	0.71	NE	NE
4-Aminobiphenyl	92-67-1	8270C	IX	--	50	0.91	NE	NE
Aniline	62-53-3	8270C	IX	--	10	1.1	NE	12
Anthracene	120-12-7	8270C	IX	CLP	10	0.89	NE	1800
Aramite	140-57-8	8270C	IX	--	10	1.3	NE	2.7
Atrazine	1912-24-9	8270C	--	CLP	10	2.3	3	0.3
Benzaldehyde	100-52-7	8270C	--	CLP	10	1.6	NE	3600
Benzo[a]anthracene; Benzanthracene	56-55-3	8270C	IX	CLP	10	2.8	0.1	0.092
Benzo[b]fluoranthene	205-99-2	8270C	IX	CLP	10	2.6	0.2	0.092
Benzo[k]fluoranthene	207-08-9	8270C	IX	CLP	10	1.2	NE	0.92
Benzo[ghi]perylene	191-24-2	8270C	IX	CLP	10	3.3	NE	1500 [7]
Benzo[a]pyrene	50-32-8	8270C	IX	CLP	10	3	0.2	0.0092
Benzyl alcohol	100-51-6	8270C	IX	--	10	1.2	NE	11000
1,1'-Biphenyl	92-52-4	8270C	--	CLP	10	2.1	NE	300
Bis(2-chloroethoxy)methane	111-91-1	8270C	IX	CLP	10	2.6	NE	NE
Bis(2-chloroethyl)ether	111-44-4	8270C	IX	CLP	10	2.1	NE	0.0098
Bis(2-chloro-1-methylethyl) ether; 2,2-Di-chlorodiisopropyl ether	108-60-1	8270C	IX	--	10	1.3	NE	0.96
Bis(2-ethylhexyl) phthalate	117-81-7	8270C	IX	CLP	10	2.1	NE	4.8
4-Bromophenyl phenyl ether	101-55-3	8270C	IX	CLP	10	1	NE	NE
Butyl benzyl phthalate; Benzyl butyl phthalate	85-68-7	8270C	IX	CLP	10	1.9	100	7300
Caprolactam	105-60-2	8270C	--	CLP	10	2.6	NE	18000
Carbazole	86-74-8	8270C	--	CLP	10	1.1	NE	3.4
4-Chloroaniline; p-Chloroaniline	106-47-8	8270C	IX	CLP	10	2.8	NE	150
Chlorobenzilate	510-15-6	8270C	IX	--	10	1.4	NE	0.25

TABLE A1-6
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Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (µg/L)	MDL (µg/L)	Human Health Screening Levels[5]	
							MCL (µg/L)	Region 9 PRG (µg/L)
4-Chloro-3-methylphenol; p-Chloro-m-cresol	59-50-7	8270C	IX	CLP	10	1.2	NE	NE
2-Chloronaphthalene	91-58-7	8270C	IX	CLP	10	2.5	NE	490
2-Chlorophenol	95-57-8	8270C	IX	CLP	10	1.6	NE	30
4-Chlorophenyl phenyl ether	7005-72-3	8270C	IX	CLP	10	1.3	NE	NE
Chrysene	218-01-9	8270C	IX	CLP	10	0.88	0.2	9.2
m-Cresol; 3-Methylphenol	108-39-4	8270C	IX	--	10	0.84	NE	1800
o-Cresol; 2-Methylphenol	95-48-7	8270C	IX	CLP	10	1.1	NE	1800
p-Cresol; 4-Methylphenol	106-44-5	8270C	IX	CLP	10	1.7	NE	180
Dibenz[a,h]anthracene	53-70-3	8270C	IX	CLP	10	1.2	NE	0.0092
Dibenzofuran	132-64-9	8270C	IX	CLP	10	2.8	NE	24
Di-n-butyl phthalate	84-74-2	8270C	IX	CLP	10	1.1	NE	3600
1,2-Dichlorobenzene; o-Dichlorobenzene	95-50-1	8270C	IX	CLP	10	0.86	600	370
1,3-Dichlorobenzene; m-Dichlorobenzene	541-73-1	8270C	IX	CLP	10	1	NE	5.5
1,4-Dichlorobenzene; p-Dichlorobenzene	106-46-7	8270C	IX	CLP	10	0.89	75	0.50
3,3'-Dichlorobenzidine	91-94-1	8270C	IX	CLP	50	1.1	NE	0.15
2,4-Dichlorophenol	120-83-2	8270C	IX	CLP	10	1	NE	110
2,6-Dichlorophenol	87-65-0	8270C	IX	--	10	2.1	NE	NE
Diethyl phthalate	84-66-2	8270C	IX	CLP	10	3.2	NE	29000
O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	297-97-2	8270C	IX	--	50	0.79	NE	NE
Dimethoate	60-51-5	8270C	IX	--	20	0.72	NE	7.3
p-(Dimethylamino)azobenzene	60-11-7	8270C	IX	--	20	0.78	NE	NE
7,12-Dimethylbenz[a]anthracene	57-97-6	8270C	IX	--	20	2.5	NE	NE
3,3-Dimethylbenzidine	119-93-7	8270C	IX	--	50	1.2	NE	0.0073
alpha, alpha-Dimethylphenethylamine	122-09-8	8270C	IX	--	50	12	NE	36
2,4-Dimethylphenol	105-67-9	8270C	IX	CLP	10	1.1	NE	730
Dimethyl phthalate	131-11-3	8270C	IX	CLP	10	3.7	NE	360000
1,2-Dinitrobenzene; o-Dinitrobenzene	528-29-0	8270C	IX	--	10	1	NE	15
m-Dinitrobenzene; 1,3-Dinitrobenzene	99-65-0	8270C	IX	--	10	0.8	NE	3.6
4,6-Dinitro-2-methylphenol; 4,6-Dinitro-o-cresol	534-52-1	8270C	IX	CLP	50	7.5	NE	NE
2,4-Dinitrophenol	51-28-5	8270C	IX	CLP	50	13	NE	73
2,4-Dinitrotoluene	121-14-2	8270C	IX	CLP	10	0.8	NE	73
2,6-Dinitrotoluene	606-20-2	8270C	IX	CLP	10	2.8	NE	36
Di-n-octyl phthalate	117-84-0	8270C	IX	CLP	10	2	NE	730
1,4-Dioxane	123-91-1	8270C	IX	--	10	1.7	NE	6.1
Diphenylamine	122-39-4	8270C	IX	--	10	0.91	NE	910

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							MCL (µg/L)	Region 9 PRG (µg/L)
Disulfoton	298-04-4	8270C	IX	--	50	0.68	NE	1.5
Ethyl methanesulfonate	62-50-0	8270C	IX	--	10	0.9	NE	NE
Famphur	52-85-7	8270C	IX	--	10	1.2	NE	NE
Fluoranthene	206-44-0	8270C	IX	CLP	10	0.94	NE	1500
Fluorene	86-73-7	8270C	IX	CLP	10	2.9	NE	240
Hexachlorobenzene	118-74-1	8270C	IX	CLP	10	1.8	1	0.042
Hexachlorobutadiene	87-68-3	8270C	IX	CLP	10	1.2	NE	0.86
Hexachlorocyclopentadiene	77-47-4	8270C	IX	CLP	50	3.4	50	260
Hexachloroethane	67-72-1	8270C	IX	CLP	10	2.3	NE	4.8
Hexachloropropene	1888-71-7	8270C	IX	--	100	0.75	NE	NE
Indeno(1,2,3-cd)pyrene	193-39-5	8270C	IX	CLP	10	1.2	NE	0.092
Isophorone	78-59-1	8270C	IX	CLP	10	2.7	NE	71
Isosafrole	120-58-1	8270C	IX	--	20	0.74	NE	NE
Methapyrilene	91-80-5	8270C	IX	--	50	3.1	NE	NE
3-Methylcholanthrene	56-49-5	8270C	IX	--	20	4.5	NE	NE
Methyl methanesulfonate	66-27-3	8270C	IX	--	10	5.3	NE	NE
2-Methylnaphthalene	91-57-6	8270C	IX	CLP	10	0.92	NE	6.2 [7]
Naphthalene	91-20-3	8270C	IX	CLP	10	0.72	NE	6.2
1,4-Naphthoquinone	130-15-4	8270C	IX	--	50	4.3	NE	NE
1-Naphthylamine	134-32-7	8270C	IX	--	10	2.4	NE	NE
2-Naphthylamine	91-59-8	8270C	IX	--	10	0.93	NE	NE
2-Nitroaniline; o-Nitroaniline	88-74-4	8270C	IX	CLP	50	1.4	NE	2.1
3-Nitroaniline; m-Nitroaniline	99-09-2	8270C	IX	CLP	50	2	NE	NE
4-Nitroaniline; p-Nitroaniline	100-01-6	8270C	IX	CLP	50	1.2	NE	NE
Nitrobenzene	98-95-3	8270C	IX	CLP	10	2.6	NE	3.4
2-Nitrophenol; o-Nitrophenol	88-75-5	8270C	IX	CLP	10	0.99	NE	NE
4-Nitrophenol; p-Nitrophenol	100-02-7	8270C	IX	CLP	50	4.8	NE	290
4-Nitroquinoline 1-oxide	56-57-5	8270C	IX	--	100	7.3	NE	NE
N-Nitrosodi-n-butylamine	924-16-3	8270C	IX	--	10	0.78	NE	0.002
N-Nitrosodiethylamine	55-18-5	8270C	IX	--	10	0.84	NE	0.00045
N-Nitrosodimethylamine	62-75-9	8270C	IX	--	10	1.7	NE	0.0013
N-Nitrosodiphenylamine	86-30-6	8270C	IX	CLP	10	0.91	NE	14
N-Nitrosodi-n-propylamine; N-Nitrosodipropylamine; Di-n-propylnitrosamine	621-64-7	8270C	IX	CLP	10	1	NE	0.0096
N-Nitrosomethylethylamine	10595-95-6	8270C	IX	--	10	4.2	NE	0.0031
N-Nitrosomorpholine	59-89-2	8270C	IX	--	10	0.79	NE	NE
N-Nitrosopiperidine	100-75-4	8270C	IX	--	10	0.83	NE	NE
N-Nitrosopyrrolidine	930-55-2	8270C	IX	--	10	0.71	NE	0.032
5-Nitro-o-toluidine	99-55-8	8270C	IX	--	20	3.6	NE	2.0
2,2'-Oxybis(1-chloropropane)	108-60-1	8270C	--	CLP	10	1.3	NE	0.27
Pentachlorobenzene	608-93-5	8270C	IX	--	10	0.91	NE	29
Pentachloronitrobenzene	82-68-8	8270C	IX	--	50	0.71	NE	0.26

TABLE A1-6
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR GROUNDWATER MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (µg/L)	MDL (µg/L)	Human Health Screening Levels[5] MCL (µg/L)	Human Health Screening Levels[5] Region 9 PRG (µg/L)
Pentachlorophenol	87-86-5	8270C	IX	CLP	10	0.58	1	0.56
Phenacetin	62-44-2	8270C	IX	--	20	0.86	NE	NE
Phenanthrene	85-01-8	8270C	IX	CLP	10	2.4	NE	1800 [7]
Phenol	108-95-2	8270C	IX	CLP	10	1.3	NE	22000
p-Phenylenediamine	106-50-3	8270C	IX	--	100	4	NE	6900
Phorate	298-02-2	8270C	IX	--	50	0.87	NE	7.3
2-Picoline	109-06-8	8270C	IX	--	20	4.4	NE	NE
Pronamide	23950-58-5	8270C	IX	--	20	0.54	NE	2700
Pyrene	129-00-0	8270C	IX	CLP	10	1.4	NE	180
Pyridine	110-86-1	8270C	IX	--	20	0.85	NE	36
Safrole	94-59-7	8270C	IX	--	20	0.68	NE	NE
Sulfotepp; Tetraethyl dithiopyrophosphate	3689-24-5	8270C	IX	--	50	0.87	NE	18
1,2,4,5-Tetrachlorobenzene	95-94-3	8270C	IX	--	10	0.87	NE	11
2,3,4,6-Tetrachlorophenol	58-90-2	8270C	IX	--	50	14	NE	1100
o-Toluidine	95-53-4	8270C	IX	--	20	0.63	NE	0.28
1,2,4-Trichlorobenzene	120-82-1	8270C	IX	CLP	10	2.5	70	190
2,4,5-Trichlorophenol	95-95-4	8270C	IX	CLP	10	1.1	NE	3600
2,4,6-Trichlorophenol	88-06-2	8270C	IX	CLP	10	1.3	NE	6.1
O,O,O-Triethyl phosphorothioate	126-68-1	8270C	IX	--	50	0.81	NE	NE
1,3,5-Trinitrobenzene; sym-Trinitrobenzene	99-35-4	8270C	IX	--	50	5.2	NE	1100
Aroclor 1016	12674-11-2	8082	IX	CLP	1	0.018	0.5 [10]	0.96
Aroclor 1221	11104-28-2	8082	IX	CLP	1	0.094	0.5 [10]	0.034
Aroclor 1232	11141-16-5	8082	IX	CLP	1	0.16	0.5 [10]	0.034
Aroclor 1242	53469-21-9	8082	IX	CLP	1	0.3	0.5 [10]	0.034
Aroclor 1248	12672-29-6	8082	IX	CLP	1	0.22	0.5 [10]	0.034
Aroclor 1254	11097-69-1	8082	IX	CLP	1	0.096	0.5 [10]	0.034
Aroclor 1260	11096-82-5	8082	IX	CLP	1	0.065	0.5 [10]	0.034
Aldrin	309-00-2	8081A	IX	CLP	0.05	0.0064	NE	0.004
alpha-BHC	319-84-6	8081A	IX	CLP	0.05	0.0059	NE	0.011
beta-BHC	319-85-7	8081A	IX	CLP	0.05	0.0062	NE	0.037
delta-BHC	319-86-8	8081A	IX	CLP	0.05	0.006	NE	NE
gamma-BHC (Lindane)	58-89-9	8081A	IX	CLP	0.05	0.0062	0.2	0.052
alpha-Chlordane	5103-71-9	8081A	--	CLP	0.05	0.0067	NE	NE
gamma-Chlordane	5103-74-2	8081A	--	CLP	0.05	0.0065	NE	NE
Chlordane	57-74-9	8081A	IX	--	0.5	0.075	2	0.192
Chlorobenzilate	510-15-6	8081A	IX	--	0.1	0.082	NE	0.25
4,4'-DDD	72-54-8	8081A	IX	CLP	0.05	0.0064	NE	0.28
4,4'-DDE	72-55-9	8081A	IX	CLP	0.05	0.0074	NE	0.2
4,4'-DDT	50-29-3	8081A	IX	CLP	0.05	0.0072	NE	0.2
Diallate	2303-16-4	8081A	IX	--	1	0.034	NE	1.1
Dieldrin	60-57-1	8081A	IX	CLP	0.05	0.0069	NE	0.0042

TABLE A1-6
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR GROUNDWATER MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]		RL (µg/L)	MDL (µg/L)	Human Health Screening Levels[5]	
							MCL (µg/L)	Region 9 PRG (µg/L)
Endosulfan I	959-98-8	8081A	IX	CLP	0.05	0.0069	NE	NE
Endosulfan II	33213-65-9	8081A	IX	CLP	0.05	0.0066	NE	NE
Endosulfan sulfate	1031-07-8	8081A	IX	CLP	0.05	0.007	NE	NE
Endrin	72-20-8	8081A	IX	CLP	0.05	0.0087	2	11
Endrin aldehyde	7421-93-4	8081A	IX	CLP	0.05	0.0064	NE	NE
Endrin ketone	53494-70-5	8081A	--	CLP	0.05	0.0066	NE	NE
Heptachlor	76-44-8	8081A	IX	CLP	0.05	0.0071	0.4	0.015
Heptachlor epoxide	1024-57-3	8081A	IX	CLP	0.05	0.0068	0.2	0.0074
Isodrin	465-73-6	8081A	IX	--	0.1	0.0043	NE	NE
Kepone	143-50-0	8081A	IX	--	1	0.059	NE	0.0037
Methoxychlor	72-43-5	8081A	IX	CLP	0.1	0.0084	40	180
Toxaphene	8001-35-2	8081A	IX	CLP	2	0.23	3	0.061
Total Hexachlorodibenzo-*p*-dioxin (HxCDD)	34465-46-8	8280A	IX	--	0.025	0.00261	NE	0.000011
Total Hexachlorodibenzofuran (HxCDF)	55684-94-1	8280A	IX	--	0.025	0.00144	NE	0.00000045
Total Pentachlorodibenzo-*p*-dioxin (PeCDD)	36088-22-9	8280A	IX	--	0.025	0.00264	NE	0.00000045
Total Pentachlorodibenzofuran (PeCDF)	30402-15-4	8280A	IX	--	0.025	0.00144	NE	0.00000045
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD)	1746-01-6	8280A	IX	--	0.01	0.00071	0.00003	0.00000045
Total Tetrachlorodibenzo-*p*-dioxin (TCDD)	41903-57-5	8280A	IX	--	0.01	0.00071	NE	0.00000045
Total Tetrachlorodibenzofuran (TCDF)	55722-27-5	8280A	IX	--	0.01	0.00065	NE	0.00000045

Notes:

1 Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2 Chemical Abstracts Service registry number (CAS RN). Where "Total" is entered, all species that contain this element are included.

3 Analytical methods refer to analytical procedure numbers used in the U.S. Environmental Protection Agency (USEPA) publication, SW-846, Test Methods for Evaluating Solid Waste, Current Edition.

4 Target Analyte List (TAL) indicates whether a chemical is included on the Appendix IX (IX) - TAL or Contract Laboratory Program (CLP) - TAL.

5 Human Health Screening Levels -- Maximum Contaminant Level (MCL); In the absence of an MCL, secondary MCLs or proposed MCLs are provided, if a USEPA Region 9 Preliminary Remediation Goal "Tap Water" Value (USEPA, 1999b).

6 Action level.

7 Screening criteria were not available. Based on similarities in chemical and physical structure, the following surrogate screening criteria are proposed:

acenaphthylene= acenaphthene *2-methylnaphthalene= naphthalene*

benzo(ghi)perylene= fluoranthene *phenanthrene= anthracene*

8 MCL is for total halomethanes.

9 MCL is for total trihalomethanes (THMs), the sum of bromoform, chloroform, bromodichloromethane, and dibromomethane.

10 MCL is for total PCBs, the sum of Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

µg/L = micrograms per liter.
RL = Reporting Limit.
MDL = Method Detection Limit. (MDLs are updated periodically and values are subject to change).
NE = No Level Established.

TABLE A1-7
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SEDIMENT MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]	RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
Aluminum	(Total)	6010B	CLP	20	1.1	NE	76000
Antimony	(Total)	6010B	CLP	1	0.49	NE	5
Arsenic	(Total)	6010B	CLP	1	0.3	5.9	0.39
Barium	(Total)	6010B	CLP	20	0.13	NE	1600
Beryllium	(Total)	6010B	CLP	0.5	0.046	NE	63
Cadmium	(Total)	6010B	CLP	0.2	0.043	0.596	8
Calcium	(Total)	6010B	CLP	500	37	NE	NE
Chromium	(Total)	6010B	CLP	0.5	0.38	26	38
Cobalt	(Total)	6010B	CLP	5	0.15	50	4700
Copper	(Total)	6010B	CLP	2.5	0.27	16	2900
Cyanide	57-12-5	9012A	CLP	0.5	0.17	0.0001	40
Iron	(Total)	6010B	CLP	10	6.6	NE	23000
Lead	(Total)	6010B	CLP	0.3	0.24	31	400
Magnesium	(Total)	6010B	CLP	500	12	NE	NE
Manganese	(Total)	6010B	CLP	1.5	0.15	NE	1800
Mercury	(Total)	7471A	CLP	0.1	0.0084	0.174	2
Nickel	(Total)	6010B	CLP	4	0.27	16	130
Potassium	(Total)	6010B	CLP	500	5.1	NE	NE
Selenium	(Total)	6010B	CLP	0.5	0.31	NE	5
Silver	(Total)	6010B	CLP	0.5	0.15	0.5	34
Sodium	(Total)	6010B	CLP	500	50	NE	NE
Sulfide	18496-25-8	376.1	CLP	50	21.5	0.00358	NE
Thallium	(Total)	6010B	CLP	1	0.5	NE	0.7
Vanadium	(Total)	6010B	CLP	5	0.13	NE	550
Zinc	(Total)	6010B	CLP	2	1.2	120	12000
Acetone	67-64-1	8260B	CLP	0.02	0.0016	NE	16
Benzene	71-43-2	8260B	CLP	0.005	0.0001	0.14157	0.03
Bromochloromethane	74-97-5	8260B	CLP	0.005	0.00063	NE	NE
Bromodichloromethane	75-27-4	8260B	CLP	0.005	0.000079	0.00113	0.6
Bromoform; Tribromomethane	75-25-2	8260B	CLP	0.005	0.00051	0.99627	0.8
Bromomethane; Methyl bromide	74-83-9	8260B	CLP	0.01	0.00013	0.000148	3.9
Carbon disulfide	75-15-0	8260B	CLP	0.005	0.000083	0.13397	32
Carbon tetrachloride	56-23-5	8260B	CLP	0.005	0.0001	0.03573	0.07
Chlorobenzene	108-90-7	8260B	CLP	0.005	0.00087	0.06194	1
Chloroethane; Ethyl chloride	75-00-3	8260B	CLP	0.01	0.00019	58.6	3
Chloroform	67-66-3	8260B	CLP	0.005	0.000062	0.027	0.24
Cyclohexane	110-82-7	8260B	CLP	0.01	0.0011	NE	NE
Dibromochloromethane; Chlorodibromomethane	124-48-1	8260B	CLP	0.005	0.00024	0.26761	0.4
1,2-Dibromo-3-chloropropane; DBCP	96-12-8	8260B	CLP	0.01	0.00038	0.01998	0.45
1,2-Dibromoethane; Ethylene dibromide (EDB)	106-93-4	8260B	CLP	0.005	0.0018	0.01237	0.0069

TABLE A1-7
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SEDIMENT MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]	RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
Dichlorodifluoromethane	75-71-8	8260B	CLP	0.01	0.00015	0.00133	94
1,1-Dichloroethane (1,1-DCA)	75-34-3	8260B	CLP	0.005	0.0001	0.000575	23
1,2-Dichloroethane; Ethylene dichloride	107-06-2	8260B	CLP	0.005	0.000088	0.05418	0.02
1,1-Dichloroethene; 1,1-Dichloroethylene; Vinylidene chloride	75-35-4	8260B	CLP	0.005	0.0002	0.02327	0.054
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2	8260B	CLP	0.0025	0.00024	NE	43
trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	156-60-5	8260B	CLP	0.0025	0.00021	0.20894	0.7
1,2-Dichloropropane	78-87-5	8260B	CLP	0.005	0.00013	0.35161	0.03
cis-1,3-Dichloropropene	10061-01-5	8260B	CLP	0.005	0.00046	0.00296	0.004
trans-1,3-Dichloropropene	10061-02-6	8260B	CLP	0.005	0.0001	0.00296	0.004
Ethylbenzene	100-41-4	8260B	CLP	0.005	0.00099	0.0001	13
2-Hexanone	591-78-6	8260B	CLP	0.02	0.0014	1.01	NE
Isopropylbenzene; cumene	98-82-8	8260B	CLP	0.005	0.0067	NE	160
Methyl acetate	79-20-9	8260B	CLP	0.01	0.0025	NE	22000
Methyl chloride; Chloromethane	74-87-3	8260B	CLP	0.01	0.00066	0.00000785	1.2
Methyl cyclohexane	108-87-2	8260B	CLP	0.01	0.00098	NE	2600
Methylene chloride; Dichloromethane	75-09-2	8260B	CLP	0.005	0.0007	1.26	0.02
Methyl ethyl ketone; 2-Butanone; MEK	78-93-3	8260B	CLP	0.02	0.0017	0.13696	7300
4-Methyl-2-pentanone; Methyl isobutyl ketone (MIBK)	108-10-1	8260B	CLP	0.02	0.00079	0.54437	790
Methyl tert-butyl ether	1634-04-4	8260B	CLP	0.02	0.00044	NE	NE
Styrene	100-42-5	8260B	CLP	0.005	0.001	0.44496	4
1,1,2,2-Tetrachloroethane	79-34-5	8260B	CLP	0.005	0.00061	0.02908	0.003
Tetrachloroethylene; Perchloroethylene; Tetrachlorethene (PCE)	127-18-4	8260B	CLP	0.005	0.0007	0.019583	0.06
Toluene	108-88-3	8260B	CLP	0.005	0.00067	52.5	12
1,1,1-Trichloroethane; Methylchloroform	71-55-6	8260B	CLP	0.005	0.000062	0.24685	2
1,1,2-Trichloroethane	79-00-5	8260B	CLP	0.005	0.0012	0.67351	0.02
Trichloroethylene; Trichloroethene	79-01-6	8260B	CLP	0.005	0.0001	0.17956	0.06
Trichlorofluoromethane	75-69-4	8260B	CLP	0.01	0.0001	0.00307	390
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	8260B	CLP	0.005	0.0013	NE	5600
Vinyl chloride	75-01-4	8260B	CLP	0.01	0.0005	0.002	0.01
Xylenes (total)	1330-20-7	8260B	CLP	0.01	0.0029	1.88	190
Acenaphthene	83-32-9	8270C	CLP	0.33	0.035	NE	570
Acenaphthylene	208-96-8	8270C	CLP	0.33	0.035	NE	570 [6]
Acetophenone	98-86-2	8270C	CLP	0.33	0.028	NE	0.49

TABLE A1-7
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SEDIMENT MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]	RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
Anthracene	120-12-7	8270C	CLP	0.33	0.037	0.0469	12000
Atrazine	1912-24-9	8270C	CLP	0.33	0.024	NE	2.2
Benzaldehyde	100-52-7	8270C	CLP	0.33	0.098	NE	6100
Benzo[a]anthracene; Benzanthracene	56-55-3	8270C	CLP	0.33	0.035	0.0317	0.62
Benzo[b]fluoranthene	205-99-2	8270C	CLP	0.33	0.035	10.4	0.62
Benzo[k]fluoranthene	207-08-9	8270C	CLP	0.33	0.041	0.24	6.2
Benzo[ghi]perylene	191-24-2	8270C	CLP	0.33	0.045	0.17	2300 [6]
Benzo[a]pyrene	50-32-8	8270C	CLP	0.33	0.033	0.0319	0.062
1,1'-Biphenyl	92-52-4	8270C	CLP	0.33	0.017	NE	350
Bis(2-chloroethoxy)methane	111-91-1	8270C	CLP	0.33	0.035	NE	NE
Bis(2-chloroethyl)ether	111-44-4	8270C	CLP	0.33	0.033	0.21196	0.0004
Bis(2-ethylhexyl) phthalate	117-81-7	8270C	CLP	0.33	0.065	NE	35
4-Bromophenyl phenyl ether	101-55-3	8270C	CLP	0.33	0.035	1.55	NE
Butyl benzyl phthalate; Benzyl butyl phthalate	85-68-7	8270C	CLP	0.33	0.044	4.19	930
Caprolactam	105-60-2	8270C	CLP	0.33	0.044	NE	31000
Carbazole	86-74-8	8270C	CLP	0.33	0.042	NE	24
4-Chloroaniline; p-Chloroaniline	106-47-8	8270C	CLP	0.33	0.033	0.14608	0.7
4-Chloro-3-methylphenol; p-Chloro-m-cresol	59-50-7	8270C	CLP	0.33	0.031	0.38818	NE
2-Chloronaphthalene	91-58-7	8270C	CLP	0.33	0.032	0.41723	4900
2-Chlorophenol	95-57-8	8270C	CLP	0.33	0.028	0.0117	4
4-Chlorophenyl phenyl ether	7005-72-3	8270C	CLP	0.33	0.036	0.65612	NE
Chrysene	218-01-9	8270C	CLP	0.33	0.05	0.0571	62
o-Cresol; 2-Methylphenol	95-48-7	8270C	CLP	0.33	0.037	0.000826	15
p-Cresol; 4-Methylphenol	106-44-5	8270C	CLP	0.33	0.027	0.000808	310
Dibenz[a,h]anthracene	53-70-3	8270C	CLP	0.33	0.038	0.00622	0.062
Dibenzofuran	132-64-9	8270C	CLP	0.33	0.036	1.52	290
Di-n-butyl phthalate	84-74-2	8270C	CLP	0.33	0.059	0.1105	2300
1,2-Dichlorobenzene; o-Dichlorobenzene	95-50-1	8270C	CLP	0.33	0.029	231.32	370
1,3-Dichlorobenzene; m-Dichlorobenzene	541-73-1	8270C	CLP	0.33	0.032	3010	13
1,4-Dichlorobenzene; p-Dichlorobenzene	106-46-7	8270C	CLP	0.33	0.036	1450	3.4
3,3'-Dichlorobenzidine	91-94-1	8270C	CLP	1.6	0.14	0.02822	0.007
2,4-Dichlorophenol	120-83-2	8270C	CLP	0.33	0.045	0.13363	1
Diethyl phthalate	84-66-2	8270C	CLP	0.33	0.038	0.00804	470
2,4-Dimethylphenol	105-67-9	8270C	CLP	0.33	0.057	0.30453	9
Dimethyl phthalate	131-11-3	8270C	CLP	0.33	0.036	0.02495	100000
4,6-Dinitro-2-methylphenol; 4,6-Dinitro-o-cresol	534-52-1	8270C	CLP	1.6	0.18	NE	NE

TABLE A1-7
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SEDIMENT MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]	RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
2,4-Dinitrophenol	51-28-5	8270C	CLP	1.6	0.15	0.00133	0.3
2,4-Dinitrotoluene	121-14-2	8270C	CLP	0.33	0.041	0.07513	0.0008
2,6-Dinitrotoluene	606-20-2	8270C	CLP	0.33	0.03	0.02062	0.0007
Di-n-octyl phthalate	117-84-0	8270C	CLP	0.33	0.05	40.6	1200
Fluoranthene	206-44-0	8270C	CLP	0.33	0.038	0.1113	2300
Fluorene	86-73-7	8270C	CLP	0.33	0.029	0.0212	560
Hexachlorobenzene	118-74-1	8270C	CLP	0.33	0.041	0.02	0.3
Hexachlorobutadiene	87-68-3	8270C	CLP	0.33	0.031	1.38	2
Hexachlorocyclopentadiene	77-47-4	8270C	CLP	1.6	0.15	0.90074	400
Hexachloroethane	67-72-1	8270C	CLP	0.33	0.04	2.23	0.5
Indeno(1,2,3-cd)pyrene	193-39-5	8270C	CLP	0.33	0.042	0.2	0.62
Isophorone	78-59-1	8270C	CLP	0.33	0.032	0.4223	0.5
2-Methylnaphthalene	91-57-6	8270C	CLP	0.33	0.033	0.0202	56 [6]
Naphthalene	91-20-3	8270C	CLP	0.33	0.035	0.0346	56
2-Nitroaniline; o-Nitroaniline	88-74-4	8270C	CLP	1.6	0.033	0.000222	NE
3-Nitroaniline; m-Nitroaniline	99-09-2	8270C	CLP	1.6	0.033	0.000222	NE
4-Nitroaniline; p-Nitroaniline	100-01-6	8270C	CLP	1.6	0.047	0.000222	NE
Nitrobenzene	98-95-3	8270C	CLP	0.33	0.032	0.4876	0.1
2-Nitrophenol; o-Nitrophenol	88-75-5	8270C	CLP	0.33	0.044	0.00777	NE
4-Nitrophenol; p-Nitrophenol	100-02-7	8270C	CLP	1.6	0.35	7.782	490
N-Nitrosodiphenylamine	86-30-6	8270C	CLP	0.33	0.037	0.15524	1
N-Nitrosodi-n-propylamine; N-Nitrosodipropylamine; Di-n-propylnitrosamine	621-64-7	8270C	CLP	0.33	0.031	NE	0.00005
2,2'-Oxybis(1-chloropropane)	108-60-1	8270C	CLP	0.33	0.093	NE	8.1
Pentachlorophenol	87-86-5	8270C	CLP	0.33	0.034	30.1	0.03
Phenanthrene	85-01-8	8270C	CLP	0.33	0.043	0.4119	12000 [6]
Phenol	108-95-2	8270C	CLP	0.33	0.035	0.02726	100
Pyrene	129-00-0	8270C	CLP	0.33	0.057	0.053	2300
1,2,4-Trichlorobenzene	120-82-1	8270C	CLP	0.33	0.038		650
2,4,5-Trichlorophenol	95-95-4	8270C	CLP	0.33	0.069	0.08556	270
2,4,6-Trichlorophenol	88-06-2	8270C	CLP	0.33	0.057	0.08484	0.2
Aroclor 1016	12674-11-2	8082	CLP	0.033	0.0053	0.0341 [7]	3.9
Aroclor 1221	11104-28-2	8082	CLP	0.033	0.019	0.0341 [7]	0.22
Aroclor 1232	11141-16-5	8082	CLP	0.033	0.011	0.0341 [7]	0.22
Aroclor 1242	53469-21-9	8082	CLP	0.033	0.018	0.0341 [7]	0.22
Aroclor 1248	12672-29-6	8082	CLP	0.033	0.0046	0.0341 [7]	0.22
Aroclor 1254	11097-69-1	8082	CLP	0.033	0.02	0.0341 [7]	0.22
Aroclor 1260	11096-82-5	8082	CLP	0.033	0.0074	0.0341 [7]	0.22
Aldrin	309-00-2	8081A	CLP	0.0017	0.00055	NE	0.029
alpha-BHC	319-84-6	8081A	CLP	0.0017	0.00046	0.006	0.0005
beta-BHC	319-85-7	8081A	CLP	0.0017	0.00046	0.005	0.003

TABLE A1-7
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SEDIMENT MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]	RL (mg/kg)	MDL (mg/kg)	EDQL (mg/kg)	Human Health Screening Level[5] (mg/kg)
delta-BHC	319-86-8	8081A	CLP	0.0017	0.00048	71.5	NE
gamma-BHC (Lindane)	58-89-9	8081A	CLP	0.0017	0.00057	0.00094	0.009
alpha-Chlordane	5103-71-9	8081A	CLP	0.0017	0.00059	4.5 [8]	NE
gamma-Chlordane	5103-74-2	8081A	CLP	0.0017	0.00057	4.5 [8]	NE
4,4'-DDD	72-54-8	8081A	CLP	0.0017	0.00079	0.0053	2.4
4,4'-DDE	72-55-9	8081A	CLP	0.0017	0.00057	0.00142	1.7
4,4'-DDT	50-29-3	8081A	CLP	0.0017	0.0013	0.0019	1.7
Dieldrin	60-57-1	8081A	CLP	0.0017	0.0015	0.002	0.004
Endosulfan I	959-98-8	8081A	CLP	0.0017	0.00067	0.000175	NE
Endosulfan II	33213-65-9	8081A	CLP	0.0017	0.00038	0.000104	NE
Endosulfan sulfate	1031-07-8	8081A	CLP	0.0017	0.00028	0.0346	NE
Endrin	72-20-8	8081A	CLP	0.0017	0.00061	0.00267	1
Endrin aldehyde	7421-93-4	8081A	CLP	0.0017	0.0015	3.2	NE
Endrin ketone	53494-70-5	8081A	CLP	0.0017	0.00026	NE	NE
Heptachlor	76-44-8	8081A	CLP	0.0017	0.00061	0.006	0.11
Heptachlor epoxide	1024-57-3	8081A	CLP	0.0017	0.00066	0.006	0.053
Methoxychlor	72-43-5	8081A	CLP	0.0033	0.00082	0.00359	160
Toxaphene	8001-35-2	8081A	CLP	0.067	0.0069	0.000109	0.44

Notes:

1 Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2 Chemical Abstracts Service registry number (CAS RN). Where "Total" is entered, all species that contain this element are included.

3 Analytical methods refer to analytical procedure numbers used in the U.S. Environmental Protection Agency (USEPA) publication, SW-846, "Test Methods for Evaluating Solid Waste," Current Edition.

4 Sediment samples will only be analyzed for compounds detected in Phase I groundwater monitoring.

5 Human Health Screening Level -- Lowest value reported between the Region 5 Risk Based Soil Screening Level for groundwater protection (USEPA, 1998) and the Region 9 Preliminary Remediation Goal for Residential Soil (USEPA, 1999b).

6 Screening criteria were not available. Based on similarities in chemical and physical structure, the following surrogate screening criteria are proposed:

acenaphthylene= acenaphthene *2-methylnaphthalene= naphthalene*

benzo(ghi)perylene= fluoranthene *phenanthrene= anthracene*

7 EDQL is for total PCBs, the sum of Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

8 EDQL is for total chlordanes.

mg/kg = milligrams per kilogram.
RL = Reporting Limit.
MDL = Method Detection Limit. (MDLs are updated periodically and values are subject to change).
EDQL = Ecological Data Quality Limit (USEPA, 1999a).
NE = No Level Established.
CLP = Contract Laboratory Program - Target Analyte List defined in Table A1-1.

TABLE A1-8
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SURFACE WATER MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]	RL (µg/L)	MDL (µg/L)	EDQL (µg/L)	Human Health Screening Levels[5] MCL (µg/L)	Human Health Screening Levels[5] Region 9 PRG (µg/L)
Aluminum	(Total)	6010B	CLP	200	28	NE	50 to 200	36000
Antimony	(Total)	6010B	CLP	10	2.2	31	6	15
Arsenic	(Total)	6010B	CLP	10	4.1	53	50	0.045
Barium	(Total)	6010B	CLP	200	3	5000	2000	2600
Beryllium	(Total)	6010B	CLP	5	0.54	7.6	4	73
Cadmium	(Total)	6010B	CLP	2	0.28	0.66	5	18
Calcium	(Total)	6010B	CLP	5000	250	NE	NE	NE
Chromium	(Total)	6010B	CLP	5	1.4	42	100	NE
Cobalt	(Total)	6010B	CLP	7	1.3	5	NE	2200
Copper	(Total)	6010B	CLP	25	4.2	5	1000	1400
Cyanide	57-12-5	9012A	CLP	10	3.3	5.2	200	730
Iron	(Total)	6010B	CLP	100	88	NE	300	11000
Lead	(Total)	6010B	CLP	3	2.5	1.3	15[6]	NE
Magnesium	(Total)	6010B	CLP	5000	30	NE	NE	NE
Manganese	(Total)	6010B	CLP	15	0.9	NE	50	880
Mercury	(Total)	7471A	CLP	0.2	0.13	0.0013	2	11
Nickel	(Total)	6010B	CLP	40	2.2	29	NE	730
Potassium	(Total)	6010B	CLP	5000	41	NE	NE	NE
Selenium	(Total)	6010B	CLP	5	4.5	5	50	180
Silver	(Total)	6010B	CLP	5	1.5	1	100	180
Sodium	(Total)	6010B	CLP	5000	630	NE	NE	NE
Sulfide	18496-25-8	376.1	CLP	1000	920	NE	NE	NE
Thallium	(Total)	6010B	CLP	10	5	0.56	2	2.9
Vanadium	(Total)	6010B	CLP	7	0.82	19	NE	260
Zinc	(Total)	6010B	CLP	20	12	58.9	5000	11000
Acetone	67-64-1	8260B	CLP	10	0.49	78,000	NE	610
Benzene	71-43-2	8260B	CLP	1	0.096	114	5	0.41
Bromochloromethane	74-97-5	8260B	CLP	1	0.23	NE	100 [8]	NE
Bromodichloromethane	75-27-4	8260B	CLP	1	0.21	NE	80 [9]	0.18
Bromoform; Tribromomethane	75-25-2	8260B	CLP	1	0.2	466	80 [9]	8.5
Bromomethane; Methyl bromide	74-83-9	8260B	CLP	2	0.22	NE	100 [8]	8.7
Carbon disulfide	75-15-0	8260B	CLP	1	0.18	84.1	NE	1000
Carbon tetrachloride	56-23-5	8260B	CLP	1	0.12	5.9	5	0.17
Chlorobenzene	108-90-7	8260B	CLP	1	0.15	10	100	110
Chloroethane; Ethyl chloride	75-00-3	8260B	CLP	2	0.25	230,000	NE	4.6
Chloroform	67-66-3	8260B	CLP	1	0.13	79	80 [9]	0.16
Cyclohexane	110-82-7	8260B	CLP	1	0.16	NE	NE	NE
Dibromochloromethane; Chlorodibromomethane	124-48-1	8260B	CLP	1	0.1	6400	80 [9]	0.13
1,2-Dibromo-3-chloropropane; DBCP	96-12-8	8260B	CLP	2	0.26	11.2	0.2	0.048
1,2-Dibromoethane; Ethylene dibromide (EDB)	106-93-4	8260B	CLP	1	0.16	22.5	0.05	0.00076

TABLE A1-8
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SURFACE WATER MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]	RL (µg/L)	MDL (µg/L)	EDQL (µg/L)	Human Health Screening Levels[5]	
							MCL (µg/L)	Region 9 PRG (µg/L)
Dichlorodifluoromethane	75-71-8	8260B	CLP	2	0.23	NE	NE	390
1,1-Dichloroethane (1,1-DCA)	75-34-3	8260B	CLP	1	0.12	47	NE	810
1,2-Dichloroethane; Ethylene dichloride	107-06-2	8260B	CLP	1	0.11	190	5	0.12
1,1-Dichloroethene; 1,1-Dichloroethylene; Vinylidene chloride	75-35-4	8260B	CLP	1	0.3	78	7	0.046
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2	8260B	CLP	0.5	0.059	NE	70	61
trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	156-60-5	8260B	CLP	0.5	0.11	310	100	120
1,2-Dichloropropane	78-87-5	8260B	CLP	1	0.13	380	5	0.16
cis-1,3-Dichloropropene	10061-01-5	8260B	CLP	1	0.15	7.9	NE	0.081
trans-1,3-Dichloropropene	10061-02-6	8260B	CLP	1	0.12	7.9	NE	0.081
Ethylbenzene	100-41-4	8260B	CLP	1	0.22	17.2	700	1330
2-Hexanone	591-78-6	8260B	CLP	10	0.18	1710	NE	NE
Isopropylbenzene; cumene	98-82-8	8260B	CLP	1	0.15	NE	NE	660
Methyl acetate	79-20-9	8260B	CLP	10	0.81	NE	NE	6100
Methyl chloride; Chloromethane	74-87-3	8260B	CLP	2	0.17	NE	NE	1.5
Methyl cyclohexane	108-87-2	8260B	CLP	1	0.11	NE	NE	5200
Methylene chloride; Dichloromethane	75-09-2	8260B	CLP	5	.34	430	5	4.3
Methyl ethyl ketone; 2-Butanone; MEK	78-93-3	8260B	CLP	10	0.39	7100	NE	1900
4-Methyl-2-pentanone; Methyl isobutyl ketone (MIBK)	108-10-1	8260B	CLP	10	0.33	3680	NE	160
Methyl tert-butyl ether	1634-04-4	8260B	CLP	5	0.11	NE	NE	20
Styrene	100-42-5	8260B	CLP	1	0.19	56	100	1600
1,1,2,2-Tetrachloroethane	79-34-5	8260B	CLP	1	0.12	13	NE	0.055
Tetrachloroethylene; Perchloroethylene; Tetrachlorethene (PCE)	127-18-4	8260B	CLP	1	0.21	8.9	5	1.1
Toluene	108-88-3	8260B	CLP	1	0.13	253	1000	720
1,1,1-Trichloroethane; Methylchloroform	71-55-6	8260B	CLP	1	0.16	88	200	790
1,1,2-Trichloroethane	79-00-5	8260B	CLP	1	0.21	650	5	0.2
Trichloroethylene; Trichloroethene	79-01-6	8260B	CLP	1	0.18	75	5	1.6
Trichlorofluoromethane	75-69-4	8260B	CLP	2	0.21	NE	NE	1300
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	8260B	CLP	1	0.18	NE	NE	59000
Vinyl chloride	75-01-4	8260B	CLP	2	0.097	9.2	2	0.02
Xylenes (total)	1330-20-7	8260B	CLP	1	0.58	117	10000	1400
Acenaphthene	83-32-9	8270C	CLP	10	2.7	9.9	NE	370
Acenaphthylene	208-96-8	8270C	CLP	10	2.7	4840	NE	370 [7]
Acetophenone	98-86-2	8270C	CLP	10	3.7	688	NE	0.042

TABLE A1-8
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SURFACE WATER MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]	RL (µg/L)	MDL (µg/L)	EDQL (µg/L)	Human Health Screening Levels[5]	
							MCL (µg/L)	Region 9 PRG (µg/L)
Anthracene	120-12-7	8270C	CLP	10	0.89	0.029	NE	1800
Atrazine	1912-24-9	8270C	CLP	10	2.3	NE	3	0.3
Benzaldehyde	100-52-7	8270C	CLP	10	1.6	NE	NE	3600
Benzo[a]anthracene; Benzanthracene	56-55-3	8270C	CLP	10	2.8	0.839	0.1	0.092
Benzo[b]fluoranthene	205-99-2	8270C	CLP	10	2.6	9.07	0.2	0.092
Benzo[k]fluoranthene	207-08-9	8270C	CLP	10	1.2	0.0056	NE	0.92
Benzo[ghi]perylene	191-24-2	8270C	CLP	10	3.3	7.64	NE	1500 [7]
Benzo[a]pyrene	50-32-8	8270C	CLP	10	3	0.014	0.2	0.0092
1,1'-Biphenyl	92-52-4	8270C	CLP	10	2.1	NE	NE	300
Bis(2-chloroethoxy)methane	111-91-1	8270C	CLP	10	2.6	NE	NE	NE
Bis(2-chloroethyl)ether	111-44-4	8270C	CLP	10	2.1	1140	NE	0.0098
Bis(2-ethylhexyl) phthalate	117-81-7	8270C	CLP	10	2.1	2.1	NE	4.8
4-Bromophenyl phenyl ether	101-55-3	8270C	CLP	10	1	1.5	NE	NE
Butyl benzyl phthalate; Benzyl butyl phthalate	85-68-7	8270C	CLP	10	1.9	49	100	7300
Caprolactam	105-60-2	8270C	CLP	10	2.6	NE	NE	18000
Carbazole	86-74-8	8270C	CLP	10	1.1	NE	NE	3.4
4-Chloroaniline; p-Chloroaniline	106-47-8	8270C	CLP	10	2.8	231.97	NE	150
4-Chloro-3-methylphenol; p-Chloro-m-cresol	59-50-7	8270C	CLP	10	1.2	34.79	NE	NE
2-Chloronaphthalene	91-58-7	8270C	CLP	10	2.5	0.396	NE	490
2-Chlorophenol	95-57-8	8270C	CLP	10	1.6	8.8	NE	30
4-Chlorophenyl phenyl ether	7005-72-3	8270C	CLP	10	1.3	NE	NE	NE
Chrysene	218-01-9	8270C	CLP	10	0.88	0.033	0.2	9.2
o-Cresol; 2-Methylphenol	95-48-7	8270C	CLP	10	1.1	NE	NE	1800
p-Cresol; 4-Methylphenol	106-44-5	8270C	CLP	10	1.7	NE	NE	180
Dibenz[a,h]anthracene	53-70-3	8270C	CLP	10	1.2	0.0016	NE	0.0092
Dibenzofuran	132-64-9	8270C	CLP	10	2.8	20	NE	24
Di-n-butyl phthalate	84-74-2	8270C	CLP	10	1.1	3	NE	3600
1,2-Dichlorobenzene; o-Dichlorobenzene	95-50-1	8270C	CLP	10	0.86	11	600	370
1,3-Dichlorobenzene; m-Dichlorobenzene	541-73-1	8270C	CLP	10	1	87	NE	5.5
1,4-Dichlorobenzene; p-Dichlorobenzene	106-46-7	8270C	CLP	10	0.89	43	75	0.5
3,3'-Dichlorobenzidine	91-94-1	8270C	CLP	50	1.1	99.75	NE	0.15
2,4-Dichlorophenol	120-83-2	8270C	CLP	10	1	18	NE	110
Diethyl phthalate	84-66-2	8270C	CLP	10	3.2	3	NE	29000
2,4-Dimethylphenol	105-67-9	8270C	CLP	10	1.1	100.17	NE	730
Dimethyl phthalate	131-11-3	8270C	CLP	10	3.7	73	NE	360000
4,6-Dinitro-2-methylphenol; 4,6-Dinitro-o-cresol	534-52-1	8270C	CLP	50	7.5	NE	NE	NE

TABLE A1-8
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SURFACE WATER MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]	RL (µg/L)	MDL (µg/L)	EDQL (µg/L)	Human Health Screening Levels[5] MCL (µg/L)	Human Health Screening Levels[5] Region 9 PRG (µg/L)
2,4-Dinitrophenol	51-28-5	8270C	CLP	50	13	100.17	NE	73
2,4-Dinitrotoluene	121-14-2	8270C	CLP	10	0.8	230	NE	73
2,6-Dinitrotoluene	606-20-2	8270C	CLP	10	2.8	42	NE	36
Di-n-octyl phthalate	117-84-0	8270C	CLP	10	2	NE	NE	730
Fluoranthene	206-44-0	8270C	CLP	10	0.94	8.1	NE	1500
Fluorene	86-73-7	8270C	CLP	10	2.9	3.9	NE	240
Hexachlorobenzene	118-74-1	8270C	CLP	10	1.8	0.00024	1	0.042
Hexachlorobutadiene	87-68-3	8270C	CLP	10	1.2	0.223	NE	0.86
Hexachlorocyclopentadiene	77-47-4	8270C	CLP	50	3.4	77.04	50	260
Hexachloroethane	67-72-1	8270C	CLP	10	2.3	30.5	NE	4.8
Indeno(1,2,3-cd)pyrene	193-39-5	8270C	CLP	10	1.2	4.31	NE	0.092
Isophorone	78-59-1	8270C	CLP	10	2.7	900	NE	71
2-Methylnaphthalene	91-57-6	8270C	CLP	10	0.92	329.55	NE	6.2 [7]
Naphthalene	91-20-3	8270C	CLP	10	0.72	44	NE	6.2
2-Nitroaniline; o-Nitroaniline	88-74-4	8270C	CLP	50	1.4	NE	NE	2.1
3-Nitroaniline; m-Nitroaniline	99-09-2	8270C	CLP	50	2	NE	NE	NE
4-Nitroaniline; p-Nitroaniline	100-01-6	8270C	CLP	50	1.2	NE	NE	NE
Nitrobenzene	98-95-3	8270C	CLP	10	2.6	740	NE	3.4
2-Nitrophenol; o-Nitrophenol	88-75-5	8270C	CLP	10	0.99	13.5	NE	NE
4-Nitrophenol; p-Nitrophenol	100-02-7	8270C	CLP	50	4.8	35	NE	290
N-Nitrosodiphenylamine	86-30-6	8270C	CLP	10	0.91	13	NE	14
N-Nitrosodi-n-propylamine; N-Nitrosodipropylamine; Di-n-propylnitrosamine	621-64-7	8270C	CLP	10	1	NE	NE	0.0096
2,2'-Oxybis(1-chloropropane)	108-60-1	8270C	CLP	10	1.3	NE	NE	0.27
Pentachlorophenol	87-86-5	8270C	CLP	10	0.58	5.23	1	0.56
Phenanthrene	85-01-8	8270C	CLP	10	2.4	2.1	NE	1800 [7]
Phenol	108-95-2	8270C	CLP	10	1.3	100	NE	22000
Pyrene	129-00-0	8270C	CLP	10	1.4	0.3	NE	180
1,2,4-Trichlorobenzene	120-82-1	8270C	CLP	10	2.5	69.2	70	190
2,4,5-Trichlorophenol	95-95-4	8270C	CLP	10	1.1	NE	NE	3600
2,4,6-Trichlorophenol	88-06-2	8270C	CLP	10	1.3	2	NE	6.1
Aroclor 1016	12674-11-2	8082	CLP	1	0.018	0.000029	0.5 [10]	0.96
Aroclor 1221	11104-28-2	8082	CLP	1	0.094	0.000029	0.5 [10]	0.034
Aroclor 1232	11141-16-5	8082	CLP	1	0.16	0.000029	0.5 [10]	0.034
Aroclor 1242	53469-21-9	8082	CLP	1	0.3	0.000029	0.5 [10]	0.034
Aroclor 1248	12672-29-6	8082	CLP	1	0.22	0.000029	0.5 [10]	0.034
Aroclor 1254	11097-69-1	8082	CLP	1	0.096	0.000029	0.5 [10]	0.034
Aroclor 1260	11096-82-5	8082	CLP	1	0.065	0.000029	0.5 [10]	0.034
Aldrin	309-00-2	8081A	CLP	0.05	0.0064	0.0185	NE	0.004
alpha-BHC	319-84-6	8081A	CLP	0.05	0.0059	12.38	NE	0.011
beta-BHC	319-85-7	8081A	CLP	0.05	0.0062	0.495	NE	0.037

TABLE A1-8
TARGET ANALYTE LIST, ANALYTICAL REPORTING VALUES, AND SCREENING LEVELS FOR SURFACE WATER MATRICES

Morton Facility
Reading, Ohio

Common name[1]	CAS RN [2]	Analytical Method [3]	Target Analyte List[4]	RL (µg/L)	MDL (µg/L)	EDQL (µg/L)	Human Health Screening Levels[5]	
							MCL (µg/L)	Region 9 PRG (µg/L)
delta-BHC	319-86-8	8081A	CLP	0.05	0.006	666.67	NE	NE
gamma-BHC (Lindane)	58-89-9	8081A	CLP	0.05	0.0062	0.01	0.2	0.052
alpha-Chlordane	5103-71-9	8081A	CLP	0.05	0.0067	0.00029 [11]	NE	NE
gamma-Chlordane	5103-74-2	8081A	CLP	0.05	0.0065	0.00029 [11]	NE	NE
4,4'-DDD	72-54-8	8081A	CLP	0.05	0.0064	0.0011	NE	0.28
4,4'-DDE	72-55-9	8081A	CLP	0.05	0.0074	4.51E-09	NE	0.2
4,4'-DDT	50-29-3	8081A	CLP	0.05	0.0072	0.001	NE	0.2
Dieldrin	60-57-1	8081A	CLP	0.05	0.0069	0.000026	NE	0.0042
Endosulfan I	959-98-8	8081A	CLP	0.05	0.0069	0.003	NE	NE
Endosulfan II	33213-65-9	8081A	CLP	0.05	0.0066	0.003	NE	NE
Endosulfan sulfate	1031-07-8	8081A	CLP	0.05	0.007	2.22	NE	NE
Endrin	72-20-8	8081A	CLP	0.05	0.0087	0.002	2	11
Endrin aldehyde	7421-93-4	8081A	CLP	0.05	0.0064	0.15	NE	NE
Endrin ketone	53494-70-5	8081A	CLP	0.05	0.0066	NE	NE	NE
Heptachlor	76-44-8	8081A	CLP	0.05	0.0071	0.00039	0.4	0.015
Heptachlor epoxide	1024-57-3	8081A	CLP	0.05	0.0068	0.00048	0.2	0.0074
Methoxychlor	72-43-5	8081A	CLP	0.1	0.0084	0.005	40	180
Toxaphene	8001-35-2	8081A	CLP	2	0.23	0.0002	3	0.061

Notes:

1 Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

2 Chemical Abstracts Service registry number (CAS RN). Where "Total" is entered, all species that contain this element are included.

3 Analytical methods refer to analytical procedure numbers used in the U.S. Environmental Protection Agency (USEPA) publication, SW-846, Test Methods for Evaluating Solid Waste, Current Edition.

4 Surface Water (seep) samples will only be analyzed for compounds detected in Phase I groundwater monitoring.

5 Human Health Screening Levels -- Maximum Contaminant Level (MCL); In the absence of an MCL, secondary MCLs or proposed MCLs are provided, if available. USEPA Region 9 Preliminary Remediation Goal "Tap Water" Value (USEPA, 1999b).

6 Action level.

7 Screening criteria were not available. Based on similarities in chemical and physical structure, the following surrogate screening criteria are proposed:

acenaphthylene= acenaphthene — *2-methylnaphthalene= naphthalene*

benzo(ghi)perylene= fluoranthene — *phenanthrene= anthracene*

8 MCL is for total halomethanes.

9 MCL is for total trihalomethanes (THMs), the sum of bromoform, chloroform, bromodichloromethane, and dibromomethane.

10 MCL is for total PCBs, the sum of Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

11 EDQL is for total chlordanes.

µg/L = micrograms per liter.
RL = Reporting Limit.
MDL = Method Detection Limit. (MDLs are updated periodically and values are subject to change).
EDQL = Ecological Data Quality Limit (USEPA, 1999a)
NE = No Level Established.
CLP = Contract Laboratory Program - Target Analyte List defined in Table A1-1.

TABLE A3-1
SAMPLE MATRIX AND LABORATORY/FIELD PARAMETER SUMMARY
Morton Facility
Reading, Ohio

Matrix	Laboratory Parameter	Field Parameter[10]
Soil	VOC[1] SVOC[2] PCBs[3] Pesticides[4] Dioxins/Furans[5] Metals[6] GT[7]	Total Organic Vapors [11]
Groundwater	VOC SVOC PCBs Pesticides Dioxins/Furans Metals General Water Quality[8]	pH Temperature Specific Conductance Turbidity Dissolved Oxygen Water Level
Sediment	VOC SVOC PCBs Metals Pesticides GT[7]	pH Temperature Specific Conductance Dissolved Oxygen
Surface Water	VOC SVOC PCBs Pesticides Metals General Water Quality[8] TSS[9]	pH Temperature Specific Conductance Turbidity Dissolved Oxygen Water Level

Notes:

[1] *VOC = Volatile Organic Compounds listed in Table A1-1 or A1-2. Analyzed by SW-846 Method 8260B.*
[2] *SVOC = Semivolatile Organic Compounds listed in Table A1-1 or A1-2. Analyzed by SW-846 Method 8270C.*
[3] *PCBs = Total Polychlorinated Biphenyls listed in Table A1-1 or A1-2. Analyzed by SW-846 Method 8082.*
[4] *Pesticides as listed in Table A1-1 or A1-2. Analyzed by SW-846 Method 8081A.*
[5] *Dioxins/Furans as listed in Table A1-1 or A1-2. Analyzed by SW-846 Method 8280A.*
[6] *Metals listed in Table A1-1 or A1-2. Analyzed by SW-846 Method 6010/7000/9000.*
[7] *GT = Geotechnical Parameters listed in Table A1-3*
[8] *General Water Quality Parameters listed in Table A1-3.*
[9] *TSS = Total Suspended Solids as presented in Table A1-3.*
[10] *Field Parameters as presented in Table A1-4.*
[11] *Total organic vapors by field screening using a Flame Ionization Detector (FID) or Photoionization Detector (PID).*

TABLE A3-2
PROJECT GOALS FOR PRECISION, ACCURACY, AND COMPLETION OF LABORATORY MEASUREMENT

Morton Facility
Reading, Ohio

Analytical Method	General Precision Goal [1] (RPD) [2]	General Accuracy Goal (%R) [3]		Completeness Goal (%)
	Soil, Water, and Sediment	Soil and Sediment	Water	
EPA 8260B	± 30	± 50	± 30	90
EPA 8270C	± 30	± 50	± 30	90
EPA 8081	± 30	± 50	± 30	90
EPA 8082	± 30	± 50	± 30	90
EPA 8280A	± 50	± 50 - 150	± 50 - 150	90
EPA 6010B and EPA 7471A	± 30	± 50	± 30	90
Water Quality Parameters	± 30	NA	± 30	90

Notes:
For more detailed precision and accuracy goals, see Tables 8.2-4 in the STL - Laboratory Quality Manual (STL, 2000).
1 Precision and accuracy goals vary depending on the compound being analyzed.
2 RPD = Relative percent difference
3 %R = Percent Recovery

TABLE A3-3
PROJECT GOALS FOR PRECISION, ACCURACY, AND COMPLETION OF FIELD MEASUREMENTS

Morton Facility
Reading, Ohio

Field Parameter	Precision Goal	Accuracy Goal	Completeness Goal
pH (units)	±0.2 unit	±0.2 unit	90%
Temperature (°C) [1]	±0.2 °C	±0.4 °C	90%
Turbidity (NTU) [2]	±0.05 NTU	±0.05 NTU	90%
Specific Conductance (µmhos/cm) [3]	±100 µmhos/cm	±100 µmhos/cm	90%
Dissolved Oxygen (mg/l) [4]	±0.3 mg/l	±0.3 mg/l	90%
Water Level (fbgs) [5]	±0.01 foot	±0.01 foot	90%

Notes:
[1] *°C = degrees Centigrade*
[2] *NTU = Nephelometric Turbidity Unit*
[3] *µmhos/cm = micromhos per centimeter, or microSiemens per centimeter*
[4] *mg/l = milligrams per liter*
[5] *fbgs = feet below ground surface*

TABLE A3-4
DATA MEASUREMENT UNITS FOR FIELD AND LABORATORY PARAMETERS

Morton Facility
Reading, Ohio

Parameter	Units
Water Level	feet below ground surface (fbgs)
pH	pH units
Temperature	degrees Celcius (°C)
Turbidity	Nephelometric Turbidity Unit (NTU)
Dissolved Oxygen	milligrams per liter (mg/l)
Specific Conductance	microSiemens per centimeter at 25 °C (µS/cm)
Concentration of chemical in water/surface water	micrograms per liter (µg/l)
Concentration of chemical in soil/sediment	milligrams per kilogram (mg/kg)
Cation Exchange Capacity (CEC)	milliequivalents per kilogram (meq/kg)
Hydraulic Conductivity	centimeters per second (cm/sec)

TABLE A4-1
FIELD OPERATING PROCEDURES
Morton Facility
Reading, Ohio

Field Instrument Calibration & Maintenance

A-1 Calibration and Maintenance of Portable Flame Ionization Detector
A-2 Calibration and Maintenance of Portable Photoionization Detector
A-3 Calibration and Maintenance of Portable Field pH Meter
A-4 Calibration Check and Maintenance of Portable Specific Conductance Meter
A-5 Calibration and Maintenance of Portable Dissolved Oxygen Meter
A-6 Calibration Check and Maintenance of Portable Field Turbidity Meter

Drilling & Excavation

B-1 Hollow Stem Auger Drilling Procedures
B-2 Direct-Push Technique Procedures
B-3 Sonic Drilling and Soil Sampling Procedures
B-4 Plugging and Abandonment of Monitoring Wells
B-5 Sealing of Boreholes
B-6 Test Pit Excavation and Logging

Monitoring Wells

C-1 Monitoring Well Construction for Hollow Stem Auger Boreholes
C-2 Monitoring Well Construction for Sonic Boreholes
C-3 Monitoring Well Development

Soil Sampling

D-1 Split-Spoon Sampling
D-2 Soil Sample Field Screening Using an Organic Vapor Meter
D-3 Soil Sample Handling for Volatile Organic Constituent (VOC) Analysis

Groundwater Sampling

E-1 Low-Flow (Minimal Drawdown) Groundwater Purging Procedures
E-2 Groundwater Sample Collection

Surface Water & Sediment Sampling

F-1 Surface Water Sampling From Seeps
F-2 Sediment Sampling From River or Creek Banks

Decontamination

G-1 Non-disposable and Non-dedicated Sampling Equipment Decontamination
G-2 Drilling and Excavation Equipment Decontamination

Aquifer Testing

H-1 Groundwater Level Measurement
H-2 In-Situ Hydraulic Conductivity by Slug Test for Unconfined (Water Table) Aquifers

TABLE A4-1
FIELD OPERATING PROCEDURES
Morton Facility
Reading, Ohio

H-3 Performance of Aquifer Pumping/Recovery Tests

Geophysical

I-1 Electromagnetic (EM) Survey - EM61 Time Domain Electromagnetic Survey

I-2 Electromagnetic (EM) Survey - EM31 Frequency Domain Electromagnetic Survey

Other Procedures

J-1 Sampling, Labeling, Storage and Shipment

J-2 Documentation Requirements for Drilling and Well Installation

J-3 Management of Investigation-Derived Waste

TABLE A4-2
SAMPLE CONTAINER REQUIREMENTS PER MATRIX
Morton Facility
Reading, Ohio

Parameter	Matrix	Method	Protocol	Sample Containers			Preservation	Holding Time
				Type	Required Volume	Quantity		
VOC [1]	water	8260B	SW-846	vial	40 ml	2 - 4	HCl to pH<2, Cool to 4 °C, Zero Headspace	14 days from Sample Date
SVOC [2]	water	8270C	SW-846	amber glass	1 liter	1	Cool to 4 °C	7 days from sampling to prep/ 40 days after prep to analysis.
PCBs [3]	water	8081A	SW-846	amber glass	1 liter	1	Cool to 4 °C	7 days from sampling to prep/ 40 days after prep to analysis.
Pesticides [4]	water	8082	SW-846	amber glass	1 liter	1	Cool to 4 °C	7 days from sampling to prep/ 40 days after prep to analysis.
Dioxins/Furans [5]	water	8280A	SW-846	amber glass	1 liter	2	Cool to 4 °C	30 days from sampling to prep/ 45 days after prep to analysis.
Metals [6]	water	6010B	SW-846	plastic	4 oz.	1	HNO_3 to pH<2	6 months from Sample Date
Cyanide	water	9012A	SW-846	plastic	4 oz.	1	NaOH to pH>12, Cool to 4 oC	14 days from Sample Date
Mercury	water	7470A	SW-846	plastic	4 oz.	1	HNO_3 to pH<2, Cool to 4 °C	28 days from Sample Date
Chloride	water	325.3 or 300.0	40 CFR 136	plastic or glass	250 ml	1	Cool to 4 °C	28 days from Sample Date
Alkalinity [7]	water	310.1	40 CFR 136	plastic	4 oz.	1	Cool to 4 °C, Zero Headspace	14 days from Sample Date
Ammonia-Nitrogen	water	350.1	40 CFR 136	plastic	4 oz.	1	H_2SO_4 to pH<2, Cool to 4 °C	28 days from Sample Date
Nitrate/Nitrite	water	353.2	40 CFR 136	plastic	4 oz.	1	H_2SO_4 to pH<2, Cool to 4 °C	48 hours from Sample Date
Phosphate	water	365.2	40 CFR 136	glass	16 oz.	1	H_2SO_4 to pH<2, Cool to 4 °C	28 days from Sample Date
Phosphorous	water	365.2	40 CFR 136	plastic	4 oz.	1	H_2SO_4 to pH<2, Cool to 4 °C	28 days from Sample Date
Sulfide	water	376.1	40 CFR 136	plastic	16 oz.	1	NaOH, 20 drops Zinc Acetate to pH>9, Cool to 4 °C	7 days from Sample Date
TDS	water	160.1	40 CFR 136	plastic	4 oz.	1	Cool to 4 °C	7 days from Sample Date
TOC	water	415.1	40 CFR 136	plastic	4 oz.	1	H_2SO_4 to pH<2, Cool to 4 °C	28 days from Sample Date
TSS	water	160.2	40 CFR 136	plastic	16 oz.	1	Cool to 4 °C	7 days from Sample Date
VOC [1]	soil/sediment	8260B	SW-846	EnCore ™	4 oz.	3	Cool to 4 oC, Zero Headspace	48 hours from sampling to prep/14 days from prep to analysis

TABLE A4-2
SAMPLE CONTAINER REQUIREMENTS PER MATRIX
Morton Facility
Reading, Ohio

Parameter	Matrix	Method	Protocol	Sample Containers			Preservation	Holding Time
				Type	Required Volume	Quantity		
SVOC [2]	soil/sediment	8270C	SW-846	glass jar	16 oz.	3	Cool to 4 °C	14 days from sampling to prep/40 days from prep to analysis
PCBs [3]	soil/sediment	8081A	SW-846	glass jar	16 oz.	3	Cool to 4 °C	14 days from sampling to prep/40 days from prep to analysis
Pesticides[4]	soil/sediment	8082	SW-846	glass jar	16 oz.	3	Cool to 4 °C	14 days from sampling to prep/40 days from prep to analysis
Dioxins/Furans [5]	soil	8280A	SW-846	glass jar	8 oz.	1	Cool to 4 °C	30 days from sampling to prep/ 45 days after prep to analysis.
Metals [6]	soil/sediment	6010B	SW-846	glass jar	4 oz.	1	Cool to 4 °C	6 months from sampling to analysis
Cyanide	soil/sediment	9012A	SW-846	glass jar	4 oz.	1	Cool to 4 °C	14 days from Sample Date
Mercury	soil/sediment	7471A	SW-846	glass jar	4 oz.	1	Cool to 4 °C	28 days from sampling to analysis
Sulfide [8]	soil/sediment	376.1	40 CFR 136	glass jar	4 oz.	1	Cool to 4 °C	7 days from Sample Date
Atterberg Limits	soil	D4318	ASTM D4318	glass jar	8 oz.	1	NA	NA
CEC	soil	9081	SW-846	glass jar	8 oz.	1	NA	NA
Grain Size	soil	4822	ASTM D421, 422	glass jar	8 oz.	1	NA	NA
Moisture Content	soil	D2216-90	ASTM D2216	glass jar	8 oz.	1	Cool to 4 °C	NA
pH	soil	9045C	ASTM D2976	glass jar	8 oz.	1	Cool to 4 °C	7 days from Sample Date
TOC	soil	Walkley Black	Walkley Black	glass jar	8 oz.	1	Cool to 4 oC	28 days from Sample Date

Notes:

[1] *VOC = Volatile Organic Compounds as listed in Table A1-1 or A1-2.*
[2] *SVOC = Semivolatile Organic Compounds as listed in Table A1-1 or A1-2.*
[3] *PCBs = Total Polychlorinated biphenyls as listed in Table A1-1 or A1-2.*
[4] *Pesticides = Pesticides as listed in Table A1-1 or A1-2.*
[5] *Dioxins/Furans = the Dioxin and Furan Congeners listed in Table A1-2.*
[6] *Metals = Inorganics analyzed by Method 6010B, as listed in Table A1-1 or A1-2.*
[7] *Alkalinity = Total Alkalinity, Carbonate, and Bi-Carbonate, as indicated in Table A1-3.*
[8] *Sulfide for soil is determined as per leachable method 376.1 of 40CFR Part 136.*

Acronyms:

TDS = Total Dissolved Solids
TOC = Total Organic Content
TSS = Total Suspended Solids
CEC = Cation Exchange Capacity
NA = Not Applicable

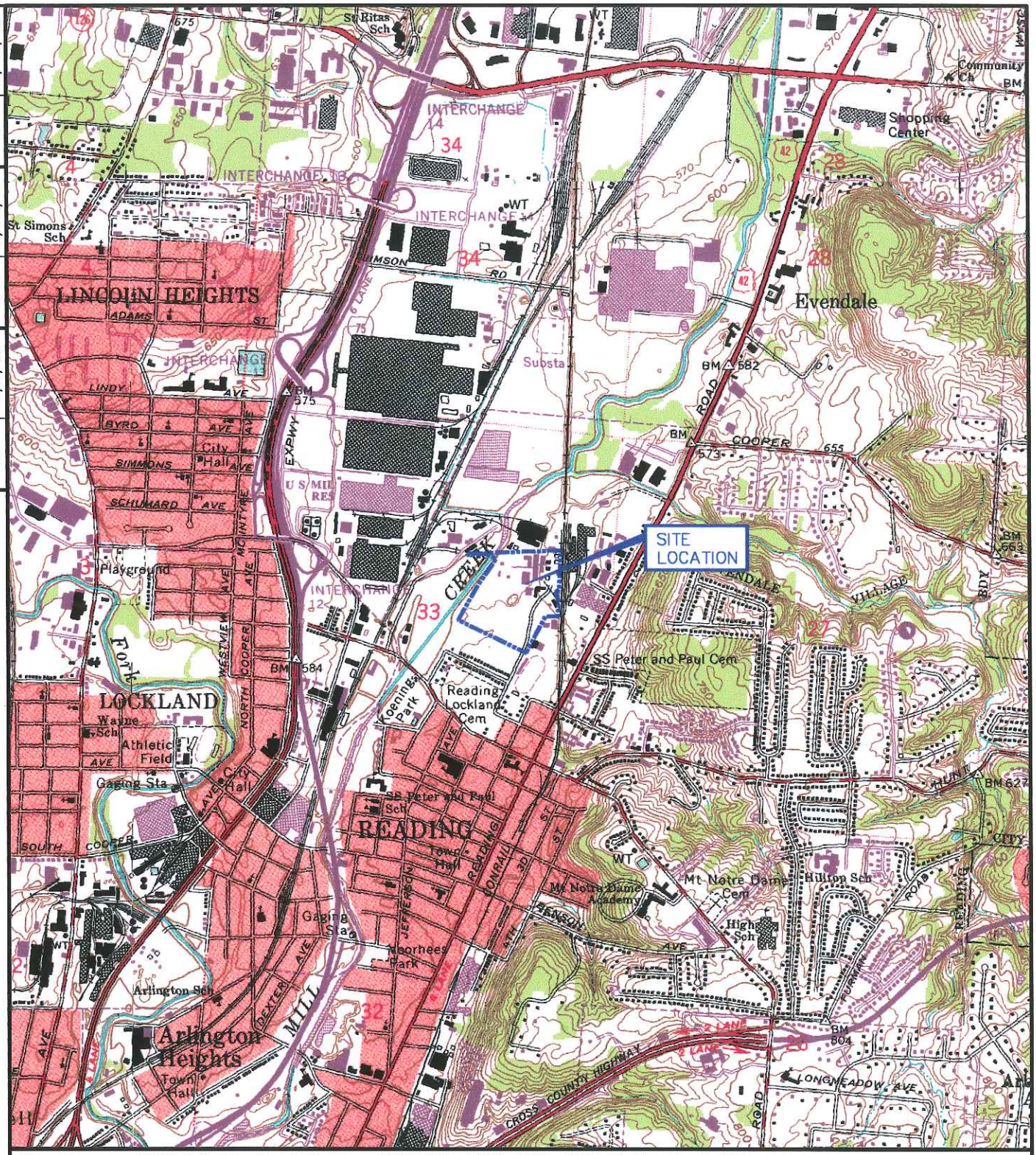
TABLE A4-3
SUMMARY OF SAMPLING AND ANALYSIS PROGRAM
Morton Facility
Reading, Ohio

Sample Matrix	Field Parameters [1]	Lab Parameters [2]	Samples	Blind Duplicate [3]	MS/MSD [3,4]	Blanks [5]	Matrix Total
Soil	Qualitative screening with organic vapor meter	CLP -- Target Analyte List[6]	102	6	6	34	148
		App.IX -- Target Analyte List[6]	18	1	1	4	24
		Geotechnical [7]	40	0	0	0	40
Sediment	Qualitative screening with organic vapor meter	CLP -- Target Analyte List[6]	10	1	1	1	13
		Geotechnical [7]	5	0	0	0	5
Groundwater	pH specific conductance temperature dissolved oxygen turbidity	CLP -- Target Analyte List[6]	146	8	8	48	210
		App.IX -- Target Analyte List[6]	10	1	1	2	14
		General Water Quality [8]	156	0	0	0	156
Surface Water (Seeps)	pH specific conductance temperature dissolved oxygen turbidity	CLP -- Target Analyte List[6]	10	1	1	1	13
		General Water Quality [8]	10	0	0	0	10

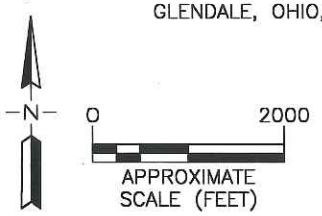
Notes:

1. *Field parameters are provided in Table A1-4.*
2. *Laboratory parameters are provided in Table A1- and A1-2.*
3. *The frequency of sampling is one per every twenty samples.*
4. *Additional volume required for matrix spike/matrix spike duplicate (MS/MSD).*
5. *Blank totals include estimated trip and rinse blanks.*
6. *Target Analyte Lists are provided in Tables A1-5, -6, -7, and -8. Analytes for sediment and seep samples will be based on detections in Phase 1 samples, but are assumed to fall within the CLP-TAL for the purposes of the QAPP.*
7. *Geotechnical analyses include grain size distribution, moisture content, Atterberg Limits, Cation Exchange Capacity, Total Organic Carbon, and pH (Table A1-3).*
8. *General Water Quality water samples: Alkalinity (bicarbonate/carbonate), NH_3, NO_3/NO_2, PO_4^{3-}, P, Ca, $Fe^{2+}/Fe^{3+}/Fe_{total}$, Mg, K, Na, Cl, TDS, TSS (Table A1-3).*

DRAFT BY	RPS 8/5/00	PROJ. CHK	AMH 9/26/00	APPRV. BY	MPH 9/26/00



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



QUADRANGLE LOCATION

GEOMATRIX

SITE LOCATION MAP

PREPARED FOR

ROHM AND HAAS CO. – READING, OHIO

Project No. 6452

Figure No. A1–1

6452A03.DWG

FIGURE A2-1
PROJECT ORGANIZATION
Morton Facility
Reading, Ohio

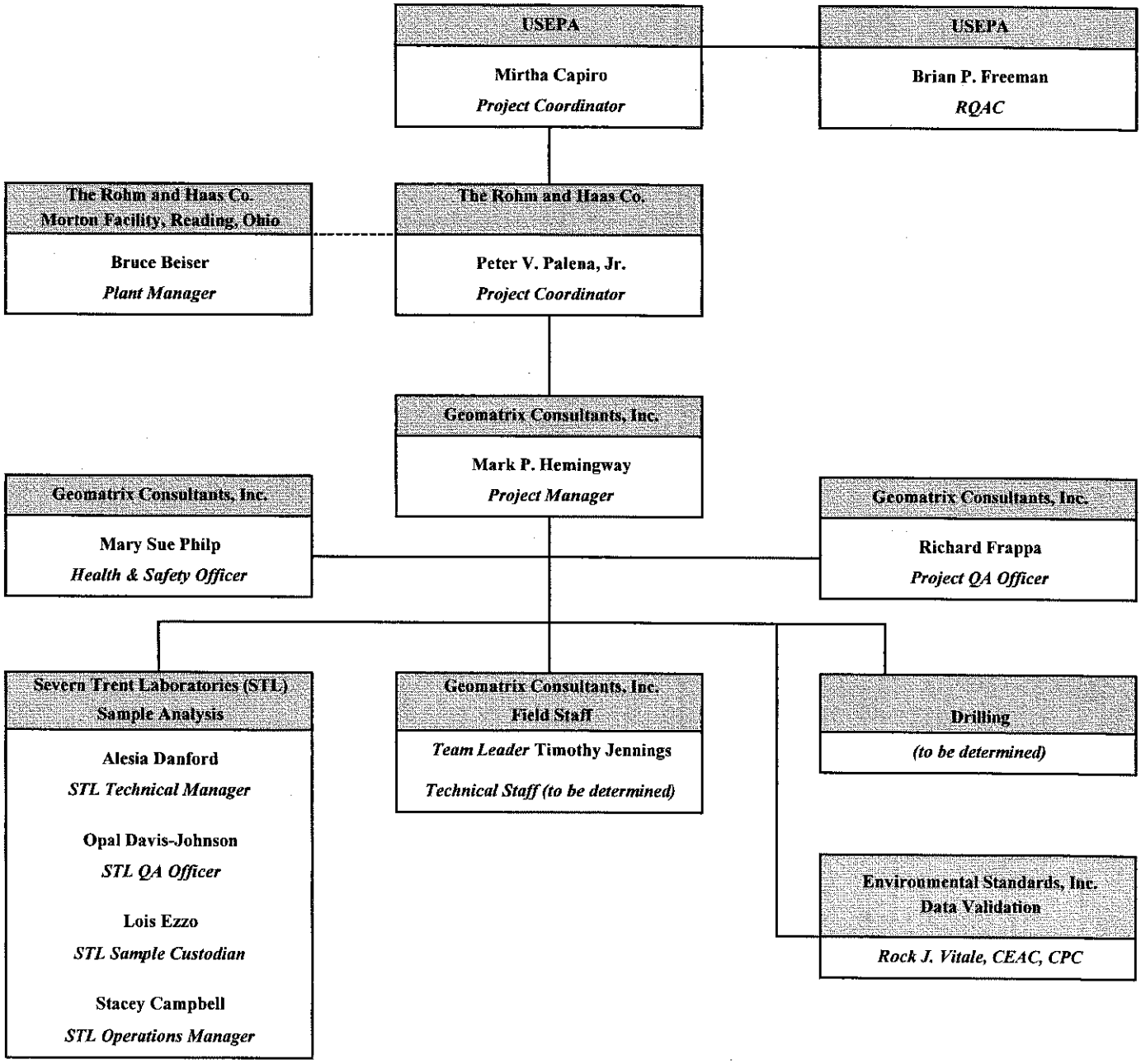


FIGURE A2-2
MANAGEMENT PERSONNEL INFORMATION
Morton Facility
Reading, Ohio

The names, addresses, and telephone numbers of key personnel are as follows:

USEPA Mirtha Capiro, Project Coordinator Brian P. Freeman, RQAC	77 West Jackson DRE-9J Chicago, IL 60604-3590 (312) 886-7567 (M. Capiro) (312) 353-4542 Fax (M. Capiro) capiro.mirtha@epamail.epa.gov (312) 353-2720 (B. Freeman) (312) 353-4342 Fax (B. Freeman) freeman.brian@epa.gov
The Rohm and Haas Co. Peter V. Palena Jr., Project Coordinator	Route 413 & State Road Bristol, PA 19007 (215) 785-7079 (215) 785-7077 Fax Peter_V_Palena@rohmhaas.com
Morton International, Inc. Bruce Beiser, Plant Manager	2000 West Street Reading, Ohio 45215-3431 (513) 733-2179 (513) 733-2276 Fax Bruce_Beiser@rohmhaas.com
Geomatrix Consultants, Inc. Mark Hemingway, Project Manager Timothy Jennings, Field Team Leader	1214 West Sixth Street, Suite 201 Austin, Texas 78703 (512) 494-0333 (512) 494-0334 Fax mhemingway@geomatrix.com tjennings@ecosouth.com

FIGURE A2-2
MANAGEMENT PERSONNEL INFORMATION
Morton Facility
Reading, Ohio

Geomatrix Consultants, Inc. Richard Frappa, Project QA Officer	338 Harris Hill Road, Suite 201 Williamsville, New York 14221 (716) 565-0624 (716) 565-0625 Fax rfrappa@geomatrix.com
Geomatrix Consultants, Inc. Mary Sue Philp, Health and Safety Officer	2101 Webster Street, 12th Floor Oakland, California 94612 (510) 663-4100 mphip@geomatrix.com
Severn Trent Laboratories - *Sample Analysis* Alesia Danford, Technical Manager Opal David-Johnson, QA Officer Lois Ezzo, Sample Custodian Stacey Campbell, Operations Manager	4101 Shuffel Drive NW North Canton, Ohio 44720 (330) 497-9396 (330) 497-0772 Fax adanford@stl-inc.com ojohnson@stl-inc.com
Drilling Contractor	To Be Determined
Environmental Standards, Inc. - *Data Validation* Rock Vitale, CPC	1140 Valley Forge Road P.O. Box 810 Valley Forge, PA 19482-0810 (610) 935-5577 (610) 935-5583 Fax rvitale@EnvStd.com

FIGURE A5-1
CHAIN-OF-CUSTODY SEQUENCE
Morton Facility
Reading, Ohio

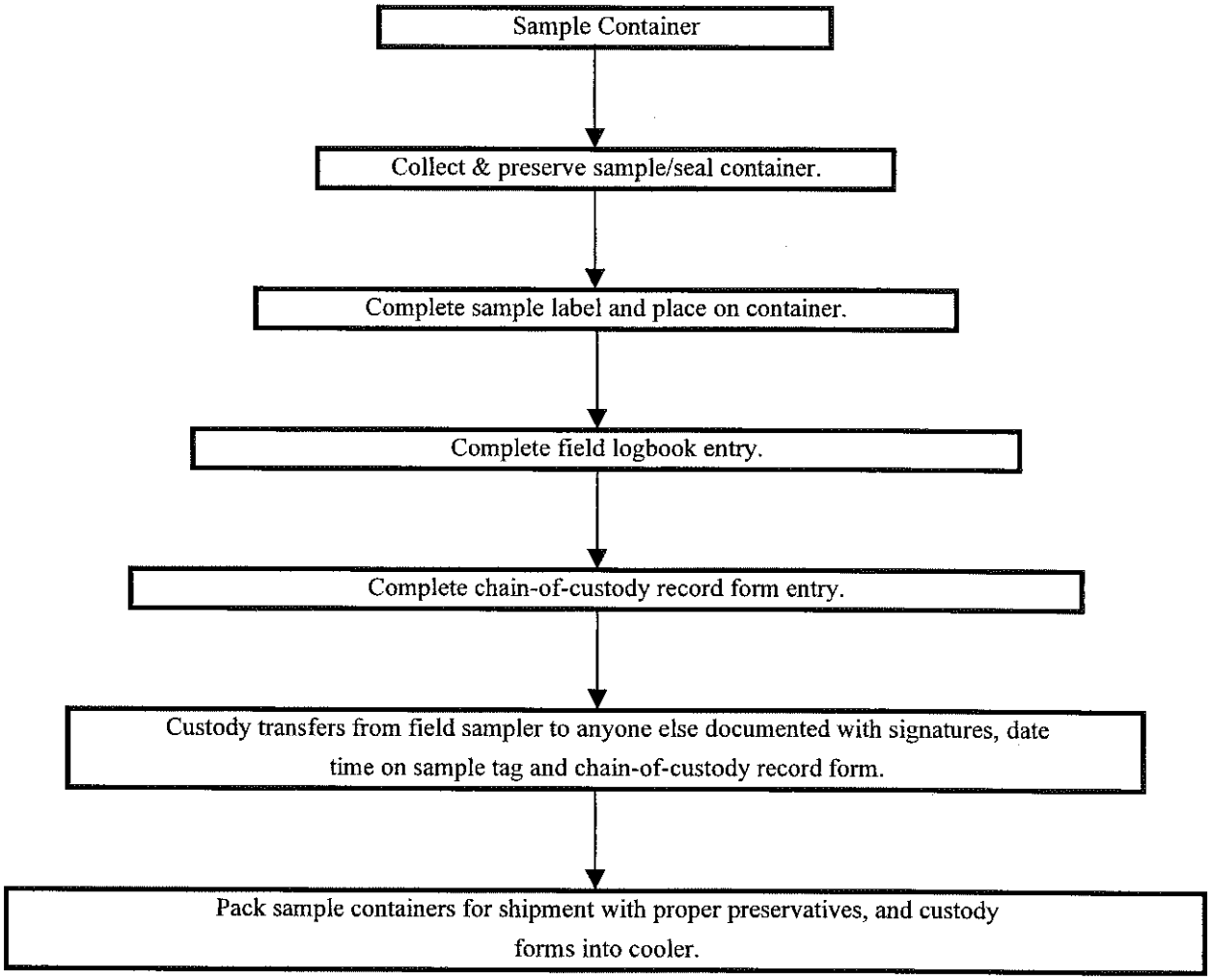


FIGURE A5-2
LABORATORY CUSTODY SEQUENCE
Morton Facility
Reading, Ohio

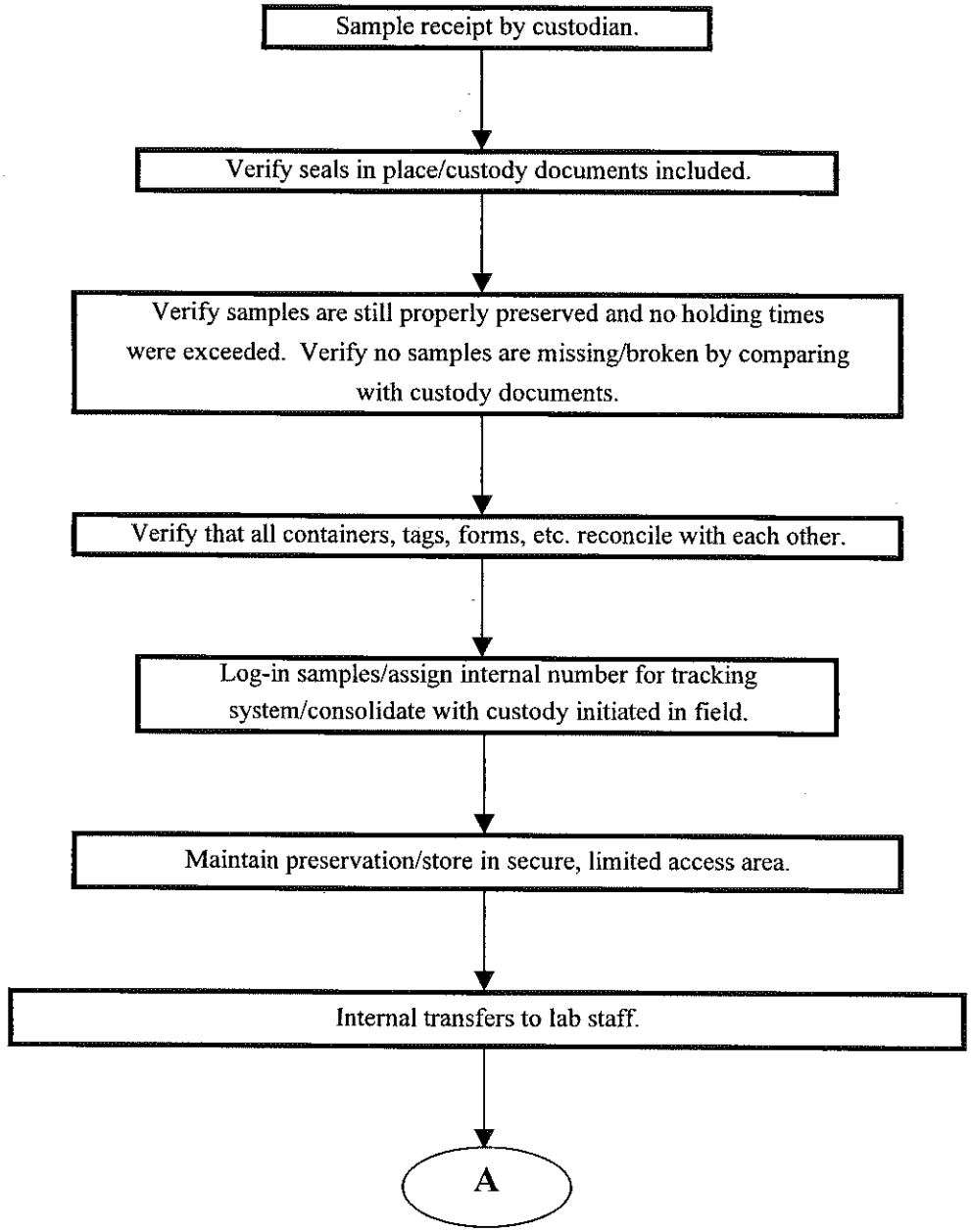
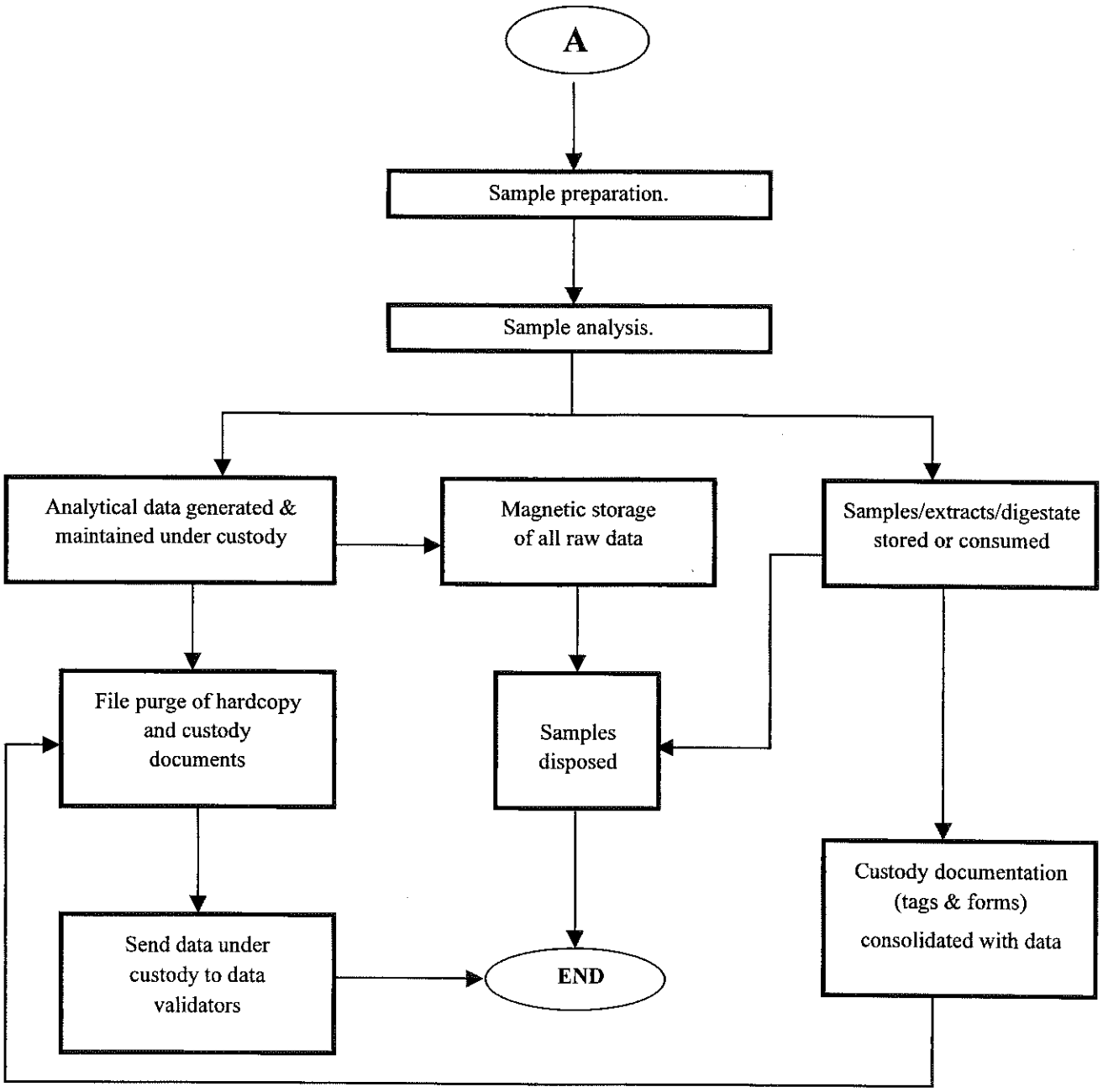


FIGURE A5-2
LABORATORY CUSTODY SEQUENCE
Morton International Inc.
West Alexandria, Ohio



ATTACHMENT 1

EXCERPTED BACKGROUND INFORMATION
FROM THE CURRENT CONDITIONS REPORT
(GEOMATRIX, 2000)

2.0 SITE DESCRIPTION

2.1 LOCATION AND SETTING

The Morton Facility is located in the City of Reading, which is a northern suburb of Cincinnati, Ohio. The Morton Facility is located at 2000 West Street, Reading, Hamilton County (Figure 2-1). It consists of a single tract of land totaling 34 acres. Of these, approximately 27 acres comprise the fenced, operational area of the facility. The remaining 7 acres contain baseball fields used by the City of Reading.

As illustrated in Figure 2-2, the Morton Facility is bounded:

- On the north by a drum recycling facility owned and operated by Cincinnati Drum Service (Cincinnati Drum), and by the Pristine Superfund Site (Pristine). Further to the north, the property is owned by the City of Reading. This property was formerly used as a municipal water supply well field, and for the disposal of foundry sand and fly ash from the City of Reading incinerator (Camp, Dresser & McKee Inc., or CDM, 1986).

- On the east by a Conrail railroad track. Further to the east lie a grain elevator, various small commercial/industrial facilities, and residential areas. The nearest residential area in this direction lies approximately 600 feet from the Morton Facility's eastern boundary.

- On the south by an instrument manufacture facility operated by Rosemont Industries, and recreational facilities operated by the City of Reading. The recreational areas include baseball fields (actually on property owned by Rohm and Haas, as noted above), a swimming pool, and a track and field area. Further to the south lie a residential area and a cemetery. The residential area lies approximately 350 feet from the southernmost boundary of the Morton Facility.

- On the west by a City of Reading hike and bike trail. Immediately to the west of this trail lies Mill Creek, a tributary of the Ohio River. A small portion of the Morton Facility property at the northwest corner of the facility extends across Mill Creek. The area across Mill Creek to the west is occupied by an aircraft engine manufacturing facility operated by General Electric and by an asphalt plant.

Figure 2-3 illustrates the adjacent property ownership.

Land use in the area of the Morton Facility is mixed (Figure 2-4), with industrial, commercial, recreational, and residential all present within 0.5 miles of the facility boundary. The nearest school is Sisters of Notre Dame de Namur, located approximately 0.5 miles to the east. The nearest hospital is Jewish Hospital at Kenwood, approximately 2 miles to the east-southeast. No agricultural use is identified in the vicinity of the facility. A 1994 aerial photograph of the Morton Facility and adjacent areas is included in Appendix A.

2.2 MORTON FACILITY DESCRIPTION

The facility has approximately 175 employees. Manned operations are on a 24-hours-per-day, 7-days-per-week basis. The operational portion of the Morton Facility consists of approximately 28 buildings, including process, warehouse, office, laboratory, and waste treatment activities. The facility also includes approximately 70 aboveground tanks for feedstock, product, and waste storage. No active underground storage tanks (USTs) are currently present at the facility, although two former heating oil USTs are abandoned in place (see Section 3.3). Figure 2-5 illustrates the layout of the Morton Facility.

Except for the baseball fields operated by the City of Reading, and for the small portion of the facility that extends west across Mill Creek, the entire Morton Facility is security fenced and access-controlled. Neither of these unfenced areas include operational or storage areas. A security guard mans the facility gate on a 24-hours per day, 7-days-per-week basis.

The Morton Facility (under several owners) has been engaged in the manufacturing of chemical products since approximately 1950. These products include:

- Synthetic waxes, used as lubricants in plastic extrusion processes and defoamers in the paper industry;
- Asphalt additives, specifically antistripping agents;

- Antioxidants (this process has been sold to another manufacturer and is anticipated to be terminated at the facility by the end of 2000);
- 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, 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. A portion of the dimethyl tin dichloride intermediate produced at the Morton Facility is transported off-site for use at other Morton facilities.

Wastes generated from the manufacturing process are stored at the Morton Facility for less than 90 days, then transported off-site for disposal, recycling, or other appropriate disposition. Historic and current solid and hazardous waste management is discussed in Section 3.4 of this report.

Underground utilities present at the Morton Plant include gas, electric, combined sewer, sprinkler, and water. The location of the combined sewer system (CSS) including outfalls is shown on Figure 2-6. The CSS has been defined as SWMU by the USEPA, and is discussed further in Section 3.4 of this report.

2.3 Physiography And Topography

Hamilton County lies in the Till Plains Region of the Central Lowlands Physiographic Province (ODNR, 1992). The Morton Facility is located within the middle reaches of the Mill Creek Valley, and lies on a terrace of Mill Creek. The facility reportedly does not lie within the 100-year floodplain of the creek (PRC, 1993). Mill Creek is discussed in greater detail in Section

2.6 of this report. The axis of the creek valley is oriented generally north-south, and the valley is bounded to the east and west by hills of outcropping Ordovician bedrock.

The topography slopes toward the creek on the west side of the facility (Figure 2-7). This slope is relatively gentle across most of the facility, but steeper in the northeast portion. Beyond the western facility boundary, the topography drops more steeply down to the creek itself. Based on a survey performed in June 1998 by American Process Designs, Inc., surface elevations are highest in the northeast corner of the Morton Facility, at approximately 578 feet above mean sea level, and lowest in the western area, at approximately 550 feet. The approximate elevation of the creek bed west of the facility is 535 feet.

2.4 CLIMATE

According to a Remedial Investigation report for neighboring Pristine, (Camp, Dresser, & McKee, 1986), the average temperature ranges from 29° Fahrenheit in January to 75° Fahrenheit in July. Prevailing winds are from the south-southwest, averaging 9.1 miles per hour. The average annual precipitation is 40 inches, with the maximum precipitation during spring and winter. All data are from the Cincinnati Airport, approximately 18 miles southwest of the Morton Facility.

2.5 GEOLOGY AND HYDROGEOLOGY

The following sections discuss the regional and local geology and hydrogeology.

2.5.1 Regional Geology and Hydrogeology

Hamilton County is located on the west flank of the regional anticline termed the Cincinnati Arch. The Morton Facility is located within the Mill Creek Valley, which is one of a series of buried glacially-incised valleys in the region. The Mill Creek Valley is a buried valley of the Deep Stage Cincinnati River.

In general, the lower portion of this valley is formed of the Ordovician Kope Formation, comprising limey shales with limestone interbeds (Osborne, 1968; Osborne, 1974). The

valley is filled predominantly with glacial outwash deposits, with lesser amounts of moraine deposits and alluvial deposits from the valley walls.

Sand and gravel deposits within the outwash facies filling the buried valleys form a generally prolific aquifer system, referred to as the Buried Valley Aquifer System (E&E, 1991). This aquifer system is the primary source of groundwater for the Cincinnati area (ODNR, 1989), and is widely used for municipal and industrial supply. A review of supply well logs from the vicinity of the facility (Appendix B) confirms that wells are typically completed in these outwash deposits.

The underlying and surrounding bedrock is noted in an early groundwater availability report (U.S. Geological Survey, 1948) as being insufficiently porous to contain large quantities of water. This report also notes that the bedrock groundwater often contains high concentrations of dissolved solids and sometimes hydrogen sulfide. This is supported by the Ohio Department of Natural Resources (ODNR) Division of Water (ODNR, 1989), which noted that, in Hamilton County:

> "Limited ground water supplies are available for the Ordovician limestone-shale sequence. . . . Wells in these formations may experience seasonal losses of water and dry wells are not uncommon. When groundwater is present in the bedrock, it usually occurs in the upper few feet of weathered material or in fractures and bedding planes within the bedrock."

For activities at neighboring Pristine, the bedrock is not treated as a transmissive unit for the purposes of assessment, modeling, or remediation. Instead, it is considered a no-flow boundary (Conestoga-Rovers, 1996a)

2.5.2 Site Geology and Hydrogeology

Based on Pristine drilling and the log of the on-site water supply well, the outwash deposits at the Morton Facility range from approximately 130 to 160 feet thick. These deposits thin dramatically to the east and west of the site, at the margins of the buried valley. A conceptual cross-sectional view of the site hydrogeologic setting is shown in

Figure 2-8. The boundaries of the outwash deposits are shown in a figure prepared by Conestoga-Rovers & Associates (Conestoga-Rovers, 2000a), included as Appendix C.

In general terms, the facility geology consists of the following strata, from shallow to deep:

1. Fill soils, typically comprising clay.
2. A lacustrine clay and silt sequence, with interbeds of sand and gravel which are generally thin and discontinuous. These interbeds are referred to as "outwash lenses" in Pristine reporting.
3. A till from Wisconsin glaciation (PRC, 1992), described as sandy, gravelly clay with rock fragments (H.C. Nutting, 1980).
4. A lacustrine clay, absent in some locations.
5. A thick sequence predominantly comprising silty sand and gravelly sand, with some clay and silt interbeds.
6. A basal clay, absent in some locations.
7. Shale bedrock

The thickness of these units may vary considerably over relatively short distances.

Previous work at this and neighboring facilities have divided the outwash deposits into two aquifers, separated by the till and lower lacustrine clay, for the purposes of investigation and remediation. These are generally referred to as the Upper and Lower Aquifers, although terminology varies. Descriptions of the hydrogeology of these two aquifers is provided below.

Upper Aquifer

The Upper Aquifer consists of the transmissive interbeds within the shallow lacustrine deposits, above the till. For any given location within the Morton Facility, from one to

three sand or gravelly sand interbeds may be present. Groundwater within each of these interbeds is described as perched (Camp Dresser & McKee, 1986), with flow directions controlled primarily by the dip of the interbeds. These interbeds may be in direct hydraulic communication at locations where they come into close proximity or actual contact with one another. Where they are more widely separated, groundwater is believed to move downward from upper to lower interbeds primarily by leakage through the surrounding clays and silts.

Depths to saturation vary across the Morton Facility, from approximately 5 feet at the east-central edge of the facility, to approximately 24 feet in the southwestern area. The Upper Aquifer groundwater gradient has generally been characterized as sloping from the northeast area of the site predominantly westward, mirroring the surface topography. A groundwater flow direction survey performed in 1983 by K-V Associates, Inc . noted strong southerly flow velocities in some wells. These findings suggest that anisotropy plays a strong local role in groundwater flow.

A large portion, perhaps all, of the Upper Aquifer at the Morton Facility is believed to crop out in the Mill Creek bank west of the facility. Groundwater flowing in this direction and reaching outcrop would be present as seepage. Note that groundwater collection efforts at the site are believed to interrupt most or all of this flow, as discussed in Section 7.1.

Various assessments have characterized the hydraulic character of the Upper Aquifer. The findings of these assessments with respect to primary hydraulic parameters are summarized in Table 2-1.

Lower Aquifer

The Lower Aquifer is generally divided into an upper and lower portion based on lithology. The upper portion predominantly comprises silty sand, and is reportedly not

widely used for local water supply. The lower portion is typically screened by local production wells, and predominantly comprises sands and gravels (CDM, 1986).

The two former City of Reading municipal well fields which produced from this zone are both located in the general vicinity of the facility. One is located to the north of Cincinnati Drum and Pristine, approximately 500 feet from the north Morton Facility boundary. This well field consisted of wells RPW1 through RPW6 on the west side of Mill Creek, and wells RPW9, RPW10, and RPW15 to the east of the creek. The second well field is located in the Koenig Park area approximately 1600 feet south-southwest of the Morton Facility, and consisted of wells RPW-13 and RPW-14 (Conestoga-Rovers, 1996b). Use of both well fields was discontinued by March 1994, and City of Reading public works personnel report that municipal wells were plugged with bentonite as part of the fields' closure. The well fields were closed in response to the presence of dissolved chlorinated hydrocarbons, especially 1,2-dichloroethane (1;2-DCA). 1,2-DCA is the primary groundwater contaminant emanating from Pristine, and the chlorinated hydrocarbon plume emanating from Pristine is currently being captured by that site's groundwater recovery and treatment system. Since the well fields' closure, the City of Reading has obtained its water supply from the City of Cincinnati.

Other municipalities also utilize the Lower Aquifer for groundwater supply. Within three miles of the Morton Facility, the cities of Glendale, Lockland, and Wyoming all utilize the aquifer. Major industrial users in the area include General Electric and Formica. One Lower Aquifer supply well is known to have been historically present in the southwest area of the Morton Facility, near the current location of Building 40 (Figure 2-5). This well was reportedly abandoned in the 1970s. Lower Aquifer supply wells were reportedly also installed at the International Minerals & Chemical Corporation property currently occupied by Cincinnati Drum and Pristine. Information regarding the status of these wells was not available to Geomatrix at the time of this report's preparation.

Although widely utilized for municipal and industrial supply in this area, a consultant for the USEPA concluded that "private wells are virtually non-existent in Hamilton County," based on the prevalence of public supply (E&E, 1991).

The Lower Aquifer is characterized as a leaky confined aquifer. Recharge from the Upper Aquifer can occur through the overlying till layer (Conestoga-Rovers, 1996b). Water level measurements from well clusters in the site's vicinity, however, do not demonstrate the presence of any appreciable vertical gradients within the Lower Aquifer. This suggests that the bulk of Lower Aquifer groundwater at the facility is not being derived from leakage. Instead, it is probably derived from recharge in the more northerly portions of the aquifer, which then migrates south along the buried valley (U.S. Geological Survey, 1948).

The degree of leakage from above is probably controlled by the thickness and character of the overlying till layer. Although the till is believed to be relatively continuous across the Morton Facility, there may be areas where it is thin, absent, or where its permeability is higher due to secondary structures or higher admixtures of coarser sediments. One relatively thin area is located near the boundary between the Morton Facility and Pristine, where the till is observed to be only approximately 10 feet thick (Conestoga-Rovers, 1996b).

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, 1996a). The potentiometric surface of the Lower Aquifer is typically present approximately 50 feet above the upper stratigraphic boundary of that aquifer; at the Morton Facility potentiometric surface is generally equivalent to a depth of approximately 30 feet below the surface. The overall groundwater gradient within the Lower Aquifer is to the south at an average gradient of 10.7 feet per mile (E&E, 1991). Given the relatively narrow character of the aquifer, however, this gradient is strongly

affected by local pumping. During the period of active pumping by the Reading municipal well field north of the Cincinnati Drum facility, a portion of the Lower Aquifer under the Morton Facility, Cincinnati Drum, and Pristine facilities had a northern gradient, toward the well field (Conestoga-Rovers, 1994). Currently, with that municipal well field inactive, the Pristine extraction wells strongly modify the gradient at the Morton Facility. The entire extent of the Lower Aquifer at the Morton Facility is within the interpreted capture zone of wells EW1 and EW2. Appendix C contains potentiometric surface maps generated by Conestoga-Rovers & Associates. These illustrate the Lower Aquifer gradient both with and without active pumping by the nearby Pristine extraction wells.

Various hydrogeologic studies conducted for Pristine have measured or estimated hydraulic parameters for the Lower Aquifer. Values for these parameters are summarized in Table 2-1. Hydraulic testing has shown that the Lower Aquifer is quite variable in terms of transmissivity, due to variations in lithology and thickness. It is also anisotropic, with the highest hydraulic conductivity direction oriented north-south, parallel to the buried valley axis (Conestoga-Rovers, 1996b, 1997).

The Lower Aquifer is bounded on the sides and base primarily by bedrock, although a basal clay stratum is documented in some areas. Bedrock consists of Ordovician shales and limestones of relatively low hydraulic conductivity. The ODNR estimated the bedrock's hydraulic conductivity as 1 to 100 gallons per day per square foot (4.72×10^{-5} to 4.72×10^{-3} cm/sec) in Hamilton County (ODNR, 1989).

2.6 SURFACE WATER HYDROLOGY

Mill Creek is the only body of surface water in the vicinity of the Morton Facility. Mill Creek is a tributary of the Ohio River, and the confluence of the two streams is located approximately 14 miles, measured along the Mill Creek channel, south of the Morton Facility.

Although Mill Creek currently lies 80 to 100 feet west of the Morton Facility property boundary, this is not its original course. An aerial photograph from April 1949 (Appendix A) shows Mill Creek following a meandering channel approximately 300 feet to the west of its current position. The portion beginning at approximately the Cincinnati Drum property and extending south was rerouted to its current, relatively straight course at some point later than this. A May 1949 map shows the channel in its current location, although possibly illustrating the planned rerouting, suggesting that the rerouting occurred in 1949 or the early 1950s. The northwestern portion of the Morton Facility property that currently extends across Mill Creek apparently extended to the former Mill Creek channel.

A contributing stream enters Mill Creek from the General Electric property to the northwest of the Morton Facility, and surface drainages also enter Mill Creek from the Cincinnati Drum and Pristine properties.

According to the USEPA's contractors (PRC, 1992), none of the on-site drainage from the Morton Facility directly enters Mill Creek. Instead, this drainage enters the existing facility's sewers, discharging into the combined sewer system operated by the Metropolitan Sewer District (MSD). Facility runoff may have historically entered Mill Creek through overflow structures during major storm events; one such overflow is noted on a 1949 facility map (E.A. Gast Engineering Co., 1949). Alternatively, runoff and wastewaters from local facilities have entered Mill Creek through documented on-going failures in the MSD sewer system (Thiokol, 1981).

Mill Creek is not used for drinking water supply or agricultural watering in Hamilton County (PRC, 1992), and no surface water intakes are located within three miles of the Morton Facility (TechLaw, 1998). The creek is, however, occasionally used for recreational purposes (U.S. Army Corps of Engineers, 1990, CDM, 1986).

Stream flow in Mill Creek is variable, as shown by data summarized in the Pristine Remedial Investigation Report (CDM, 1986) for the period October 1980 through September 1983. During this period, the mean monthly discharge for the creek varied from a minimum of 10.3 cubic feet per second (cfs) to a maximum of 336 cfs in May 1983. The recorded instantaneous discharge ranged from 5.3 cfs (September 1983) to 1980 cfs (May 1983). All data were from a gauging station approximately one mile south of the Morton Facility.

A 1994 study (OEPA, 1994) found stream waters pervasively impacted by pesticides, industrial chemicals, sewage, and fecal coliform bacteria. Sediments in the lower 17 miles of the creek (i.e. including approximately 3 miles of Mill Creek upstream of the Morton Facility) contained elevated metals, polychlorinated biphenyls, organics, and pesticides. The study concluded that the lower reaches of Mill Creek were being impacted by a variety of sources, including former landfills (1.2 miles of these landfills directly border Mill Creek), hazardous waste sites, industrial discharge, combined sewer overflows, raw sewage discharges, and general urban runoff. The upper reaches were impacted primarily by suburban and agricultural non-point source pollution.

3.0 SITE HISTORICAL BACKGROUND

3.1 PROPERTY OWNERSHIP

The Morton Facility was constructed in 1949 and commenced chemical manufacture operations is 1950. Prior to its purchase, the property use and ownership was as follows:

- The southern part of 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 location of Building 40, in the southwestern portion of the Morton Facility.

- The northern area was owned by Western Reserve Co., and consisted of a winery or wine distillery. A smokehouse and a fireworks manufacture facility are also reported to have been present in the north. The 1949 topographic map shows a business named Woodfire Brands at the approximate current location of Buildings 26 and 27; this presumably represents the smokehouse. A lumber company (S&D Lumber Co.) is shown at the current location of Rosemont Instruments, Inc.

Based on a letter between corporate personnel and the Ohio Environmental Protection Agency (Thiokol, 1983), the Morton Facility property was purchased by Cincinnati Milling Machine Co., Inc. in 1948. This company, which had acquired Carlisle Chemical Works in 1948, constructed the initial facility and moved the chemical manufacture operations to this location in 1949. Although owned by Cincinnati Milling Machine Co., Inc., the operation retained the name of Carlisle Chemical Works from 1949 to 1970.

The name was changed to Cincinnati Milacron Chemicals, Inc. (Cincinnati Milacron) in 1970 as a part of the division of Cincinnati Milling Machine Co. Inc. into separate business entities. It operated under that name until 1980, when it was purchased by Carstab, a subsidiary of Thiokol, Inc. (Thiokol)T.

Morton International, Inc. and Thiokol merged in 1982. The two companies separated again in 1989, but Morton retained the ownership and operation of the facility. In 1999,

all of Morton's assets were purchased by Rohm and Haas, and Morton became a wholly-owned subsidiary of Rohm and Haas.

3.2 PERMITTING AND REGULATORY HISTORY

The following discussion is not intended to provide an exhaustive description of every permit or interaction with various regulatory agencies. Rather, it is intended to summarize major permits and actions that directly affect the objectives of the AO and this CCR. A similar summary is provided by the USEPA contractor TechLaw, Inc (1998).

3.2.1 Resource Conservation and Recovery Act (RCRA) Solid Waste Permitting

Thiokol submitted a Part A Application for RCRA Hazardous Waste Treatment, Storage, and Disposal at the Morton Facility on November 17, 1980. This Application was approved in December of 1981 by the USEPA. A State Hazardous Waste Facility Installation and Operation Permit was issued, also in December of 1981, by the Hazardous Waste Facility Approval Board of Ohio.

Thiokol withdrew the Part A Application in September 1982, reverting to a generator-only status. It has operated under that status since that time, with on-site storage of hazardous wastes for less than 90 days. The State Hazardous Waste Facility Installation and Operation Permit expired in 1984.

The Ohio Environmental Protection Agency (OEPA) issued notices of violations regarding non-compliance with RCRA hazardous waste storage procedures during 1991. The violations related to placement of more than one drum at accumulation sites, maintenance of inspection logs, and availability of emergency equipment. An OEPA inspection later in 1991 indicated the facility had achieved compliance on these issues.

A RCRA Facility Assessment (RFA) was performed by the USEPA in 1998, in the form of a Preliminary Assessment/Visual Site Inspection (PA/VSI). The RFA was conducted

by a USEPA contractor, TechLaw, Inc. (TechLaw). The RFA concluded there were 11 Solid Waste Management Units (SWMUs) at the Morton Facility. Of these, all but 4 had a low potential for releases to environmental media. Of the remaining four, two had medium potential for releases, and two (former surface impoundments and an area termed the "Former Swale Area") had high potential. A more detailed description of the sampling and analytical activities performed during the RFA is provided in Section 5.1.11 of this report.

3.2.2 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Actions

Thiokol provided a Submittal of Notification of Hazardous Waste Site, under Section 103(c) of CERCLA, to USEPA in June of 1981, placing the site on the USEPA's Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS). Based on this listing, the OEPA performed a CERCLA Preliminary Assessment in June of 1986. The Preliminary Assessment conclusions were that only the Upper Aquifer had been impacted by the facility, and that the groundwater collection system was functioning satisfactorily (OEPA, 1986). The site was designated low Field Inspection Team priority, and medium state priority, contingent upon the continued operation of the groundwater collection system.

Further inspections under CERCLA were subsequently performed by the USEPA. These consisted of a Site Screening Inspection (SSI) by Ecology and Environment, Inc. in September 1991, and an Expanded Site Investigation by PRC Environmental Management, Inc. in 1992. The SSI detected elevated levels of chlorobenzene and 1,2-dichlorobenzene (1,2-DCB) in the Upper Aquifer. The ESI concluded that facility activities had released these two compounds, in addition to toluene and other constituents, into the Upper Aquifer. It noted that compounds (primarily 1,2-dichloroethane) detected in the local municipal supply wells did not appear to be originating at the Morton Facility. In addition, it concluded that leachate seeps along Mill Creek may have received

contribution from the Morton Facility surface impoundments, although other facilities to the north were probably contributing to the seeps as well. A more detailed description of the sampling and analytical activities performed during the SSI and ESI is provided in Section 5.1 of this report.

Morton was also identified as a potentially responsible party for the Pristine Superfund Site, based on the shipment of a small amount of facility waste to Pristine. Morton participated in the Federal Consent Decree for Pristine, and provided cash payment as a de minimis party to settle both federal and state actions relating to Pristine.

3.2.3 State and Local Regulatory Activities

Based on the identification of impacted seeps along Mill Creek west of the facility in 1979, the OEPA drilled and sampled soil borings at the facility in June 1980. Based on the sampling and analytical results, they requested in July 1980 that the Morton Facility perform a hydrogeologic investigation and identify an appropriate remedy. Although the hydrogeologic investigation was subsequently performed, the agency issued an administrative order (Directors Final Findings and Orders) to the facility in December 1982 (OEPA, 1991). This order established a timetable for submittal of the investigation findings and a remedial design. Thiokol appealed the order and met with the OEPA; based on this, a second order was issued in January 1983, revoking the first.

The Morton Facility was cited in March 1983 by the Ohio Division of Hazardous Materials Management for illegal discharge of hazardous waste and illegal discharge to state waters. This citation also was related to the suspected presence of facility constituents in groundwater and seeps.

The OEPA issued a Permit to Install (PTI) to the Morton Facility in January 1986 for the installation of a groundwater collection and treatment system. The system had actually been completed in 1985, and was operational at the time of the PTI issuance. A second

Permit to Install was reportedly issued in early 1992 or 1993 for a pH control system. This system (SWMU 9) monitored the pH of the combined storm water and wastewater effluent from the facility, and maintained it between 6 and 10.

Throughout its operational life, the facility has performed discharge of this combined effluent into the municipal sewer system. Permits for this discharge have been issued by the MSD. The MSD permits were modified in 1985 to allow the discharge of recovered and treated groundwater into the combined sewer system. In 1992, civil litigation was initiated against the MSD by a citizens' group, the Ohio Public Interest Research Group, alleging Clean Water Act violations and other claims. As a result of this litigation, Morton International, Inc. entered into a Consent Order with the MSD, OEPA, and other parties regarding the facility's MSD discharge. In order to comply with the requirements of the Consent Order, the Morton Facility installed the pH control system mentioned in the preceding paragraph. The facility has also been fined at that time for a Clean Water Act violation based on toluene exceedances. The Consent Order is still in force, and compliance issues are being reviewed by the National Environmental Law Center.

3.2.4 Air

The Morton Facility has received a large number of air emissions permits for individual operations and structures within the facility (TechLaw, 1998). Currently, all of Morton's active air emissions permits are being incorporated into a Federally Enforceable State Operations Permit, as described in Title V of the federal Clean Air Act Amendments. The Title V Permit application by the facility was certified complete in 2000, and the OEPA is anticipated to issue a draft Permit by early 2001.

3.3 STORAGE TANK USE

The facility currently includes approximately 70 aboveground storage tanks (ASTs). Most of these ASTs are located in three tank farms in the northern portion of the facility, termed the East Tank Farm, North or Middle Tank Farm, and West Tank Farm (Figure 2-5). The Morton Facility utilizes these ASTs for the following purposes:

- Liquid raw material storage;
- Liquid nitrogen storage;
- Liquid product storage;
- Wastewater treatment (primarily separation);
- Fuel storage; and
- Reserve fire fighting water storage.

All ASTs containing hazardous materials are equipped with secondary containment for release detection and control. Certain of the facility's ASTs have been designated as SWMUs by the USEPA Region 5 (TechLaw, 1998). These are discussed in detail in Section 3.4 of this report.

There are currently no active underground storage tanks (USTs) at the facility. Available facility records identify the presence of two closed-in-place USTs at the southeast corner of Building 10 (the Power Plant building) (Figure 3-1). Because these USTs were historically used for heating oil storage, they were reportedly not subject to the Ohio State Fire Marshal's Office, Bureau of Underground Storage Tank regulations. (Chemical Waste Management, Inc., 1992; City of Reading Bureau of Fire Prevention, 1992). Despite this, that Office issued a permit for UST removal in 1992 when Morton commissioned the removal of one of these USTs, and the closure-in-place of the second. During the removal effort, however, excavation collapse threatened the integrity of nearby structures, including a rail spur, building foundations, and a natural gas main.

Based on this, and with the concurrence of the City of Reading Bureau of Fire Prevention, both USTs were therefore internally pressure-washed and vacuumed out, then abandoned in place by filling with concrete. The surrounding excavation was backfilled with a combination of concrete and compacted fill.

During the closure, evidence was observed of heating oil releases from the UST system. This evidence included the presence of a hole in one of the USTs, and field indications of impact to tankhold soils and groundwater by petroleum fuels (Chemical Waste Management, Inc., 1992; Morton; 1992). Excavated tankhold soils were sampled and found to contain low concentrations of aromatics—the total concentration of benzene, toluene, ethylbenzene, and xylenes (BTEX) was 194 micrograms per kilogram (μg/kg). After the tank closure, 57 tons of hydrocarbon-impacted soil from the tankhold were transported to an off-site biotreatment facility. Shallow groundwater from the tankhold area was subsequently sampled and analyzed by facility personnel; no BTEX constituents were detected at quantitation limits ranging from 0.5 to 1.5 micrograms per liter (μg/l).

TechLaw (1998) identified an additional 300-gallon UST formerly used for fork lift fuel storage. Facility personnel report this tank was located west of Building 6, and was removed in the 1980s.

3.4 Solid Waste Management History

A RCRA Facility Assessment (RFA) was performed by the USEPA in 1998. This RFA took the form of a Preliminary Assessment/Visual Site Inspection (PA/VSI) conducted by a USEPA contractor, TechLaw. The findings of this RFA are summarized in the PA/VSI Report (TechLaw, 1998).

The RFA identified eleven SWMUs at the facility. Seven of these were described as having little or practically no potential for environmental releases, typically based on process knowledge and/or engineering controls. The remaining four were identified as

having a medium to high potential for such releases. Table 3-1 lists the SWMUs identified by the RFA and their associated release potential. SWMU locations are shown on Figure 3-1 (SWMUs 1 through 10) and 3-6 (SWMU 11). Several of these SWMUs were subsequently identified as Study Areas in the AO. The following summarizes available information regarding the physical character and operational history of each SWMU.

SWMU 1—Former Surface Impoundments

A series of six surface impoundments were excavated in 1950 for wastewater treatment. Although impoundment areas varied, the typical area of each was approximately 2500 square feet, (E&E, 1991), and they occupied a total area of approximately 21,200 square feet (PRC, 1992). Impoundment depths were estimated at 5 to 6 feet. There is no indication that the impoundments were lined.

The impoundments received wastewaters from scrubbers, centrifuges, floor drains, and processes during the period from 1950 to approximately 1980 (Thiokol, 1983). These impoundments were primarily used to neutralize and dispose of dilute acid solutions. The first two ponds contained crushed dolomite to neutralize acid constituents. Neutralized wastewater then passed through a series of three settling ponds, then into an evaporation/infiltration pond.

Based on correspondence from facility personnel (Thiokol, 1983), the three western impoundments were used in the mid-1960s for the disposal of lime sludge from another facility acid neutralization process. The impoundments were dredged at least once to provide additional capacity. The neutralization impoundments were also periodically dredged and refilled with new limestone. Based on gradual changes in facility waste management practices, the impoundments were dredged and backfilled with soil during

the period from 1970 to 1980. Most of the former impoundment area is now paved with concrete and/or asphalt.

A 1979 letter from Cincinnati Milacron to the OEPA (CMC, 1979a) estimated the daily volume of discharge to the impoundments at approximately 960 gallons. This is generally consistent with internal correspondence earlier in 1979 (CMC, 1979b). In 1979, approximately 95 percent of the discharge was dilute hydrochloric acid, with lesser amounts of methanol and dilute sulfuric acid. The discharge also included a large number of minor constituents, including phenols, various other alcohols, amines, ammonia, ketones, chlorides, benzoic acid, and "soluble oils." Facility correspondence (Thiokol, 1983) also references various alcohols (i.e. myristyl, lauryl, stearyl, isopropyl), sodium bicarbonate washes, "fumes from the benzotrichloride vent scrubber," benzophenones, and various chemical additives as being discharged to the impoundments. 1977 documentation (CMC, 1977) described a lower volume of discharge, equivalent to approximately 550 gallons per day, and noted that process reactor cleanouts were also periodically routed to the impoundment. Copies of the documents detailing the waste streams discharged to the impoundments are included in Appendix D.

The 1998 RFA (TechLaw, 1998) concluded that the former surface impoundments had a high potential for releases, and that data indicated that they were a source of hazardous constituents to groundwater, soil, and sediments. This conclusion was based on the results of soil sampling below the former impoundments, groundwater sampling in their vicinity, and sediment sampling at Mill Creek. The results of historic sampling efforts are described in Section 5.1.

SWMU1 is identified as a Study Area in Paragraph 16 of the AO.

SWMU 2—Former Neutralization Tank

After the surface impoundments were phased out for acid waste stream neutralization in 1980, the Morton Facility neutralized these wastestreams in a 10,000-gallon fiberglass aboveground tank (AST). This AST, designated Tank 9089, is located in the East Tank Farm, along the eastern facility boundary (Figure 3-1). All ASTs within the East Tank Farm, including the Former Neutralization Tank, are placed on a concrete pad and equipped with secondary containment.

Neutralized acid waste streams were discharged from the Former Neutralization Tank into the CSS. After the Morton Facility brought a pH Control System (SWMU 9) on line in 1993 for the treatment of facility-wide wastewater/storm water, use of the Neutralization Tank for wastewater treatment was terminated. Tank 9093 is currently used for intermediate material (dimethyl tin dichloride) storage.

There are no documented releases from the Former Neutralization Tank. The 1998 RFA noted that the integrity of the AST and containment appeared intact during the site inspection. The RFA concluded the potential for past or present releases was low, and that "no further investigation appears necessary, since there is no evidence of a spill or release and secondary containment appeared to be intact at the time of the [Visual Site Inspection]."

SWMU 2 is identified as a Study Area in Paragraph 17 of the AO.

SWMU 3—Former Drum Storage Area

This area was historically used for the storage of drummed solid wastes under 90-day accumulation, in accordance with the Morton Facility's generator status. It is located on the north boundary of the facility, overlying the former location of the easternmost three surface impoundments (SWMU 1) (Figure 3-1). The 1982 Closure Plan submitted to the

Ohio Division of Hazardous Materials Management by the facility (Thiokol, 1982) described the Former Drum Storage Area as having dimensions of approximately 130 by 65 feet. The 1998 RFA noted that the area was paved with concrete and curbed, although the concrete was reportedly cracked in several spots. The facility's 1981 State of Ohio Hazardous Waste Facility Installation and Operation Permit (Ohio Hazardous Waste Facility Approval Board, 1981) estimated the area would annually manage:

- Flammable wastes—100 to 275 tons of D001 wastes;
- Corrosive wastes—800 tons of D002 wastes;
- Reactive wastes—40 tons of D003 wastes;
- Methanol wastes—75 tons of U154 wastes; and
- Listed spent halogenated and non-halogenated solvent wastes—100 tons of F001 wastes, 400 pounds of F003 wastes, 10 pounds of F004 wastes, and 10 to 70 tons of F005 wastes.

The use of this area for drummed hazardous waste storage reportedly began in or around 1980, and ended in 1992, in favor of the current Hazardous Waste Drum Storage Area (SWMU 4).

Although no releases were documented for this SWMU, the RFA designated it to have a moderate potential for past or present releases, based on the presence of cracks in the concrete slab. Given this area's location (within the boundaries of SWMU 1), the two SWMUs could be readily addressed by a single assessment.

SWMU 3 is identified as a Study Area in Paragraph 18 of the AO.

SWMU 4—Hazardous Waste Drum Storage Area

Like SWMU 3, SWMU 4 was used for the storage of drummed solid wastes under 90-day accumulation. It is located in the west central area of the facility, near Buildings 24 and 29 (Figure 3-1). The 1982 Closure Plan submitted to the Ohio Division of Hazardous Materials Management by the facility (Thiokol, 1982) described the Hazardous Waste Drum Storage Area as having dimensions of approximately 24 by 12 feet, but noted that it was part of a larger storage area used for raw materials and process intermediates. By the 1998 RFA (TechLaw, 1998), the area had been improved with a storage building constructed specifically to comply with modern management practices for drummed hazardous waste storage. The building is roofed, floored with concrete, and is walled on three sides; the open side is enclosed by heavy plastic sheeting to allow fork lift traffic, but restrict vapor or dust migration. It is constructed to provide containment of liquid releases. The facility's 1981 State of Ohio Hazardous Waste Facility Installation and Operation Permit (Ohio Hazardous Waste Facility Approval Board, 1981) estimated the area would annually manage up to 175 tons of flammable (D001) wastes. The RFA described 1998 waste management as consisting of 30 to 40 drums of flammable (D001) wastes, a partial drum of other corrosive and toxicity wastes (D002, D004, D007, and D008), and an unspecified quantity of spent non-halogenated laboratory solvents (F003 and F005). Use of the area for hazardous waste drum storage reportedly commenced around 1980, and continues today.

There are no documented releases from the Hazardous Waste Drum Storage Area. The 1998 RFA concluded the potential for past or present releases was low, and that "no further investigation appears necessary, since the Hazardous Waste Drum Storage Area (SWMU 4) is covered, contained by walls and a trench system, and there is no evidence of a spill or release from the unit." SWMU 4 is not identified as a Study Area in the AO, and the AO does not require any further evaluation of this unit.

SWMU 5—Former Sulfide Waste Treatment Tank

SWMU 5 is a steel 10,000-gallon AST, designated Tank 9111, and located in the northeastern portion of the site, within the North or Middle Tank Farm (Figure 3-1). The Former Sulfide Waste Treatment Tank is positioned on a concrete surface, and was equipped with secondary containment curbing for release control in 1992. According to the 1998 RFA (PRC, 1998), the Tank was used from 1980 to 1986 or 1987. SWMU 5 is reported to have stored approximately 40,000 gallons of high pH wastewater each year. This wastewater was generated from the sulfurization of fats and oils, and was subsequently transported off-site for disposal. This AST is currently used for fuel oil storage.

There is some inconsistency with regard to the early history of this SWMU in the context of sulfide waste management operations. The ESI Report (PRC, 1993) states that the facility utilized several tanks in the northeast portion of the site for sulfide waste treatment and storage. This report further states that these activities were the basis for the Morton Facility's Part A Permit application.

This is not completely consistent, however, with facility documents from 1982, which describe the hazardous waste management activities during the period November 1980 through September 1982 (Thiokol, 1982a & b). As discussed in Other Waste Management and On-site Waste Disposal Factors below, these documents describe a single tank for the storage of reactive wastes, a second for the storage of corrosive wastes, and a third used for separation of separate-phase organic liquids. These descriptions do not immediately suggest "sulfide waste treatment and storage." In any case, if other tanks were used for sulfide waste treatment and/or storage, it seems likely that they also would have been located within the North Tank Farm with SWMU 5.

The Former Sulfide Waste Treatment Tank is currently used for fuel oil storage. The 1998 RFA noted that its integrity appeared intact. The RFA further concluded that "[no]

further investigation appears necessary, since the structural integrity of the tank appeared intact and there is no evidence of a spill or release from the unit." SWMU 5 is, however, identified as a Study Area in Paragraph 19 of the AO.

SWMU 6—Groundwater Collection System

Based on negotiations in the early 1980s between Thiokol and the OEPA regarding environmental impact at the Morton Facility, 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 groundwater migrating to seeps on the eastern bank of Mill Creek. The system became operational at full-scale in 1985 (Thiokol, 1986) and has operated with only brief hiatuses since that time. SWMU 6 consists of four major components:

- A french drain extending to a nominal depth of approximately 21 feet, across the uppermost saturated zone. The french drain lies generally along the western property boundary.
- A collection sump at the southern extremity of the french drain. Groundwater is pumped from the french drain at this location, removing it from the Upper Aquifer.
- An Upper Aquifer extraction or recovery well in the west-central portion of the facility, at the former location of a "swale" area reportedly used for on-site waste disposal (see SWMU 11 discussion, below). A submersible pump within this well removes groundwater, pumping it via underground transfer piping to the french drain sump.
- A slurry wall, also to a nominal depth of approximately 21 feet. The slurry wall extends for approximately 350 feet along the northern property boundary.

The locations of these components are shown in Figure 3-1. A discussion of the impact detected along the Creek and in the shallow groundwater is provided in Section 5.2 of this report, and the groundwater collection system is discussed further in Section 7.1.

SWMU 6 does not manage facility wastes per se, but does collect, store, and transfer waste and hazardous material constituents from the subsurface to a groundwater treatment system (SWMU 7). Groundwater collected from this system has historically contained high concentrations of organics (Table 3-2). Concentrations of certain metals may also be elevated, but in the absence of a well-defined site-specific background, it is not possible to make a definitive statement in this regard. Although some portion of these constituents are believed to have originated on-site, it should also be noted that there is not currently sufficient on-site data to evaluate the contribution of potential off-site sources (i.e. Cincinnati Drum, Pristine, et al.).

The RFA did not identify any releases from this SWMU. Given the physical nature of this operation, releases could only occur from groundwater transfer piping. Because collected groundwater is transferred to a treatment system located immediately upgradient of the french drain, any such releases would be recaptured by the system. Presumably in recognition of this, the RFA further noted that the potential for past or future releases from this system is low, and did not recommend any investigation. It did recommend, however, that the system continue to operate as long as necessary to control the off-site migration of impacted groundwater.

With SWMU 7, SWMU 6 is identified as a Study Area in Paragraph 20 of the AO.

SWMU 7—Groundwater Treatment Unit

As noted under the SWMU 6 discussion, Upper Aquifer groundwater is collected by a french drain and extraction well, both in the western portion of the facility, and transferred via underground piping to an on-site treatment plant. The Groundwater Treatment Unit was constructed at pilot scale in 1984, then full scale in 1985. The purpose of this Unit was to render groundwater suitable for permitted discharge (with the balance of the facility's effluent) into the MSD sewer (Morton Thiokol, 1984). The initial

treatment was the addition of a concentrated hydrogen peroxide solution to the recovered groundwater, in order to oxidize organics and reduced inorganics (particularly sulfides).

The MSD permit to discharge treated groundwater apparently expired on May 1, 1991, although discharge was allowed to continue on a conditional basis until May 1, 1992 (Municipal Sewer District, 1991). During this period, and as a part of efforts to improve compliance with MSD discharge criteria, the Morton Facility enhanced the treatment of recovered groundwater. Additional treatment consisted of carbon adsorption, bag filtration, and softening. At approximately the same time, the Morton Facility began efforts to identify a reuse for the approximately 12,200 gallons per day of treated groundwater. The reuse selected was as make-up non-contact cooling water in a recirculating cooling tower; as of 1990, the facility required an average of 24,900 gallons of make-up water each day (Morton, 1991).

Facility personnel have voluntarily performed regular sampling of the influent and effluent water quality since at least 1993 to verify the effectiveness of the treatment system. The resulting analytical data is summarized in Table 3-2.

The RFA did not identify any releases from SWMU 7, but did note verbal reports by facility personnel that the treated groundwater would be released from the cooling system via evaporation and overflows (presumably minor). As shown in Table 3-2, this treated groundwater may contain low levels (aggregate concentration of metals and organics at less than 1 milligram per liter, or mg/l) of a small number of hazardous constituents.

The RFA did not recommend any investigation of this SWMU, but did recommend that the water quality testing program be continued on a mandatory basis. With SWMU 6, however, SWMU 7 is identified as a Study Area in Paragraph 20 of the AO.

SWMU 8—Satellite Waste Accumulation Unit

There are five Satellite Waste Accumulation Areas at the Morton Facility, each consisting of a single drum. These are located within Buildings 3, 4, 6, 11/12, and 27 in the eastern portion of the facility (Figure 3-1). These Areas are used for temporary storage of drummed hazardous wastes, pending their consolidation at the Hazardous Waste Drum Storage Area (SWMU 4). These areas reportedly manage flammability (D001), toxicity (D004, D007, D008), and spent non-halogenated solvent (F003, F005) wastes (TechLaw, 1998). They have been used for this purpose since 1982.

The RFA designated SWMU 8 as having a low potential for past or present releases. It further concluded that "[no] further investigation appears necessary, since all Satellite Waste Accumulation Areas . . . are located over concrete surfaces and there is no evidence of past or present spills or releases from the units." SWMU 4 is not identified as a Study Area in the AO, and the AO does not require any further evaluation of this unit.

SWMU 9—pH Control System

As discussed in Section 3.2.3 of this report, civil litigation was filed against the MSD for Clean Water Act violations. As a part of the resolution of this litigation, the Morton Facility entered into a Consent Order addressing facility discharge to the MSD. To minimize excursions from permitted discharge criteria, the facility installed and operated the pH Control System. The System was placed to treat process wastewaters discharging to the facility's west outfall (see discussion of SWMU 11—Combined Sewer System).

The Morton Facility commission a siting investigation prior to construction of the pH Control System. This investigation was performed in November 1992 by IT Corporation, and identified acetone, toluene, ethylbenzene, and xylenes in one soil sample at a depth of

8 to 14 feet (see Section 5.1.10 of this report). Groundwater was encountered at a depth of 10 to 12 feet below grade.

The pH Control System came on line in 1993. It consists of two lined concrete sumps in series, with automated pH monitoring and metering of caustic or acid addition. pH-adjusted water is discharged from SWMU 9 into the MSD.

The RFA designated this SWMU to have a low potential for past or present releases, based on the construction of the unit. It did not recommend any further investigation of the pH Control System.

With SWMU 11, SWMU 9 is identified as a Study Area in Paragraph 21 of the AO.

SWMU 10—Former Swale Area

As depicted in the 1949 topographic map and 1949 aerial photograph (Appendix A) of the Morton Facility, the Former Swale Area is a broad, irregular depression, including at least one small pond. Topographically, the base of this depression was approximately 14 feet below the higher terrain to the east and southeast, and 3 to 5 feet below the terrain to the west and northwest. It was located near what is now the northwest portion of the employee parking lot, in the southwest/west central area of the facility (Figure 3-1). No physical expression of the Former Swale Area still remains. This location is frequently referred to in documents from the 1980s and 1990s as the MW-2 area.

There have been historical allegations and documentation regarding waste disposal activities at this area. Given its physical nature, the RFA notes it may readily have been used for the disposal of dairy wastes prior to the Morton Facility's construction in 1949. A 1983 letter from Thiokol (Thiokol, 1983) noted that the area probably contained construction rubble, portions of a demolished barn from the former dairy (including metal debris), and fill dirt. It further stated that the area had never been used for formal

chemical waste disposal; but acknowledged that such activities may have historically occurred. An interoffice memorandum (Thiokol, 1980a) and attached backup notes described the disposal of neutralized acid wastes (lime sludge), demolition debris, sample bottles, excavated soils, and "possibly some drums" at this location during the 1950s and early 1960s. A former employee engaged in litigation against Thiokol alleged that hundreds of fiber and metal drums of waste were buried in this area, at depths of up to 15 feet (PRC, 1993; E&E, 1991). Finally, the disposal of optical brightener waste at this location is referenced in 1982 OEPA correspondence to the facility.

Metal detector surveys were performed in the Former Swale Area by the OEPA and a USEPA contractor in 1980 (OEPA, 1980; E&E, 1982). Although these surveys did detect scattered areas of apparent buried metals, including an area with approximate dimensions of 50 feet by 100 feet in the northwest corner of the parking lot, subsequent drilling did not encounter drums or waste materials.

It is clear, however, that soils and groundwater in the former swale area are impacted with organics and possibly metals. Sample data from investigations throughout the 1980s identified relatively high levels of hexachlorobenzenes, hexachlorobutadiene, hexachloroethane, and toluene in groundwater from this location. Arsenic, chromium, lead, and other inorganics may also have been elevated. Sampling during the ESI (PRC, 1993) detected acetone, chlorobenzene, 1,2-dichlorobenzene, nickel, and vanadium in groundwater from Former Swale Area wells. Historical groundwater analyses for the facility are discussed in Section 5.1 of this report.

In response to the presence of groundwater impact, the Morton Facility installed the extraction well component of the Groundwater Collection System (SWMU 6) within the Former Swale Area. This well has been removing impacted groundwater since 1985.

The RFA concluded that it was likely that the detected groundwater impact was originating within the Former Swale Area, and designated it as having a high potential for past or present releases. It further concluded that continued groundwater recovery may be effective in containing the area of impact, and recommended further subsurface investigation of this SWMU.

SWMU 10 is identified as a Study Area in Paragraph 22 of the AO.

SWMU 11—Combined Sewer System

The CSS is a complex of underground piping underlying most of the process and other operational areas of the Morton Facility (Figure 2-6). Although most of this piping system is still active, certain portions are no longer used. The CSS collects and transports sanitary, storm water, and process wastewater to one of two facility outfalls: one on the western facility boundary, and one on the southern facility boundary. Process wastewater discharging via the western outfall are treated by the pH Control System (SWMU 9). All discharge from both outfalls is transported by the MSD main to the Mill Creek Wastewater Treatment Plant owned by Hamilton County and operated by the City of Cincinnati.

There is no definitive information on the age or integrity of the CSS. Given its complexity and extent, however, it is reasonable to conclude that portions of it were probably constructed with the initial facility. The presence of some kind of sewer system outfall is suggested by the overall configuration of the property, with a long, narrow "peninsula" extending to the former channel of Mill Creek. A similar pattern is present along the western property boundary of Cincinnati Drum. The balance of the CSS was presumably constructed in stages as the facility expanded during its 50 years of on-going operations. Figure 2-6 summarizes available information regarding the size and material of construction of CSS components. Facility personnel anticipate that the CSS will be upgraded to new MSD criteria, with separate systems to discretely manage stormwater vs.

industrial and sanitary wastewater. Upgrades are anticipated to be in place prior to the MSD permit renewal in 2002.

The RFA (TechLaw, 1998) references the presence of four floor trenches and two weir pits that collect process wastewaters into the CSS. These wastewaters include acids, amines, esters, waxes, alcohols, fats, vegetable oils, phenols, and other constituents.

Based on the potential for underground leakage of wastewater from the CSS, and absence of information regarding its integrity, the RFA concluded that this SWMU has a moderate potential of past or present releases. The RFA recommended that the integrity and construction of the CSS be evaluated, and that the construction and wastes managed be inventoried for each CSS component.

With SWMU 9, SWMU 11 are identified in the AO as Study Area 21.

Other Waste Management and On-Site Waste Disposal Features

In addition to the SWMUs described above, there are several waste management and disposal areas described in facility documentation from the late 1970s through early 1980s. These areas are listed on Table 3-1, and their locations are shown on Figure 3-1. Available information regarding the activities at each is summarized as follows:

- 5000-Gallon Ignitable Waste Storage Tank—This AST was located in the northeast area of the facility. The 1982 Closure Plan (Thiokol, 1982b) referred to the contents of this AST as "ignitable waste," but also noted that this material was anticipated to be beneficially recycled in the facility. Later 1982 correspondence to the USEPA (Thiokol, 1982) confirms that this recycling was performed, and specifies that the material should therefore "not be considered a RCRA hazardous waste." This AST is not currently in use for waste storage; it is not known when storage activities were terminated.

- 12,000-Gallon Reactive Waste Storage Tank—This AST was located in the northeast area of the facility. As with the Ignitable Waste Storage Tank, the 1982 Closure Plan referred to the AST contents as "reactive waste," but noted the

anticipated on-site beneficial recycling of these materials. Supporting correspondence (Thiokol, 1982b) indicates that the material was being "beneficially recycled by a third party." This AST is not currently in use for waste storage; it is not known when storage activities were terminated.

- Wastewater Treatment Tank—This AST was located in the northeast portion of the facility and its size is not specified in available documentation. It had a wastewater treatment capacity of 59,000 gallons per day, but was only used intermittently when a specific manufacturing process was active. Treatment consisted of separation of phase-separated organic liquids from the wastewater, followed by wastewater discharge into the CSS (Thiokol, 1982b). By September 1982, however, the process which required this treatment was changed, and the Treatment Tank was no longer used (Thiokol, 1982a).

Waste Disposal Areas—A 1980 Thiokol memorandum (Thiokol, 1980a) and attached documentation inventory the locations and contents of several on-site locations historically used for waste disposal. The locations of these disposal areas, identified as Waste Burial Areas A through G, and a summary of the reported contents, are provided on Figure 3-1. Although disposal activities varied considerably from location to location, they typically consisted of the placement of two to three drums, sample bottles, demolition debris, and other materials into an excavation. Except at one location (see Figure 3-1), there is no record of these materials being disinterred. One area, designated 'B' on Figure 3-1, was reportedly also used for the burning of waste solvents. Small amounts of laboratory wastes and other materials were noted in an area near Building 27.

One area not shown on Figure 3-1, but identified in the 1980 memorandum, was located near the current placement of Building 40, in the southwest area of the facility. This area was noted as having stockpiles of concrete rubble and clean fill. Given the nature of these materials, this is not considered a waste disposal area.

3.5 Spill History

No documentation of spills are present in the OEPA regulatory files. The RFA (TechLaw, 1998) documents statements by the former Manager of Health, Safety, and

Environmental for the Morton Facility that no chemical spills occurred during the period 1983 and 1991. Current facility personnel indicate that minor spills do routinely occur, but are either within containment or onto pavement.

Because of the prevalent use of pavement, curbing, and other secondary containment features in the storage and operational areas of the site, it is likely that the bulk of any spilled chemicals would have been contained and/or routed to the CSS.

One exception is the releases noted in a memorandum discussing elevated tin concentrations in surface soils in the late 1970s (CMC, 1979b). This memorandum noted aqueous tin chloride line leaks, leaks from storage drums, and spills from equipment failures. These releases occurred in the vicinity of Buildings 12, 19, 26, and 27.

ATTACHMENT 2

FIELD OPERATING PROCEDURES

TABLE A4-1
FIELD OPERATING PROCEDURES
Morton Facility
Reading, Ohio

Field Instrument Calibration & Maintenance

A-1 Calibration and Maintenance of Portable Flame Ionization Detector
A-2 Calibration and Maintenance of Portable Photoionization Detector
A-3 Calibration and Maintenance of Portable Field pH Meter
A-4 Calibration Check and Maintenance of Portable Specific Conductance Meter
A-5 Calibration and Maintenance of Portable Dissolved Oxygen Meter
A-6 Calibration Check and Maintenance of Portable Field Turbidity Meter

Drilling & Excavation

B-1 Hollow Stem Auger Drilling Procedures
B-2 Direct-Push Technique Procedures
B-3 Sonic Drilling and Soil Sampling Procedures
B-4 Plugging and Abandonment of Monitoring Wells
B-5 Sealing of Boreholes
B-6 Test Pit Excavation and Logging

Monitoring Wells

C-1 Monitoring Well Construction for Hollow Stem Auger Boreholes
C-2 Monitoring Well Construction for Sonic Boreholes
C-3 Monitoring Well Development

Soil Sampling

D-1 Split-Spoon Sampling
D-2 Soil Sample Field Screening Using an Organic Vapor Meter
D-3 Soil Sample Handling for Volatile Organic Constituent (VOC) Analysis

Groundwater Sampling

E-1 Low-Flow (Minimal Drawdown) Groundwater Purging Procedures
E-2 Groundwater Sample Collection

Surface Water & Sediment Sampling

F-1 Surface Water Sampling From Seeps
F-2 Sediment Sampling From River or Creek Banks

Decontamination

G-1 Non-disposable and Non-dedicated Sampling Equipment Decontamination
G-2 Drilling and Excavation Equipment Decontamination

Aquifer Testing

H-1 Groundwater Level Measurement
H-2 In-Situ Hydraulic Conductivity by Slug Test for Unconfined (Water Table) Aquifers

TABLE A4-1
FIELD OPERATING PROCEDURES
Morton Facility
Reading, Ohio

H-3 Performance of Aquifer Pumping/Recovery Tests

Geophysical

I-1 Electromagnetic (EM) Survey - EM61 Time Domain Electromagnetic Survey

I-2 Electromagnetic (EM) Survey - EM31 Frequency Domain Electromagnetic Survey

Other Procedures

J-1 Sampling, Labeling, Storage and Shipment

J-2 Documentation Requirements for Drilling and Well Installation

J-3 Management of Investigation-Derived Waste

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
Morton Facility
Reading, Ohio

CALIBRATION AND MAINTENANCE OF PORTABLE FLAME IONIZATION DETECTOR

PURPOSE

This guideline presents a general description of the method for calibration and maintenance of a portable flame ionization detector (FID). The FID detects and initially quantifies a reading of the volatile organic compound (VOC) concentration in air. The FID is used as a field screening tool for initial evaluation of soil samples and for ambient air monitoring. In order to ensure an accurate reading, the FID must be calibrated prior to use in the field.

Although the information included below is equipment manufacturer- and model-specific, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to the Sensidyne Portable Flame Ionization Detector. The actual equipment to be used in the field will be equivalent or similar.

The FID indicates total VOC concentration readings which are normalized to a methane standard, so actual quantification of individual compounds is not provided. In addition, the FID response to compounds is highly variable, dependent on the structure of the compound and the presence or absence of other compounds. In the calibration mode, a methane standard of 200 parts per million by volume (ppmv) is used, and the desired accuracy at this concentration is $\pm$ 50 ppmv.

PROCEDURE

1. Zero the machine.
2. Calibrate all field test equipment at the beginning of each sampling day and check and recalibrate according to the manufacture's specifications.
3. Calibrate the FID meter using a compressed gas cylinder containing 200 ppmv methane in air, a 2 liter per minute flow regulator, and a tubing assembly.
4. Assemble the calibration equipment and actuate the FID. Insert the probe into the calibration assembly and wait for a stable indication. Remove the cover over the calibration adjustment

screw. Using a slotted screwdriver, turn the adjustment screw until the meter reads exactly 200 ppmv.

5. Replace the adjustment screw cover and deactivate the FID.

6. Document all instrument calibrations in the field notebook, indicating the meter readings before and after the instrument has been adjusted. This is important, not only for data validation, but also to establish maintenance schedules and component replacement.

MAINTENANCE

- The probe and handle of the FID should be checked before and after every use for cleanliness and worn or damaged parts. Drain the water trap in the handle as needed. Remove any other condensation with a clean cloth or tissue. The dust filter and hydrophobic filters should be inspected and cleaned between use.

- The FID battery must be recharged when the battery level indicator is in the red sector. It is also recommended that the battery be recharged every month the instrument is not used frequently. Replace the instrument's hydrogen carrier gas as necessary.

- Store the FID in its carrying case when not in use. Additional maintenance details related to individual components of the FID are provided in the equipment manufacturer's instruction manual. If calibration or instrument performance is not in accordance with specifications, send the instrument to the equipment manufacturer for repair.

- Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance.

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
Morton Facility
Reading, Ohio

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

PURPOSE

This procedure describes a general for the method for calibration and maintenance of a portable photoionization detector (PID). The PID detects and initially quantifies a reading of the volatile organic compound (VOC) concentration in air. The PID is used as a field screening tool for initial evaluation of soil samples and for ambient air monitoring. In order to ensure an accurate reading, the PID must be calibrated prior to use in the field.

The information included below is equipment manufacturer- and model-specific, however, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to the Thermoenvironmental Instruments Inc. Model 580-B photoionization detector. The actual equipment to be used in the field will be equivalent or similar.

The PID indicates total VOC concentration readings which are normalized to an isobutylene standard, so actual quantification of individual compounds is not provided. In addition, the PID response to compounds is highly variable, dependent on ionization potential of the compound, and the presence or absence of other compounds.

PROCEDURE

1. Calibrate all field test equipment at the beginning of each sampling day and check and recalibrate according to the manufacture's specifications.

2. Calibrate the PID meter using a compressed gas cylinder containing a 100 ppmv isobutylene standard, a flow regulator, and a tubing assembly. In addition, a compressed gas cylinder containing zero air ("clean" air) may be required if ambient air conditions do not permit calibration to "clean air".

3. Assemble the calibration equipment and actuate the PID in its calibration mode. Insert the PID probe into the zero air calibration assembly (or calibrate to ambient air if conditions permit) and wait for a stable indication.

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

4. Calibrate to 100ppmv with isobutylene standard.

5. Document all instrument calibrations in the Project Field Book, indicating the meter readings before and after the instrument has been adjusted. This is important, not only for data validation, but also to establish maintenance schedules and component replacement.

MAINTENANCE

- The probe and dust filter of the PID should be checked before and after every use for cleanliness. Should instrument response become unstable, recalibration should be performed. If this does not resolve the problem, access the photoionization bulb and clean with the manufacturer-supplied abrasive compound, then recalibrate.

- The PID battery must be recharged after each use. Store the PID in its carrying case when not in use. Additional maintenance details related to individual components of the FID are provided in the equipment manufacturer's instruction manual. If calibration or instrument performance is not in accordance with specifications, send the instrument to the equipment manufacturer for repair.

- Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance.

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
Morton Facility
Reading, Ohio

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD pH METER

PURPOSE

This guideline describes a method for calibration of a portable pH meter. The pH meter measures the hydrogen ion concentration or acidity of a water sample (pH function). Calibration is performed to verify instrument accuracy and function. All field test equipment will be calibrated at the beginning of each sampling day, and checked and recalibrated according to the manufacturer's specifications. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the pH meter will be:

pH $\pm$ 0.1 pH unit, over the temperature range of $\pm$ 5° C.

CALIBRATION PROCEDURE

Note: Meters produced by different manufacturers may have different calibration procedures. These instructions will take precedence over the procedure provided here. This procedure is intended to be used as a general guideline, or in the absence of available manufacturer's instructions.

1. Obtain and activate the meter to be used. As stated above, initial calibrations will be performed at the beginning of each sampling day.
2. Immerse the sensing probe in a container of certified pH 7.0 buffer solution traceable to the National Institute of Standards and Testing.
3. Measure the temperature of the buffer solution, and adjust the temperature setting accordingly.
4. Compare the meter reading to the known value of the buffer solution while stirring. If the reading obtained by the meter does not agree with the known value of the buffer solution, recalibrate the meter according to the manufacturer's instructions until the desired reading is

obtained. This typically involves accessing and turning a dial or adjustment screw while measuring the pH of the buffer solution. The meter is adjusted until the output agrees with the known solution pH.

5. Repeat Steps 2 through 4 with a pH 4 or pH 10 buffer solution (depending on site-specific water pH) to provide a two-point calibration.

6. Document the calibration results and related information in the Project Field Book. Information will include, at a minimum:

   - Time, date, and person performing the calibration
   - The unique identifier for the meter, including manufacturer, model, and unit
   - The brand and expiration dates of buffer solutions
   - The calibration readings
   - Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate

MAINTENANCE

- When not in use, or between measurements, keep the pH probe immersed in or moist with buffer solutions.
- Check the meter batteries at the end of each day and recharge or replace as needed.
- Replace the pH probe any time that the meter response time becomes greater than two minutes or the metering system consistently fails to retain its calibrated accuracy for a minimum of ten sample measurements.
- If a replacement of the pH probe fails to resolve instrument response time and stability problems, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.

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CALIBRATION CHECK AND MAINTENANCE OF PORTABLE SPECIFIC CONDUCTANCE METER

PURPOSE

This meter measures the ability of a water sample to conduct electricity, which is largely a function of the dissolved solids within the water. The instrument has been calibrated by the manufacturer according to factory specifications. This guideline presents a method for checking the factory calibration of a portable specific conductance meter. A calibration check is performed to verify instrument accuracy and function. All field test equipment will be checked at the beginning of each sampling day. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the specific conductance meter will be within $\pm$ 1 percent of full-scale, with repeatability of $\pm$ 1 percent. The built-in cell will be automatically temperature compensated from at least 41 to 160° F (5° to 71°C).

CALIBRATION PROCEDURE

1. Field check the meter at the beginning of each sampling day.
2. Use a calibration solution of known specific conductivity and salinity. For maximum accuracy, use a Standard Solution Value closest to the samples to be tested.
3. Turn the Range Switch to 20 milliSiemens per centimeter (mS/cm) (also known as millimhos per centimeter).
4. Insert the meter probe into a container of the calibration solution (note: do not use the solution bottle). Alternatively, depending on meter design, fill the meter's test cup with calibration solution.
5. If the reading obtained does not agree with the known specific conductivity of the solution, proceed as follows:
   - Clean the cell in accordance with the instruction manual. Rinse the cell thoroughly and repeat the calibration check.

CALIBRATION CHECK AND MAINTENANCE OF PORTABLE SPECIFIC CONDUCTANCE METER

- If the meter still does not indicate the correct value, recalibrate the meter in accordance with the manufacturer's instructions. This typically involves accessing and turning a dial or adjustment screw while measuring the conductance of the calibration solution. The meter is adjusted until the output agrees with the known solution conductance.

- If calibration cannot be achieved or maintained, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.

6. Document the calibration check results and related information in the Project Field Book.

   Information will include, at a minimum:

   - Time, date, and person performing the calibration
   - The unique identifier for the meter, including manufacturer, model, and unit
   - The brand and expiration dates of calibration solutions
   - The calibration readings
   - The approximate response time
   - The overall adequacy of calibration
   - Corrective action taken (see Step 5 above) in the event of failure to adequately calibrate

MAINTENANCE

- Check the meter batteries at the end of each day and replace when needed.

- Track the meter response time and stability to determine the need for instrument maintenance. When response time becomes greater than two minutes and the meter must be recalibrated more than once per day, send the instrument to the manufacturer for maintenance and repair.

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CALIBRATION AND MAINTENANCE OF PORTABLE DISSOLVED OXYGEN METER

PURPOSE

This meter measures the concentration of dissolved oxygen within a water sample. This parameter is of interest both as a general indicator of water quality, and because of its pertinence to fate and transport of organics and inorganics. This guideline presents a method for calibration of this meter. All field test equipment will be checked at the beginning of each sampling day. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the dissolved oxygen meter will be within $\pm$1% of full-scale over the temperature range of -5°C to +45°C.

CALIBRATION

1. Calibrate the dissolved oxygen meter to ambient air based on probe temperature and true local atmospheric pressure conditions (or feet above sea level). Because procedures vary with different brands and models of meters, refer to the manufacturer's recommended calibration procedures

2. In the event of a failure to adequately calibrate, follow the corrective action directed by the manufacturer.

3. If calibration cannot be achieved or maintained, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.

4. Document the calibration check results and related information in the Project Field Book. Information will include, at a minimum:

   - Time, date, and person performing the calibration
   - The unique identifier for the meter, including manufacturer, model, and unit
   - The brand and expiration dates of calibration solutions
   - The calibration readings
   - The approximate response time

CALIBRATION AND MAINTENANCE OF PORTABLE DISSOLVED OXYGEN METER

- The overall adequacy of calibration
- Corrective action taken (see Step 5 above) in the event of failure to adequately calibrate

MAINTENANCE

- When not in use or between measurements, the dissolved oxygen probe will be kept immersed in or moist with deionized water.
- The meter batteries will be checked prior to each meter's use and will be replaced when the meter cannot be red-line adjusted.
- The meter response time and stability will be tracked to determine the need for instrument maintenance. When response time becomes greater than two minutes, probe service is indicated.

CALIBRATION CHECK AND MAINTENANCE OF PORTABLE FIELD TURBIDITY METER

PURPOSE

Turbidity is one water quality parameter measured during purging and development of wells. Turbidity is measured as a function of the samples ability to transmit light, expressed as Nephelometric Turbidity Units (NTUs). This procedure presents a method for calibration of a portable field turbidity meter. The turbidity meter is factory calibrated. The factory calibration must be checked daily prior to using the meter in the field.

ACCURACY

The calibrated accuracy of the turbidity meter will be $\pm$ 1 percent of full-scale on all scale ranges.

CALIBRATION CHECK PROCEDURE

Note: Meters produced by different manufacturers may have different calibration check procedures. These manufacturers' instructions will take precedence over the procedure provided here. This procedure is intended to be used as a general guideline, or in the absence of available manufacturer's instructions.

Note: Because the turbidity meter measures light transmission, it is critical that the meter and standards be cared for as precision optical instruments. Scratches, dirt, dust, etc. can all temporarily or permanently affect the accuracy of meter readings.

1. With the instrument turned off, check the mechanical zero adjustment on the meter face. Adjust the ZERO control for a zero reading if necessary.

2. Turn the meter on and perform a battery check. Charge the battery pack if the meter indicates low battery charge.

3. Place the focusing template into the cell holder, press the 1.0 range switch, and adjust the ZERO control to obtain a zero NTU reading.

4. Remove the focusing template and insert a 0.9 NTU turbidity standard. Adjust the SPAN control for a corrected 0.9 NTU reading, if necessary.

CALIBRATION CHECK AND MAINTENANCE OF PORTABLE FIELD TURBIDITY METER

5. Remove the 0.9 NTU standard and replace it with a 9 NTU standard. Press the 10 range switch. The meter should indicate 9 (±0.02) NTU. If it does not, the 10 range potentiometer must be adjusted in accordance with the manufacturer's instructions. Adjust the SPAN control for a reading of 9 NTU.

6. Remove the 9 NTU standard and replace it with the cell riser and 90 NTU standard. Press the 100 range switch. The meter should indicate 90 (±2) NTU.

7. Remove the 90 NTU standard and cell riser and insert the 9 NTU standard. Press the 10 NTU range switch. Adjust the SPAN control for a reading of exactly 9 NTU.

8. Remove the 9 NTU standard and replace it with a 0.9 NTU standard. Press the 1.0 range switch. The meter should indicate the correct value for the 0.9 NTU standard (±0.2). If it does not, the 1.0 range potentiometer must be adjusted in accordance with the manufacturer's instructions.

9. Document the calibration check results and related information in the Project Field Book. Information will include, at a minimum:

   - Time, date, and person performing the calibration check
   - The unique identifier for the meter, including manufacturer, model, and unit
   - The brand of calibration standards
   - The calibration readings
   - Corrective action taken in the event of failure to adequately calibrate

MAINTENANCE

- Check the meter battery pack at the end of each day and recharge when needed.
- When not in use, store the meter in a clean, dry area with the protective cover shut.
- Clean the lens periodically with a dry cloth or tissue.

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HOLLOW STEM AUGER DRILLING PROCEDURES

PURPOSE

This guideline presents a method for drilling a borehole through unconsolidated materials, including soils or overburden, and consolidated materials, including bedrock.

PROCEDURE

The following procedure will be used to drill a borehole for sampling and/or well installation, using hollow-stem auger methods and equipment.

1. Mobilize the auger rig to the site and position over the borehole.

2. Level and stabilize the rig using the rig jacks, and recheck the rig location against the planned drilling location. If necessary, raise the jacks and adjust the rig position.

3. Place a metal or plywood auger pan over the borehole location to collect the auger cuttings. This auger pan will be equipped with a 12-inch nominal diameter hole for auger passage.

4. Advance augers into the subsurface. For sampling or pilot-hole drilling, nominal 8-inch outside diameter (OD) augers should be used. For reaming or well installation, nominal 10- or 12-inch OD (nominal 6-inch inside diameter) augers should be used. The boring diameter will be approved by the Geomatrix field supervisor.

5. Check augers periodically during drilling to ensure the boring is plumb. Adjust rig position as necessary to maintain plumb.

6. Continue drilling until reaching the assigned total depth, or until auger refusal occurs. Auger refusal is when the drilling penetration drops below 0.1 feet per 10 minutes, with the full weight of the rig on the auger bit, and a center bit (not center plug) in place.

7. For boreholes intended to identify the depth to bedrock, follow auger refusal by rock coring for at least 5 feet, in order to verify the depth of the upper bedrock surface.

8. If coring does not confirm the presence of bedrock, withdraw the augers, and convert to mud rotary methods until bedrock is reached and confirmed. Perform mud rotary drilling as described in Geomatrix Field Operating Procedure for Drilling Using Mud Rotary Drilling Techniques.

9. Manage all drill cuttings, drilling mud, wash waters, and entrained solids as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

HOLLOW STEM AUGER DRILLING PROCEDURES

10. Plug and abandon boreholes not used for well installation as described in the Geomatrix Field Operating Procedure for Borehole Destruction.

Other Procedural Issues:

- Slip rings may be used for lifting a sampling or bit string. The string will not be permitted to extend more than 15 feet above the mast crown.
- Borings will not be overdrilled (rat holed) without the express permission of the Geomatrix field supervisor. All depth measurements should be accurate to the nearest 0.1 foot, to the extent practicable.
- Potable water may be placed in the auger stem if critically necessary for borehole control or to accomplish sampling objectives. This will be performed only with the express permission of the Geomatrix field supervisor. This permission will be documented.

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DIRECT PUSH TECHNIQUE PROCEDURES

PURPOSE

This guideline presents a method for advancing a borehole while sampling soils through unconsolidated materials, including soils or overburden.

PROCEDURE

The following procedure will be used to advance a borehole for sampling using direct push methods and equipment.

1. Mobilize the direct push rig to the site and position over the borehole.

2. Level and stabilize the rig using the rig jacks, and recheck the rig location against the planned boring location. If necessary, raise the jacks and adjust the rig position.

3. Advance the direct push sampling tool into the subsurface. The direct push tool typically will be configured to sample continuously as the tool advances. The Geomatrix field supervisor will verify this configuration with the operator, to ensure sampling is performed through the targeted intervals.

4. Check the drive string periodically during drilling to ensure the boring is plumb. Adjust rig position as necessary to maintain plumb.

5. Collect soil samples by withdrawing the retrievable sample tool from the drive string and the intervals dictated by the equipment's sample length capacity. The Geomatrix field supervisor will verify the appropriate intervals with the operator.

6. Continue advancing the drive string until reaching the total depth assigned by Geomatrix.

7. Manage all unused sample/core and other solids as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

8. All boreholes not used for well installation will be promptly sealed as described in the Geomatrix Field Operating Procedure for Sealing of Boreholes. In the case of direct push borings, grout will be emplaced either through the drive string as that string is withdrawn, or through a grouting string or tremie driven or pushed into the boring after the drive/sampling string is removed. The grouting string or tremie will be driven or pushed to within five feet of the borings total depth prior to grouting.

DIRECT PUSH TECHNIQUE PROCEDURES

Other Procedural Issues:

- Borings will not be advanced past the assigned total depth (rat holed) without the express permission of the Geomatrix field supervisor.
- All depth measurements should be accurate to the nearest 0.1 foot, to the extent practicable.

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SONIC DRILLING AND SOIL SAMPLING PROCEDURES

PURPOSE

This guideline presents a method for drilling a borehole through unconsolidated materials, including soils or overburden, and consolidated materials, including bedrock.

PROCEDURE

The following procedure will be used to drill a borehole for sampling and/or well installation, using sonic methods and equipment.

1. Mobilize the sonic drilling rig to the site and position over the borehole.

2. Level and stabilize the rig using the rig jacks, and recheck the rig location against the planned drilling location. If necessary, raise the jacks and adjust the rig position.

3. Advance drive casing into the subsurface. For well installation, nominal 10- or 12-inch ID outer casing should be used. The boring diameter will be approved by the Geomatrix field supervisor.

4. Check casing periodically during drilling to ensure the boring is plumb. Adjust rig position as necessary to maintain plumb.

5. Water will be used only if critically necessary for hole control during the drilling process, and with the concurrence of the Geomatrix field supervisor. All water used must be of potable quality, transported in a clean container, and sampled for verification of water quality. The Geomatrix field supervisor, with support from the driller, will track volumes of water used/lost.

6. Collect soil samples by withdrawing the inner drive casing and removing the sample liner at nominal intervals of 10 feet.

7. Continue drilling until reaching the assigned total depth.

8. Manage all drill cuttings, excess waters, unused sample/core, and entrained solids as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

9. If constructing a monitoring well, follow the Geomatrix Field Operating Procedure for Monitoring Well Construction for Sonic Boreholes.

SONIC DRILLING AND SOIL SAMPLING PROCEDURES

10. All boreholes not used for well installation will be promptly sealed as described in the Geomatrix Field Operating Procedure for Sealing of Boreholes.

Other Procedural Issues:

- Borings will not be overdrilled (rat holed) without the express permission of the Geomatrix field supervisor.
- All depth measurements should be accurate to the nearest 0.1 foot, to the extent practicable.

PLUGGING AND ABANDONMENT OF MONITORING WELLS

PURPOSE

This guideline presents a method for removing or destroying a well, including its annular seal, and sealing the resulting borehole. This is performed to remove a well which is no longer useful or constructed inadequately, and is intended to remove, to the extent practicable, the formation of preferential vertical flow paths.

PROCEDURE

The following procedure will be used to plug and abandon a well, using hollow-stem auger or sonic methods and equipment.

1. Break out and remove the protective casing or manhole and concrete well pad. This may be done using manual (i.e. sledge hammer) methods or mechanical (i.e. jackhammer) methods, or by pulling off the completion using the rig drawworks. As always, utilize safe work practices and proper protective equipment.

2. Mobilize the drilling rig to the site and position over the borehole. The auger or casing OD used should be approximately as large or larger than the original borehole diameter used for well installation.

3. Level and stabilize the rig using the rig jacks, and recheck the rig location against the planned drilling location. If necessary, raise the jacks and adjust the rig position.

4. If using an auger rig, place a metal or plywood auger pan over the borehole location to collect the auger cuttings. This auger pan will be equipped with a 12-inch nominal diameter hole for auger passage.

5. Position the augers or drive casing over the well riser, and advance augers or casing into the subsurface.

6. Continue drilling until reaching the assigned total depth. This will typically be either the total depth of the well, or the depth to the top of the screen. The Geomatrix field supervisor will identify the necessary total depth, based on available information regarding well construction.

7. Remove the well casing from the augers. This may require removal of the casing or auger string from the borehole. If so, return the casing or auger string to the borehole after the casing or auger stem is clear.

PLUGGING AND ABANDONMENT OF MONITORING WELLS

8. Mix grout to a smooth consistency using a centrifugal or reciprocating pump. Do not hand mix. All water used must be potable quality. Record the volume of cement, additives (e.g. bentonite), and water used. Measure the field density of each batch of grout using a mud scale or equivalent method.

9. Fill the auger stem or casing with grout. Filling will be performed using tremie pipe if more than approximately 1 foot of water is present in the annular space. Otherwise, the space may be filled by surface pouring or pumping from the surface. If the tremie method is used, measure the field density of grout returns using a mud scale or equivalent method.

10. With grout standing within the auger stem or casing, begin withdrawal of the augers or casing string. Periodically top the auger stem or casing off with additional grout.

11. When the auger stem or casing string is completely withdrawn from the borehole, place drums or barricades around the well for protection while the grout cures.

12. Leave the borehole undisturbed for at least 24 hours to allow the grout to cure. If excessive grout fallback occurs, top off as necessary with bentonite chips or additional grout.

13. Manage all drill cuttings, drilling mud, wash waters, and entrained solids as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

Other Procedural Issues:

- Slip rings may be used for lifting a sampling or bit string. The string will not be permitted to extend more than 15 feet above the mast crown.

- Borings will not be overdrilled (rat holed) without the express permission of the Geomatrix field supervisor. All depth measurements should be accurate to the nearest 0.1 foot, to the extent practicable.

Potable water may be placed in the auger stem if critically necessary for borehole control or to accomplish sampling objectives. This will be performed only with the express permission of the Geomatrix field supervisor. This permission will be documented.

SEALING OF BOREHOLES

PURPOSE

This guideline presents a method for sealing a borehole that will not be used for well construction, after the conclusion of drilling, sampling, and logging. This is performed to remove, to the extent practicable, the formation of preferential vertical flow paths.

PROCEDURE

The following procedure will be used to seal a borehole using hollow-stem auger or sonic methods and equipment.

1. Begin with the augers or casing at total depth.

2. Mix grout to a smooth consistency using a centrifugal or reciprocating pump. Do not hand mix. All water used must be potable quality. Record the volume of cement, additives (e.g. bentonite), and water used. Measure the field density of each batch of grout using a mud scale or equivalent method.

3. Fill the auger stem or casing with grout. Filling will be performed using tremie pipe if more than approximately 1 foot of water is present in the annular space. Otherwise, the space may be filled by surface pouring or pumping from the surface. If the tremie method is used, measure the field density of grout returns using a mud scale or equivalent method.

4. With grout standing within the auger stem or casing, begin withdrawal of the augers or casing string. Periodically top the auger stem or casing off with additional grout. Collect representative samples of each batch of grout in labeled cups or jars, and set aside to verify grout set. Document later checking of these samples in field notes.

5. When the auger stem or casing string is completely withdrawn from the borehole, place drums or barricades around the well for protection while the grout cures.

6. Leave the borehole undisturbed for at least 24 hours to allow the grout to cure. If excessive grout fallback occurs, top off as necessary with bentonite chips or additional grout.

Manage all drill cuttings, drilling mud, wash waters, and entrained solids as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

TEST PIT EXCAVATION AND LOGGING

PURPOSE

This procedure describes the methods for completing test pits, trenches, and other excavations that may be performed to expose subsurface soils or materials. In most cases, these pits will be mechanically excavated, using a backhoe, trackhoe, or other equipment. Because pits and other excavations can represent a substantial physical hazard, it requires a particular focus on safety procedures. The Project Health and Safety Plan identifies practices related to excavation permits, entry, and control that must be incorporated into excavation activities.

EXCAVATION PROCEDURE

1. Obtain applicable Plant and other permits for excavation, and clear the area for utilities.

2. Excavate pits. In uncontrolled areas, excavate only as many test pits as can be backfilled during the same day. Generally allow equal time for excavation and backfilling. To the extent practicable, no pits should be left open overnight in an uncontrolled area. If sudden weather changes or other unforeseen events necessitate this, pits will be covered and/or barricaded and flagged with hazard tape. These pits will be backfilled as soon as possible.

3. The Geomatrix field geologist should determine the depth of excavation. The depth is generally limited by the safe reach of the selected equipment, but may also be limited by the stability of the excavated materials (i.e. wall stability).

4. Excavate the test pits in compliance with applicable safety regulations. In no case should a pit deeper than 4 feet be entered without first stabilizing the sidewalls by using forms, or by terracing or sloping (2:1 slope maximum) the sidewalls.

5. Record observations in the Project Field Book or an appropriate alternate form. Information recorded should include:

   - Physical dimension of the pit;

TEST PIT EXCAVATION AND LOGGING

- A scaled sketch of one wall of the pit showing lithologic contacts, zones of groundwater seepage, other special features (jointing, boulders, zones of contamination, etc.);
- General information such as project number, pit numbers, depth, date, name of geologist, and type of excavating equipment utilized, time of excavation and backfilling, method of collecting samples (if applicable);
- Rate of groundwater inflow, depth to groundwater and time of measurement; and
- Unified Soil Classification System (USCS) designation of each distinctive unit.

6. Photograph each excavation, highlighting unique or important features.

7. Backfill pit to grade. The Geomatrix Field Team Leader will provide direction on whether excavated soils may be used as fill, or these materials are to be containerized as investigation derived waste. In the latter event, use suitable backfill material to generally match the character of the surrounding soils, contact the Morton Plant Manager regarding compaction criteria, and reference the Geomatrix Field Operating Procedure on Management of Investigation Derived Waste.

SAMPLING PROCEDURE

1. Use a stainless steel spade to scrape soil samples from the sidewalls of the excavated test pit.

2. If the test pit is greater than 4 feet in depth, it will not be entered for sampling (see Health and Safety notes below). In this event, collect samples using the backhoe bucket, then fill sample containers from the center of the bucket using the stainless steel spade noted in Step 1 or drive a Shelby tube or EnCore™ sampler for VOCs.

Place samples into precleaned, labeled sample jars. Reference Geomatrix Field Operating Procedure for Sample Labeling, Storage, and Shipment.

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MONITORING WELL CONSTRUCTION FOR HOLLOW STEM AUGER BOREHOLES

PURPOSE

Wells will be installed within selected boreholes for the purpose of evaluating groundwater characteristics. Well installation procedures depend upon the drilling method. This procedure describes well construction and installation for boreholes drilled using the hollow stem auger method. Refer to the Geomatrix Field Operating Procedure for Hollow Stem Auger Drilling. Nominal dimensions and materials for the well are shown in the attached well construction diagram.

PROCEDURE

1. Advance borehole in accordance with the Geomatrix Field Operating Procedure for Hollow Stem Auger Drilling to the required depth. The nominal inside diameter (ID) of the auger stem used should be at least 2 inches larger than the outside diameter (OD) of the riser and screen selected for the well installation. Record the monitoring well construction on the Log of Well Boring form (see Field Operating Procedures for Documentation Requirements of Drilling and Well Installation).

2. Remove the drill rods and center bit/plug from the auger stem and verify borehole depth using weighted measuring tape.

3. In the event of an over drill (i.e. borehole depth is more than one foot greater than desired base of screen depth), use bentonite chips poured through the auger stem to seal the overdrilled portion of the borehole.

4. Add a maximum of 6 inches of filter pack material through the auger stem to the base of the borehole. (Note: This step may be avoided if dense non-aqueous phase liquids are suspected to be present and it is desirable to have the screen at the base of the borehole.)

5. Measure the length of the well string (i.e. riser and screen), and lower the well string into the well assembly to the desired depth. All measurements during the well installation process will be accurate to 0.1 foot.

6. Surface pour filter pack material into the annulus between the well and the auger stem as the augers are gradually withdrawn from the borehole. Use a weighted tape to confirm that the level of sand is maintained within the augers at all times. Record material volumes used.

MONITORING WELL CONSTRUCTION FOR HOLLOW STEM AUGER BOREHOLES

7. After filter pack materials are brought to the required level, surface pour bentonite chips or pellets into the annulus between the well and the auger stem to form the filter pack seal. If necessary to avoid bridging, delayed hydration (coated) pellets may be used. Record the volume of material used.

8. Allow the bentonite to adequately hydrate. Cap or cover the upper end of the well.

9. Mix grout to a smooth consistency using a centrifugal or reciprocating pump. Do not hand mix. All water used must be potable quality. Record the volume of water used.

10. Fill the remaining annulus between the well and the auger stem with grout by surface pouring or pumping, and begin withdrawal of the auger string. Periodically top the auger string off with additional grout.

11. When the auger string is withdrawn, center the upper portion of the well riser within the borehole, and place drums or barricades around the well for protection while the grout cures. Place and lock a security cap in the opening of the well riser.

12. Leave the well undisturbed for at least 24 hours to allow the grout to cure. If excessive grout fallback occurs, top off as necessary with bentonite chips or additional grout.

13. Construct the surface completion as shown in the attached Monitoring Well Construction Diagram. Select flush completions for all locations in active operational or high traffic areas, or in other areas where an above grade completion would be undesirable. Use aboveground completions in all other areas.

14. Place a dedicated lock on the well or protective casing, and keep well locked when not actively attended.

15. Permanently mark a survey location on the north side at the top of the casing with a cut. Survey all wells for horizontal location and elevation, using a surveyor licensed by the State of Ohio. Coordinates and elevations will be provided in a coordinate system consistent with previous well surveys at the Morton Plant. Information obtained will include location (x and y) of the well, and elevation (z) of the ground surface, the pad, and the top of riser.

16. Develop the well as described in the Geomatrix Field Operating Procedure for Monitoring Well Development.

MONITORING WELL CONSTRUCTION FOR HOLLOW STEM AUGER BOREHOLES

17. Manage all waste materials generated during well installation and development as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

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MONITORING WELL CONSTRUCTION FOR SONIC BOREHOLES

PURPOSE

Wells will be installed within selected boreholes for the purpose of evaluating groundwater characteristics. Well installation procedures depend upon the drilling method. This procedure describes well construction and installation for boreholes drilled using the sonic method. Refer to the Geomatrix Field Operating Procedure for Sonic Drilling Procedures. Nominal dimensions and materials for the well are shown in the Monitoring Well Construction Diagram included with this FOP section.

PROCEDURE

1. Advance borehole in accordance with the Geomatrix Field Operating Procedure for Sonic Drilling Procedures to the required depth. The nominal inside diameter (ID) of the outer drive casing used should be approximately 4 inches or more larger than the outside diameter (OD) of the riser and screen selected for the well installation. Record the monitoring well construction on the Log of Well Boring form (see Field Operating Procedures for Documentation Requirements of Drilling and Well Installation).

2. Remove the inner drive casing or sampling tools from the outer casing and verify borehole depth using weighted measuring tape.

3. In the event of an overdrill (i.e. borehole depth is more than one foot greater than desired base of screen depth), use bentonite chips poured through the auger stem to seal the overdrilled portion of the borehole.

4. Add a maximum of 6 inches of filter pack material through the auger stem to the base of the borehole. (Note: This step may be avoided if dense non-aqueous phase liquids are suspected to be present and it is desirable to have the screen at the base of the borehole.)

5. Measure the length of the well string (i.e. riser and screen), and lower the well string into the well assembly to the desired depth. All measurements during the well installation process will be accurate to 0.1 foot.

6. Surface pour filter pack material into the annulus between the well and the outer casing as the casing is gradually withdrawn from the borehole. Use a weighted tape to confirm that the level of sand is maintained within the casing at all times. Record material volumes used.

MONITORING WELL CONSTRUCTION FOR SONIC BOREHOLES

7. After filter pack materials are brought to the required level, surface pour bentonite chips or pellets into the annulus between the well and the casing to form the filter pack seal. If necessary to avoid bridging, delayed hydration (coated) pellets may be used. Record the volume of material used.

8. Allow the bentonite to adequately hydrate, preferably through absorption of natural (formation) waters. Add potable water if necessary to promote hydration. Track any volumes of water used. Cap or cover the upper end of the well.

9. Mix grout to a smooth consistency using a centrifugal or reciprocating pump. Do not hand mix. All water used must be potable quality. Record the volume of cement, additives (e.g. bentonite), and water used. Measure the field density of each batch of grout using a mud scale or equivalent method.

10. Fill the remaining annulus between the well and the casing with grout. Filling will be performed using tremie pipe if more than approximately 1 foot of water is present in the annular space. Otherwise, the space may be filled by surface pouring or pumping from the surface. If the tremie method is used, measure the field density of grout returns using a mud scale or equivalent method.

11. With grout standing within the annular space, begin withdrawal of the casing string. Periodically top the casing off with additional grout.

12. When the casing string is withdrawn either to its final position or from the borehole, center the upper portion of the well riser within the borehole or casing, and place drums or barricades around the well for protection while the grout cures. Place and lock a security cap in the opening of the well riser.

13. Leave the well undisturbed for at least 24 hours to allow the grout to cure. If excessive grout fallback occurs, top off as necessary with bentonite chips or additional grout.

14. Construct the surface completion as shown in the Monitoring Well Construction Diagram included with this FOP section. Select flush completions for all locations in active operational or high traffic areas, or in other areas where an above grade completion would be undesirable. Use aboveground completions in all other areas.

15. Place a dedicated lock on the well or protective casing, and keep well locked when not actively attended.

16. Permanently mark a survey location on the north side at the top of the casing with a cut. Survey all wells for horizontal location and elevation, using a surveyor licensed by the State

of Ohio. Coordinates and elevations will be provided in a coordinate system consistent with previous well surveys at the Morton Plant. Information obtained will include location (x and y) of the well, and elevation (z) of the ground surface, the pad, and the top of riser.

17. Develop the well as described in the Geomatrix Field Operating Procedure for Monitoring Well Development.

18. Manage all waste materials generated during well installation and development as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

MONITORING WELL DEVELOPMENT

PURPOSE

This procedure describes the methods for the development of wells. Wells are developed after installation in order to remove introduced water and drilling fluids, reduce the turbidity of the water, and improve the hydraulic communication between the well and the water-bearing formation. Well development will not commence until the annular grout seal has cured, but will be performed within ten calendar days of well installation.

PROCEDURE

1. All well development will include surge blocking or false bailing with one or more of the following fluid removal methods. Well development activities may include:

   - Bailing
   - Air Lifting
   - Submersible Pumping
   - Other methods as approved by the Geomatrix Field Team Leader.

   The appropriate water removal method will be selected based on water level depth and anticipated well productivity.

2. Assemble and decontaminate equipment (if necessary), and place it in the well. Reference the Geomatrix Field Operating Procedure for Drilling and Excavation Equipment Decontamination.

3. Alternate the use of agitation methods with water removal methods, using the former to suspend solids in the well water, and the latter to remove the turbid water. For example, use a vented surge block to agitate the well, moving up and down within the screened interval, then use a pump to clear the well. A bailer may be used for both purposes, by surging with the bailer (false bailing) for a period within the screened interval, then bailing a volume of water from the well.

4. When using surging methods, initiate this activity gradually, with short (2 to 3 feet) strokes. After several passes across the screened interval, increase the speed and length of the surge strokes.

MONITORING WELL DEVELOPMENT

5. Continue development until the following objectives are achieved:

    - Field parameters (pH, specific conductance, temperature) stabilize. Fluctuations beyond 10 percent above or below a mean value will not be considered stable.

    - The well will generate non-turbid water during continued pumping. A turbidity level of 5 nephelometric turbidity units (NTU) will be used as a general target, but will not be considered a rigid standard, since many wells cannot achieve that level of clarity.

    - In the case of mud-rotary drilled wells, the volume of water removed exceeds twice the volume of water lost to the formation during the drilling process, as indicated by the water balance. For all wells, a volume of water equivalent to at least two well volumes (casing plus filter pack porosity volume) will be removed, provided the well has adequate yield to support this removal volume.

6. Document the development methods, volumes, field parameter measurements, and other observations on the attached Geomatrix Well Development Record form (see Field Operating Procedures for Documentation Requirements of Drilling and Well Installation).

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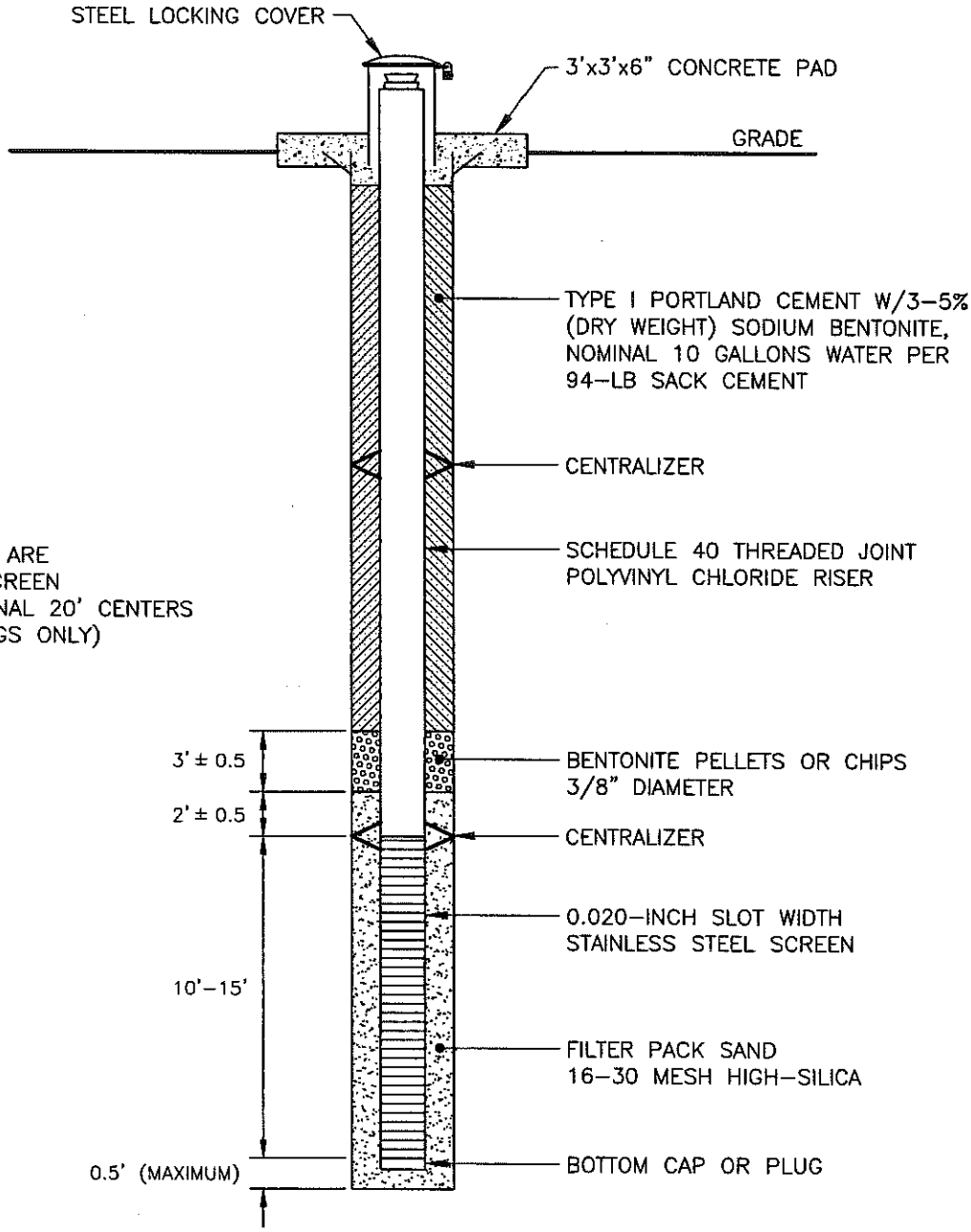
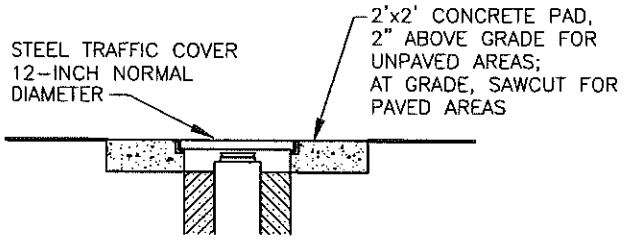


NOTE:
CENTRALIZERS ARE AT TOP OF SCREEN AND ON NOMINAL 20' CENTERS (SONIC BORINGS ONLY)



ALTERNATE SURFACE COMPLETION

GEOMATRIX

MONITORING WELL CONSTRUCTION DIAGRAM
PREPARED FOR
MORTON FACILITY – READING, OHIO

Project No. 6452

6452.DWG

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
Morton International, Inc.
RCRA Facility Investigation of Reading, Ohio, Facility

SPLIT-SPOON SAMPLING

PURPOSE

This guideline presents the methods for using a split-spoon sampler for collecting soil samples from a boring and for estimating the relative in-situ compressive strength of subsurface materials (ASTM D 1586). Representative samples for lithologic description, geochemical analysis, and geotechnical testing will be collected from the subsurface materials using the split-spoon sampler.

PROCEDURE

1. Place plastic sheeting on a sturdy surface to prevent the split-spoon and its contents from coming in contact with the surface (several layers of sheeting may be placed on the surface so that they may be removed between each sample or as needed).

2. Line the split-spoon sampler with brass or stainless steel liners, unless otherwise specified by the Geomatrix field supervisor.

3. Lower the sampling string to the base of the borehole. Measure the portion of the sampling string that extends above surrounding grade (i.e. the stickup). The depth of sampling will equal the total length of the string (sampler plus rods) minus the stickup length.

4. Measure sampling depths to an accuracy of 0.1 feet. If field measurements indicate the presence of more than 0.3 feet of disturbed materials in the base of the borehole (i.e. slough), the sampler will be used to remove this material, after which a second sampling trip will be made.

5. Select additional sampler components as required (i.e., leaf spring core retainer for clays or a sand trap for non-cohesive sands). If a retainer or trap is not used, a spacer ring will be used to hold the liners in position inside the sampler.

6. For driving samples, attach the drive head sub and hammer to the drill rods without the weight resting on the rods. For pushing samples using the rig hydraulics, skip to Step 10.

7. Mark four 6-inch intervals on the drill rods relative to a reference point on the drill rig. With the sampler resting on the bottom of the hole, drive the sampler with the 140 lb. hammer falling freely over a 30-inch fall until 24 inches have been penetrated or 50 blows applied.

SPLIT-SPOON SAMPLING

8. Record the number of blows per 6 inches. Determine the "N" value by adding the blows for the 6 to 12-inch and 12 to 18-inch intervals of each sample drive.

9. After penetration is complete, remove the sampling string. If sample retention has been poor, let the sampling string rest in place for at least 3 minutes, then rotate clockwise at least 3 times before removing from the borehole.

10. For pushed samples, mark four 6-inch intervals on the drill rods relative to a reference point on the rig. Use the rig pulldown to press the sampler downward until 24 inches have been penetrated or no further progress can be made with the full weight of the rig on the sampler.

11. Remove the split-spoon sampler from the sampling string and place on the plastic-covered surface.

12. Open the split-spoon sampler only when the Geomatrix field geologist is prepared to describe and manage the sample.

13. Describe the sample in accordance with the Unified Soil Classification System, using the Geomatrix Boring Log (see Field Operating Procedures for Documentation Requirements for Drilling and Well Installation).

14. Collect a portion of the sample for field screening as described in the Geomatrix Field Operating Procedure for Soil Sample Field Screening Using an Organic Vapor Meter.

15. If applicable, collect soil samples for volatile organic constituents (VOCs) from the end of a selected metal liner using the EnCore Sampler (reference Geomatrix Field Operating Procedure for Handling Soils for Volatile Organic Analysis). If applicable, select metal liners for semivolatile, metals, geotechnical, or other off-site analysis. Seal and manage these liners as specified in the pertinent Geomatrix Field Operating Procedure.

16. Label, store, and manage the sample as described in the Geomatrix Field Operating Procedure for Sample Management.

17. Manage the unused portion of the sample as described in Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
Morton International, Inc.
RCRA Facility Investigation of Reading, Ohio, Facility

SOIL SAMPLE FIELD SCREENING USING AN ORGANIC VAPOR METER

PURPOSE

This procedure is used to screen soil samples for the presence of volatile organic constituents (VOCs) using a field organic vapor meter. These meters will be either photoionization detector (PID) or flame-ionization detector (FID) type. This screening is performed at the drilling and sampling location as a procedure for ensuring the health and safety of personnel at the site and to identify potentially contaminated soil samples for laboratory analysis. All soil samples will be field screened.

PROCEDURE

1. When the split-spoon or other sampler is opened or accessed, shave a thin layer of material from the entire length of the core. Scan the core visually and with the PID or FID noting stratification, visible staining, or other evidence of contamination. Based on this initial scan of the sample, collect approximately 100 milliliters (ml) of soil using a decontaminated stainless steel spatula, scoop, or equivalent. Place this soil into a clean, re-sealable plastic bag and seal the bag.

2. Place field screening sample bag in a location where the ambient temperature is at least 70° Fahrenheit.

3. Leave the field screening sample bag for at least 30 minutes, but no more than 60 minutes.

4. Carefully unseal a portion of the plastic bag just big enough to insert the probe of a calibrated FID or PID.

5. Record the maximum reading in parts per million by volume (ppmv) on the Boring Log form (Field Operation Procedures for Documentation Requirements for Drilling and Well Installation), at the depth interval corresponding to the depth of sample collection.

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FIELD OPERATING PROCEDURE
Morton International, Inc.
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SOIL SAMPLE HANDLING FOR VOLATILE ORGANIC CONSTITUENT (VOC) ANALYSIS

PURPOSE

This procedure describes the methods for collecting soil samples for VOC analysis to ensure that the sample adequately represents the VOC concentrations in the soil. These compounds tend to volatilize from the soil after disturbance or introduction to the atmosphere. Therefore, care must be exercised to ensure that the sample collected is not altered during the collection and storage procedures.

PROCEDURE

1. The preferred method for collecting and storing a soil sample for VOC analysis is using the EnCore™ method. The manufacturers' directions are attached.

2. Ensure that the EnCore™ Sampler is present at the sampling location before collecting the sample from the borehole or surface sample location. The necessary parts of the EnCore™ Sampler will consist of three disposable coring bodies, three disposable caps, and a reusable stainless steel tee handle.

3. Retrieve the sampling tool from the borehole or sample location.

4. Expose a surface of the soil sample. For Shelby tube samples, this would require the extrusion of the sample. For split spoon samples, this would require the spoon be disassembled and opened. If liners are being used in conjunction with a split spoon or solid barrel sampler, this would require the removal of the liners from the sampler, so that the soil at the liner's end is exposed.

5. Following the manufacturer's directions for the use of the EnCore™ Sampler (attached), collect three aliquots of soil from the exposed soil surface, using the three coring bodies. After the collection of each aliquot, cap and label each aliquot. The manufacturer's direction for use of the EnCore™ Sampler are attached

6. If the use of the EnCore™ Sampler is not possible due to soil texture (e.g. gravels) the sample must be field preserved with acid and methanol. The procedure for field preservation of soil samples is attached.

7. If the soil material is too coarse for sampling with the EnCore™ Sampler <u>and</u> contains excessive calcium carbonate material that reacts with the acid preservative, the sample will

SOIL SAMPLE HANDLING FOR VOLATILE ORGANIC CONSTITUENT (VOC) ANALYSIS

be retained in the brass or stainless steel liner of the split-spoon sampler or similar device. The ends of these liners will be covered with Teflon™ rounds, capped and sealed with tape.

8. Label, store, and ship all samples in accordance with the Geomatrix Field Operations Procedures.

Disposable En Core™ Sampler

EXTRUSION PROCEDURES

USING THE En Core™ EXTRUSION TOOL

CAUTION! Always use the Extrusion Tool to extrude soil from the En Core Sampler. If the Extrusion Tool is not used, the Sampler may fragment, causing injury.

1. Use a pliers to break locking arms on cap of En Core Sampler. Do not remove cap at this time. **(CAUTION: Broken edges will be sharp.)**

2. To attach En Core Sampler to En Core Extrusion Tool: Depress locking lever on Extrusion Tool and place Sampler, plunger end first, into open end of Extrusion Tool, ***aligning slots on coring body with pins in Extrusion Tool.*** Turn coring body clockwise until it locks into place. Release locking lever.

3. Rotate and gently push Extrusion Tool plunger knob clockwise until plunger slides over wings of coring body. (When properly positioned plunger will not rotate further.)

4. Hold Extrusion Tool with capped Sampler pointed upward so soil does not fall out when cap is removed. To release soil core, remove cap from Sampler and push down on plunger knob of En Core Extrusion Tool. Remove and properly dispose of En Core Sampler.

Warranty and Disclaimers

IMPORTANT: FAILURE TO USE THE EN CORE™ SAMPLER IN COMPLIANCE WITH THE WRITTEN INSTRUCTIONS PROVIDED HEREIN VOIDS ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

PRINCIPLE OF USE. The En Core Sampler Cartridge System is a volumetric sampling system designed to collect, store and deliver a soil sample. The En Core Sampler comes in two sizes for sample volumes of approximately 25 or 5 grams. There are four components: the cartridge with a movable plunger; a cap with two locking arms; a T-handle (purchased separately); and an extrusion handle (purchased separately). NOTE: The En Core Sampler is designed to store soil. It is not designed to store solvent or free product.

The soil is stored in a sealed headspace-free state. The seals are achieved by three special Viton® * o-rings, two located on the plunger and one on the cap of the Sampler. **At no time and under no conditions should these o-rings be removed or disturbed.**

QUALITY CONTROL. The cartridge is sealed in an airtight package to prevent contamination prior to use. Due to the stringent quality control requirements associated with the use of this system, the disposable cartridge is designed to be used only once.

WARRANTY. En Novative Technologies, Inc. ("En Novative Technologies") warrants that the En Core Sampler shall perform consistent with the research conducted under En Novative Technologies' approval, within thirty (30) days from the date of delivery, provided that the Customer gives En Novative Technologies prompt notice of any defect or failure to perform and satisfactory proof thereof. THIS WARRANTY DOES NOT APPLY TO THE FOLLOWING, AS SOLELY DETERMINED BY EN NOVATIVE TECHNOLOGIES: (a) Damage caused by accident, abuse, mishandling or dropping; (b)Samplers that have been opened, taken apart or mishandled; (c)Samplers not used in accordance with [illegible]ions; and (d)Damages exceeding the cost of the sampler. Seller warrants that [illegible] Core Samplers shall be free from defects in title. THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY INFORMATION PROVIDED BY SALES REPRESENTATIVES OR IN MARKETING LITERATURE. IMPLIED WARRANTIES OF FITNESS AND MERCHANTABILITY SHALL NOT APPLY. En Novative Technologies' warranty obligations and Customer's remedies, except as to title, are solely and exclusively as stated herein.

LIMITATION OF LIABILITY. IN NO EVENT SHALL EN NOVATIVE TECHNOLOGIES BE LIABLE FOR ANTICIPATED PROFITS, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF REVENUE, DOWN TIME, REMEDIATION ACTIVITIES, REMOBILIZATION OR RESAMPLING, COST OF CAPITAL, SERVICE INTERRUPTION OR FAILURE OF SUPPLY, LIABILITY OF CUSTOMER TO A THIRD PARTY, OR FOR LABOR, OVERHEAD, TRANSPORTATION, SUBSTITUTE SUPPLY SOURCES OR ANY OTHER EXPENSE, DAMAGE OR LOSS, INCLUDING PERSONAL INJURY OR PROPERTY DAMAGE. En Novative Technologies' liability on any claim of any kind shall be replacement of the En Core Sampler or refund of the purchase price. En Novative Technologies shall not be liable for penalties of any description whatsoever. In the event the En Core Sampler will be utilized by Customer on behalf of a third party, such third party shall not occupy the position of a third-party beneficiary of the obligation or warranty provided by En Novative Technologies, and no such third party shall have the right to enforce same. All claims must be brought within one (1) year of shipment, regardless of their nature.

En Novative Technologies, Inc.
1241 Bellevue St.
Green Bay, WI 54302
Telephone: 920-465-3960 • Toll Free: 1-888-411-0757
Fax: 920-465-3963

The En Core™ Sampler is covered by One or More of the Following U.S. Patents: 5,343,771; 5,505,098; 5,517,868; 5,522,271. Other U.S. and Foreign Patents Pending.

* Viton® is a registered trademark of DuPont Dow Elastomers.

Disposable EnCore™ Sampler

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SAMPLING PROCEDURES

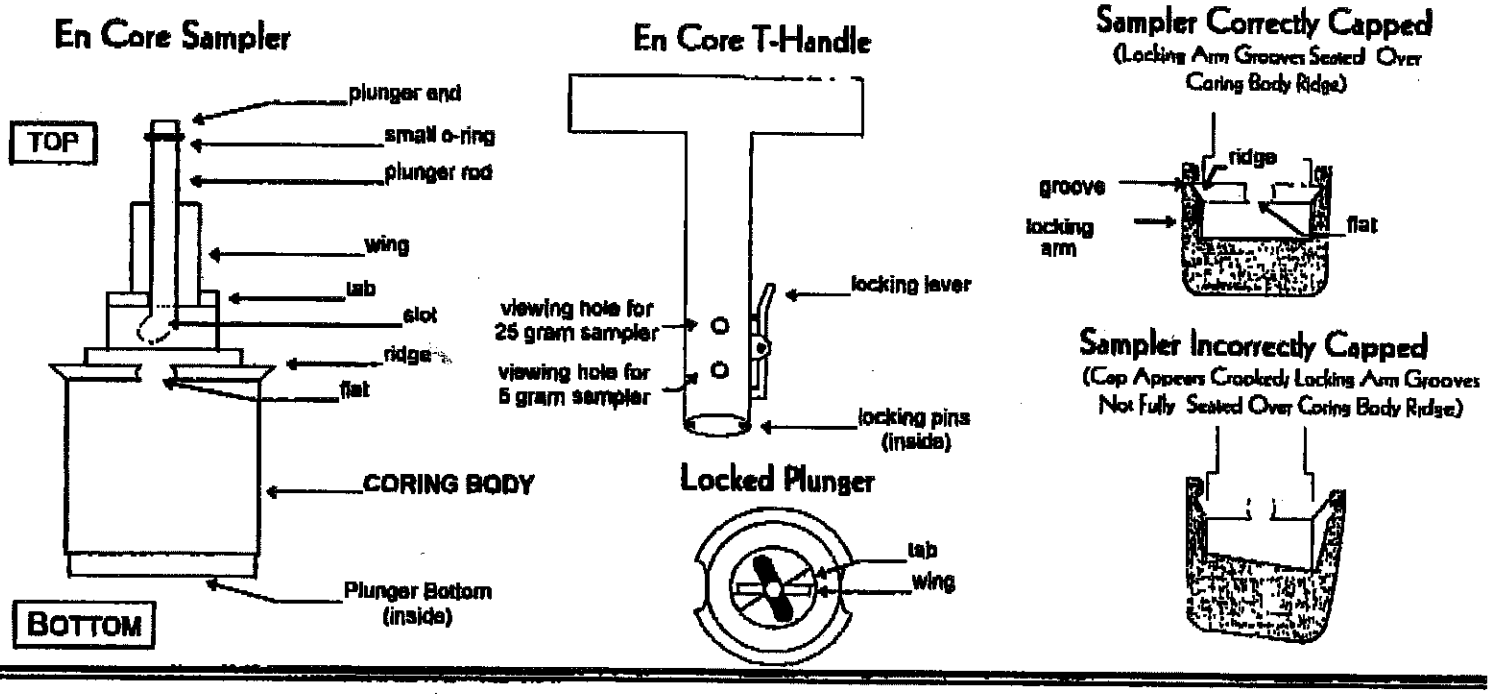
NOTE:

1. En Core Sampler is a SINGLE USE device. It cannot be cleaned and/or reused.

2. En Core Sampler is designed to store soil. Do not use En Core Sampler to store solvent or free product!

3. En Core Sampler must be used with En Core™ T-Handle and/or En Core™ Extrusion Tool exclusively. (These items are sold separately.)

USING THE EnCore™ T-HANDLE



BEFORE TAKING SAMPLE:

1. Hold coring body and push plunger rod down until small o-ring rests against tabs. This will assure that plunger moves freely.

2. Depress locking lever on En Core T-Handle. Place coring body, plunger end first, into open end of T-Handle, *aligning the (2) slots on the coring body with the (2) locking pins in the T-Handle.* Twist coring body clockwise to lock pins in slots. Check to ensure Sampler is locked in place. Sampler is ready for use.

TAKING SAMPLE:

3. Turn T-Handle with T-up and coring body down. This positions plunger bottom flush with bottom of coring body (ensure that [illegible]er bottom is in position). Using T-Handle, push Sampler in[illegible] soil until coring body is completely full. When full, small o-ring will be centered in T-Handle viewing hole. Remove Sampler from soil. Wipe excess soil from coring body exterior.

4. Cap coring body while it is still on T-handle. *Push* cap over flat area of ridge *and twist* to lock cap in place. CAP MUST BE SEATED TO SEAL SAMPLER (see diagram).

PREPARING SAMPLER FOR SHIPMENT:

5. Remove the capped Sampler by depressing locking lever on T-Handle while twisting and pulling Sampler from T-Handle.

6. Lock plunger by rotating extended plunger rod fully counter-clockwise until wings rest firmly against tabs (see plunger diagram).

7. Attach completed circular label (from En Core Sampler bag) to cap on coring body.

8. Return full En Core Sampler to zipper bag. Seal bag and put on ice.

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Developer of the EnCore™ Sampler

Frequently Asked Questions (FAQ)

- ***Does the En Core™ Sampler work in tight clay?***
  The En Core excels in sampling tight soils. A cutting edge was designed into the front of the body. Push and twist the sampler into the clay to take a core sample.

- ***Does the En Core™ Sampler work in sand?***
  The En Core cannot be used to sample sand in the normal way since dry sand will not form a cohesive plug. Pull the plunger back to form an o-ring seal on the back end of the body and scoop or push sand into the sampler. When the cap is attached, the sand will be kept in a headspace-free state.

- ***Does the En Core™ Sampler work in rocks?***
  The En Core Sampler does not work with rocks. Rocks are a difficult matrix to sample no matter what approach is used. We would recommend that you have some methanol available if you need to sample rocks. You may need to break up the rocks to get a sufficiently small sample.

- ***Does the En Core™ Sampler work with down-hole sampling methods?***
  At the present time, the En Core does not work with down hole sampling. You must bring the soil core or split spoon to the surface and quickly punch out a sample.

- ***How do I know if the En Core™ Sampler is full?***
  There is a viewing hole in the handle. The back o-ring on the plunger will show in the viewing window when the soil has pushed the plunger fully to the back. However, there is another check you should make on every sample. The plunger can only be rotated when it is fully pushed to the back of the body. If you can twist the plunger, you have guaranteed that the soil has filled the sampler and the back o-rings have sealed.

- ***How do I know if the cap is on properly?***
  When you put the cap on, it is important that you twist the cap as you push it on. The cap is properly sealed when the two locking arms are completely and symmetrically over the body ridge. This means the cap is sealed.

- ***What is the status with hold times?***
  Currently, the hold time for all methods is 48 hours. This means that the soil must be placed in a preservative before the end of the 48 hour period. A recommendation is currently pending with EPA to extend hold time to either 7 days when stored at 4 degrees C., or to 14 days when stored at –13 degrees C.

Forward your questions to: info@ennovativetech.com
Cecilia will be sure that your questions get answered!

SOP No: 003
Rev. No: 1.4
Date: 07/20/98

Soil Sampling SOP
EnCore (Medium or Low Level)

1.0 Presampling

1.1 Ship one EnCore sampler per sample location.

Note: If low-level analyses are needed, two additional EnCore samplers will be required.

2.0 Field Sampling

2.1 Remove sampler from package and attach handle.
2.2 Quickly collect sample(s) using the EnCore sampler.
2.3 Attach cap.
2.4 Fill out label and attach to sampler.
2.5 Ship to lab.

3.0 Laboratory Analysis-Medium Level

3.1 Within 48 hours of sampling, transfer to tared vial containing methanol.
3.2 Record sample weight.
3.3 Analyze according to Method 5030B.

4.0 Laboratory Analysis-Low Level

3.1 Evaluate for effervescence
3.1 Within 48 hours of sampling, transfer to tared vial containing sodium bisulfate, or, if carbonaceous, store in freezer until day of analysis.
3.2 Record sample weight.
3.3 Evaluate results from medium level analysis
3.3 If required, analyze by closed system purge and trap within 7 days of collection.

Note: This is a simple SOP for providing accurate data. State regulations and SW-846 may impose more requirements.

En Novative Technologies, Inc.

1241 Bellevue Street
Green Bay, WI 54302
PHONE (920) 465-3960 • FAX (920) 465-3963
TOLLFREE (888) 411-0757

Developer of the EnCore™ Sampler

Date: 2/19/98

SW 846 METHOD 5035 FIELD SAMPLING GUIDE

EN CORE™ SAMPLER COLLECTION FOR HIGH LEVEL ANALYSES (≥ 200 UG/KG)

EN CORE™ SAMPLING

Each sample point requires

- One 25g sampler or one 5g sampler (The sampler size used will be dependent on who is doing the sampling and who is doing the laboratory analysis).
- One dry weight cup.
- One T-handle.
- Paper toweling.

Procedure-Sampling

1. Remove sampler and cap from package and attach T-handle to sampler body.
2. Quickly push the sampler into a freshly exposed surface of soil until the sampler is full.
3. Use paper toweling to quickly wipe the sampler head so that the cap can be tightly attached.
4. Push cap on with a twisting motion to attach cap.
5. Fill out label and attach to sampler.
6. Collect dry weight sample-fill container.
7. Store samplers at 4 degrees Celsius.
8. Ship sample containers with plenty of ice to the laboratory within 40 hours of collection.

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Green Bay, WI 54302
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TOLLFREE (888) 411-0757

Developer of the EnCore™ Sampler

Date: 2/19/98

SW 846 METHOD 5035 FIELD SAMPLING GUIDE

EN CORE™ SAMPLER COLLECTION FOR LOW LEVEL ANALYSES (≥ 1 UG/KG)

When sampling for low level analyses, a high level sample also needs to be collected.

EN CORE™ SAMPLING

Each sample point requires

- Two 5g samplers.
- One 25g sampler or one 5g sampler for screening and/or high level analysis. (The sampler size used will be dependent on who is doing the sampling and who is doing the laboratory analysis).
- One dry weight cup.
- One T-handle.
- Paper toweling.

Procedure-Sampling

1. Remove sampler and cap from package and attach T-handle to sampler body.
2. Quickly push the sampler into a freshly exposed surface of soil until the sampler is full.
3. Use paper toweling to quickly wipe the sampler head so that the cap can be tightly attached.
4. Push cap on with a twisting motion to attach cap.
5. Fill out label and attach to sampler.
6. Repeat procedure for the other two samplers.
7. Collect dry weight sample-fill container.
8. Store samplers at 4 degrees Celsius.

Ship sample containers with plenty of ice to the laboratory within 40 hours of collection.

SOP No: 002
Rev. No: 1.4
Date: 07/20/98

Soil Sampling SOP
Field Methanol Preservation (Medium Level)

1.0 Presampling

- 1.1 40 mL VOA vial.
- 1.2 Add 5 mL methanol.
- 1.3 Attach label.
- 1.4 Weigh to nearest 0.1 gram and record on label.
- 1.5 Ship according to DOT regulations **(FLAMMABLE LIQUID, POISON)**.

2.0 Field Sampling

- 2.1 Quickly collect a 5 gram sample using a cut off plastic syringe or other coring device.
- 2.2 Quickly transfer to VOA vial.
- 2.3 Ship to lab per DOT regulations **(FLAMMABLE LIQUID, POISON)**.

3.0 Laboratory Analysis

- 3.1 Weigh container to determine sample weight.
- 3.2 Based on screening results, analyze the appropriate amount of methanol.

Note: This is a simple SOP for providing accurate data. State regulations and SW-846 may impose more requirements. For example, the high-level option in Method 5035 would require sample weights to be recorded in the field. The high-level option in Method 5035 would also require sample vials to be discarded if weights do not agree within 0.01 grams. The New Jersey regulations specify 10 grams of soil and 10 mL of methanol.

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Date: 2/19/98

SW 846 METHOD 5035 FIELD SAMPLING GUIDE

ACID PRESERVATION SAMPLING FOR LOW LEVEL ANALYSES (≥ 1 UG/KG)

ACID PRESERVATION SAMPLING

Each sample point requires

- One 40mL VOA vial with acid preservative (for field testing of soil pH).
- Two pre-weighed 40mL VOA vials with acid preservative and stir bar (for lab analysis).
- Two pre-weighed 40mL VOA vials with water and stir bar (in case samples effervesces).
- One pre-weighed jar that contains methanol or a pre-weighed empty jar accompanied with a pre-weighed vial that contains methanol (for screening sample and/or high level analysis).
- One dry weight cup.
- One 2oz jar with NaHSO4 acid preservative (in case additional acid is needed due to high soil pH).
- One scoop capable to deliver about one gram of solid sodium bisulfate.
- pH paper.
- Weighing balance that weighs to 0.01 g (field balances may not reliably weigh to 0.01g). IAETL suggests 0.1g.
- Set of balance weights used in daily balance calibration.
- Gloves for working with pre-weighed sample vials.
- Paper toweling.

Procedure-Field Chemistry For Testing Effervescing Capacity Of Soils

1. Place ~5g of soil into a vial that contains acid preservative and no stir bar.
2. Do not cap this vial as it may EXPLODE upon interaction with the soil.
3. Observe the sample for gas evolution (due to carbonates in the soil).
4. If vigorous or sustained gas evolution occurs: then acid preservation is not acceptable to preserve the sample.
   - In this case the samples need to be collected in the VOA vials with only water and a stir bar. The vials with acid preservative CANNOT be used.
5. If a small amount or no gas evolution occurs: then acid preservation is acceptable to preserve the sample. Keep this testing vial for use in the buffering testing detailed below.
   - In this case the samples need to be collected in the VOA vials with the acid preservative and a stir bar.

Procedure-Field Chemistry For Testing Buffering Capacity Of Soils

1. If acid preservation is acceptable for sampling soils then the sample vial that was used in the effervescing testing can be used here for the buffering testing.
2. Cap the vial that contains ~5g of soil, acid preservative and no stir bar from step 1 in the effervescing testing.
3. Shake the vial gently to attempt to make a homogenous solution.
4. When done, open the vial and check the pH of the acid solution with the pH paper.
   - If the pH paper reads below 2 then the sampling can be done in the two pre-weighed 40mL VOA vials with the acid preservative and stir bar. Since the pH was below 2, it is not necessary to add additional acid to the vials.
   - If the pH paper reads above 2, then additional acid needs to be added to the sample vial.
5. Use the jar with the solid sodium bisulfate acid and add another one gram of acid to the sample.
6. Cap the vial and shake thoroughly again.
7. When done, open the vial and check the pH of the acid solution with a new piece of pH paper.
   - If the pH paper reads below 2 then the sampling can be done in the two pre-weighed 40mL VOA vials with the acid preservative and stir bar and one extra gram of acid.
   - Make a note of the extra gram of acid needed so the same amount of extra acid can be added to the vials the lab will analyze.
   - If the pH paper reads above 2, then add another gram of acid and repeat this procedure one more time.

En Novative Technologies, Inc.

1241 Bellevue Street
Green Bay, WI 54302
PHONE (920) 465-3960 • FAX (920) 465-3963
TOLLFREE (888) 411-0757

Developer of the EnCore™ Sampler

Now that the soil chemistry has been determined the actual sampling can occur. The procedure stated below assumes the correct vials are used based on the guidance discussed.

ACID PRESERVATION SAMPLING FOR LOW LEVEL ANALYSES (≥ 1 UG/KG)

ACID PRESERVATION SAMPLING cont.

Procedure-Sampling

1. Wear gloves during all handling of pre-weighed vials.
2. Quickly collect a 5g sample using a cut off plastic syringe or other coring device designed to deliver 5g of soil from a freshly exposed surface of soil.
3. Carefully wipe exterior of sample collection device with clean paper toweling.
4. Quickly transfer to the appropriate VOA vial, extruding with caution so that the solution does not splash out of the vial.
5. Add more acid if necessary (this is based on the buffering testing discussed in the previous section).
6. Use the paper toweling and quickly remove any soil off of the vial threads.
7. Cap vial and weigh the jar to the nearest 0.01 g (IAETL suggests nearest 0.1g).
8. Record exact weight on sample label.
9. Repeat sampling procedure for the duplicate VOA vial.
10. Weigh the vial with methanol preservative in it to 0.01g. If the weight of the vial with methanol varies by more than 0.01 g from the original weight recorded on the vial-discard the vial. If the weight is within tolerance it can be used for soil preservation below. (IAETL suggests weighing to the nearest 0.1g)
11. Tare the empty jar or the jar that contains the methanol preservative.
12. Quickly collect a 25g or 5g sample using a cut off plastic syringe or other coring device designed to deliver 25g or 5g of soil from a freshly exposed surface of soil. The 25g or 5g size is dependent on who is doing the sampling and who is doing the laboratory analysis.
13. Carefully wipe the exterior of the collection device with clean paper toweling.
14. Quickly transfer the soil to an empty jar or a jar that contains methanol. If extruding into a jar that contains methanol be careful not to splash the methanol outside of the vial. Again, the type of jar received is dependent on who is doing the laboratory analysis.
15. If the jar used to collect the soil plug was empty before the soil was added, immediately preserve with the methanol provided-using only one vial of methanol preservative per sample jar.
16. Use the paper toweling and remove any soil off of the vial threads and cap the jar.
17. Weigh the jar with the soil in it to 0.01g and record the weight on the sample label. (IAETL suggests weighing to the nearest 0.1g).
18. Collect dry weight sample-fill container.
19. Store samples at 4 degrees Celsius.
20. Ship sample containers with plenty of ice and per DOT regulations (CORROSIVE, FLAMMABLE LIQUID, POISON) to the laboratory.

En Novative Technologies, Inc.

1241 Bellevue Street
Green Bay, WI 54302
PHONE (920) 465-3960 • FAX (920) 465-3963
TOLLFREE (888) 411-0757

Developer of the EnCore-Sampler

Date: 2/19/98

SW 846 METHOD 5035 FIELD SAMPLING GUIDE

METHANOL PRESERVATION SAMPLING FOR HIGH LEVEL ANALYSES (≥ 200 UG/KG)

METHANOL PRESERVATION SAMPLING

Each sample point requires

- One pre-weighed jar that contains methanol or a pre-weighed empty jar accompanied with a pre-weighed vial that contains methanol.
- One dry weight cup.
- Weighing balance that accurately weighs to 0.01g (field balances may not reliably weigh to 0.01g). IAETL suggests 0.1g.
- Set of balance weights used in daily balance calibration.
- Gloves for working with pre-weighed sample vials.
- Paper toweling.

Procedure-Sampling

1. Wear gloves during all handling of pre-weighed vials.
2. Weigh the vial with methanol preservative in it to 0.01g. If the weight of the vial with methanol varies by more than 0.01 g from the original weight recorded on the vial-discard the vial. If the weight is within tolerance it can be used for soil preservation/collection below (IAETL suggests weighing to the nearest 0.1g).
3. Tare the empty jar or the jar that contains the methanol preservative.
4. Quickly collect a 25g or 5g sample using a cut off plastic syringe or other coring device designed to deliver 25g or 5g of soil from a freshly exposed surface of soil. The 25g or 5g size used is dependent on who is doing the sampling and who is doing the laboratory analysis.
5. Carefully wipe the exterior of the collection device with clean paper toweling.
6. Quickly transfer the soil to an empty jar or a jar that contains methanol. If extruding into a jar that contains methanol be careful not to splash the methanol outside of the vial. Again, the type of jar used is dependent on who is doing the laboratory analysis.
7. If the jar used to collect the soil plug was empty before the soil was added, immediately preserve with the methanol provided-using only one vial of methanol preservative per sample jar.
8. Using the paper toweling-remove any soil off of the vial threads and cap the jar.
9. Weigh the jar with the soil in it to 0.01g and record the weight on the sample label. (IAETL suggest weighing to the nearest 0.1g).
10. Collect dry weight sample-fill container.
11. Store samples at 4 degrees Celsius
12. Ship sample containers with plenty of ice and per DOT regulations (CORROSIVE, FLAMMABLE LIQUID, POISON) to the laboratory.

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FIELD OPERATING PROCEDURE
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LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER PURGING PROCEDURES

PURPOSE

This procedure describes the methods used for performing low flow purging, also referred to as micro-purging, at a well prior to groundwater sampling to obtain a representative sample from the water-bearing zone. This method of purging is used to minimize the turbidity of the produced water. This may increase the representativeness of the groundwater samples by avoiding the necessity of filtering suspended solids in the field prior to preservation of the sample.

Well purging is typically performed immediately preceding groundwater sampling. The sample should be collected as soon as the parameters measured in the field (i.e., pH, specific conductance, dissolved oxygen, temperature, and turbidity) have stabilized.

PROCEDURE

1. Unlock and remove the protective cap or cover and place on clean plastic.

2. Monitor the top of the well casing for organic vapors using a photoionization detector or flame ionization detector. If a reading of greater than 5 parts per million by volume (ppmv) is recorded, the well should be allowed to vent until levels drop below 5 ppmv before proceeding with purging.

3. Decontaminate all equipment (Reference the Geomatrix Field Operating Procedure for Sampling Equipment Decontamination).

4. Measure the static water level (Reference the Geomatrix Field Operating Procedure for Groundwater Level Measurement). Refer to the construction diagram for the well to identify the screened depth.

5. Lower the purge pump (typically a low-flow electrical submersible) <u>slowly</u> into the well until the pump intake is approximately in the middle of the screened interval. Rapid insertion of the pump will increase the turbidity of well water, and can increase the required purge time.

LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER PURGING PROCEDURES

6. Begin pumping to purge the well. The pumping rate should be bellow 1000 milliliters (ml) per minute. Periodically check the well water level with the e-line. If the well level appears to be more than 2 feet below static and declining, slow the purge rate until the water level generally stabilizes.

7. Measure field parameters (pH, specific conductance, dissolved oxygen (DO), temperature, and turbidity). In lieu of measuring all of the parameters, a minimum subset could be limited to pH, specific conductance, and turbidity or DO. An in-line flow through cell to continuously measure the above parameters may be used. The in-line device should be disconnected or bypassed during sample collection.

8. Record well purging and sampling data in the Project Field Book or on the attached "Well Development/Purging Log" and "Well Sampling Field Data Sheet" forms. Measurements should be taken approximately every three to five minutes, or as merited given the rapidity of change.

9. Purging is complete when field parameters stabilize. Stabilization is achieved after all field parameters have stabilized for three successive readings. Three successive readings should be within ± 0.2 units for pH, ±10% for specific conductance, and ±10% for turbidity and dissolved oxygen.

10. Sample the well as discussed in the Geomatrix Field Operating Procedure for Groundwater Sampling of Monitoring Wells.

11. Restore the well to its capped/covered and locked condition.

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GROUNDWATER SAMPLE COLLECTION

PURPOSE

This procedure describes the methods for collecting water samples from monitoring wells. It also includes the order in which water samples are collected based on the suite of analytical parameters required.

PROCEDURE

1. Purge the monitoring well in accordance with the Geomatrix Field Operation Procedures for Low Flow Groundwater Purging Procedures.

2. Sampling equipment that is not disposable or dedicated to the well will be decontaminated in accordance with the Geomatrix Field Operating Procedures.

3. Groundwater samples will be collected directly from the sampling valve on the flow through cell. In low-yielding wells at which the flow through cell is not used, the samples may be collected using a disposable bailer.

4. Sampling data will be recorded on a Well Sampling Form (example attached).

5. Samples will be collected in the order designated below and in the sample containers supplied by the laboratory for the specified analytes.

6. The samples will be labeled, stored and shipped in accordance with the Geomatrix Field Operating Procedures for Sample Labeling, Storage, and Shipment.

All groundwater samples, from monitoring wells and domestic supply wells, will be collected in accordance with the following.

1. Samples will be collected preferentially in recognition of volatilization sensitivity. The preferred order of sampling is:

   - Volatile organics
   - Total Organic Carbon (TOC)
   - Extractable organics
   - Total metals
   - Phenols

GROUNDWATER SAMPLE COLLECTION

- Cyanide
- Sulfate and chloride
- Turbidity
- Nitrate and ammonia

2. Document the sampling procedures on the attached Well Sampling and Development Record.

GEOMATRIX

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: _____

Sample ID: _____ Duplicate ID: _____

Sample Depth: _____

Project and Task No.: _____

Project Name: _____

Date: _____

Sampled By: _____

Method of Purging: _____

Method of Sampling: _____

Initial Depth to Water: _____

Depth to Water after Sampling: _____

Total Depth of Well: _____

Well Diameter: _____

1 Casing/Borehole Volume = _____
(Circle one)

4 Casing/Borehole Volumes = _____
(Circle one)

Total Casing/Borehole Volumes Removed: _____

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment)

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm = µmhos/cm)			
Temperature °C			
Instrument Reading			

Model or Unit No.:

Notes: _____

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SURFACE WATER SAMPLING FROM SEEPS

PURPOSE

This procedure describes a method for collecting surface water samples from seeps. Sediment samples will be collected in conjunction with surface water samples if site-specific work plan requires. The method for collecting surface water samples uses a clean sampling dipper to collect the water, which is then transferred into the final sample bottle(s).

PROCEDURE

1. Assemble the sampler, if necessary. Use extension handles if immediate access to the seep is not possible.
2. With proper protective garment and gear, take a grab sample by slowly submerging the sample dipper with minimal surface disturbance.
3. If the seep is not sufficiently large to allow the dipper to be adequately submerged, use a clean shovel to expand the seep area, and to create a reservoir or accumulation area. Allow any turbidity associated with digging to clear before commencing sampling.
4. Allow the dipper to fill slowly and continuously. Retrieve the dipper from the surface water with minimal disturbance.
5. Measure field parameters in seep water.
6. Carefully transfer sample to appropriate pre-cleaned sample bottles.
7. Cap sample bottles. Label, store, and ship sample in accordance with Geomatrix Field Operating Procedures.
8. When possible, dedicate stainless steel dipper to sampling location. If dipper is to be used at other sampling locations, dismantle the sampler and store in plastic bags for subsequent decontamination. Perform proper decontamination procedures in accordance the Geomatrix Field Operating Procedures.
9. Record available information for the seep that was sampled, such as its size, location, discharge rate, and depth in the Project Field Book in accordance with the Geomatrix Field Operating Procedures for Documentation Requirements. Approximate sampling points should be identified on a sketch of the water body.

SURFACE WATER SAMPLING FROM SEEPS

Record pertinent information for the sample, including location and depth, in the Project Field Book in accordance with the Geomatrix Field Operating Procedures for Documentation Requirements.

SEDIMENT SAMPLING FROM RIVER OR CREEK BANKS

PURPOSE

This guideline presents a method for collection of sediment samples along the margins of creeks and rivers. This method uses a stainless steel corer fitted with a brass or steel liner, that is driven into the sediment by hand to obtain a 1.5- to 2-inch diameter sample core.

PROCEDURE

1. Assemble the decontaminated sampler. Make sure that the handle and extension rods are tightened securely. Insert a new or clean liner sleeve in the sampler end.

2. To the extent practicable, collect samples from downstream locations first to minimize impacts on sample quality.

3. Collect a grab sample by slowly driving the sampler approximately 6 inches into the sediments.

4. Retrieve the sample by twisting the sampler and gently pulling upward on the handle, again being sure to minimize disturbance at the sediment/water interface.

5. If no sediment is retrieved due to the presence of soft, non-consistent sediments, replace the standard sleeve with an eggshell-type cellulose acetate sleeve. This type of sleeve remains open on bottom while the sampler is being driven into the sediments, but closes when the sampler is removed to trap the soft sediment.

6. Remove the sleeve from the sampler and transfer contents to the appropriate pre-cleaned sample jars using a stainless steel trowel. Repeat the collection procedure as necessary immediately adjacent to the previous sampling point until adequate sample volume is obtained.

7. Follow Geomatrix Field Operating Procedures for Non-Disposable and Non-Dedicated Equipment Decontamination and Sample, Labeling, Storage and Shipment.

Record pertinent information for the sample in the Project Field Notebook in accordance with the Geomatrix Field Operating Procedures for Documentation Requirements. If the sediment sampling is performed at the location of a pertinent feature, such as a spring, seep, channel, or

outfall, include a drawing showing the size, position, etc. of this feature, and the relative location of the sample.

NON-DISPOSABLE AND NON-DEDICATED SAMPLING EQUIPMENT DECONTAMINATION

PURPOSE

This procedure is to be used for the decontamination of non-disposable and non-dedicated equipment used in the collection of environmental samples. The purpose of this procedure is to remove chemical constituents from previous samples from the sampling equipment. This prevents these constituents from being transferred to later samples, or being transported out of controlled areas.

PROCEDURES

Bailers, split-spoons, steel or brass split-spoon liners, Shelby tubes, submersible pumps, soil sampling knives, and similar equipment will be decontaminated as described below.

1. Wash equipment thoroughly with non-phosphate detergent and potable-quality water, using a brush where possible to remove any particulate matter or surface film. If the sampler is visibly coated with tars or other phase-separated hydrocarbons, pre-wash with acetone or isopropanol, or by steam cleaning.
2. Rinse with potable water.
3. Rinse with distilled water.
4. Air dry.
5. Store in a clean area or wrap in aluminum foil (shiny side out) or new plastic sheeting as necessary to ensure cleanliness.

Submersible pump discharge tubing and associated sample valves or flow-through cells used in well purging or pumping tests will be decontaminated as described below:

1. Pump a mixture of potable water and a non-phosphate detergent through the tubing, sample valves and flow cells, using the submersible pump.

NON-DISPOSABLE AND NON-DEDICATED SAMPLING EQUIPMENT DECONTAMINATION

2. Steam clean or detergent wash the exterior of the tubing, sample valves, flow cells and pump.

3. Pump potable water through the tubing, sample valve, and flow cell until no indications of detergent (e.g. foaming) are observed.

4. Double rinse the exterior of the tubing with potable water.

5. Rinse the exterior of the tubing with distilled water.

6. Store in a clean area or wrap the pump and tubing assembly in new plastic sheeting as necessary to ensure cleanliness until ready for use.

DRILLING AND EXCAVATION EQUIPMENT DECONTAMINATION

PURPOSE

This procedure is to be used for the decontamination of drilling and excavation equipment (i.e., drill rigs, backhoes, augers, drill bits, drill rods, buckets, and associated equipment) used during a subsurface investigation. The purpose of this procedure is to remove chemical constituents associated with a particular drilling or excavation location from this equipment. This prevents these constituents from being transferred between drilling or excavation locations, or being transported out of controlled areas.

PROCEDURE

The following procedure will be utilized prior to the use of drilling or excavation equipment at each location, and prior to the demobilization of such equipment from the site:

1. Remove all loose soil and other particulate materials from the equipment at the survey site.

2. Wrap augers, tools, plywood, and other reusable items with a plastic cover prior to transport from the site of use to the decontamination facility.

3. Transport equipment to the decontamination facility. All equipment must be decontaminated at an established decontamination facility. This facility will be placed within a controlled area, and will be equipped with necessary features to contain and collect wash water and entrained materials.

4. Wash equipment thoroughly with pressurized low-volume water or steam, supplied by a pressure washer or steam cleaner.

5. If necessary, use a brush or scraper to remove visible soils adhering to the equipment, and a non-phosphate detergent to remove any oils, grease, and/or hydraulic fluids adhering to the equipment. Continue pressure washing until all visible contaminants are removed.

6. Allow equipment to air dry.

7. Store equipment in a clean area or wrap the equipment in new plastic sheeting as necessary to ensure cleanliness until ready for use.

DRILLING AND EXCAVATION EQUIPMENT DECONTAMINATION

8. Manage all wash waters and entrained solids as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.

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GROUNDWATER LEVEL MEASUREMENT

PURPOSE

This procedure describes the methods used to obtain accurate and consistent water level measurements in monitoring wells. Water levels will be measured at monitoring wells to estimate purge volumes associated with sampling, and to develop a potentiometric surface of the groundwater in order to estimate the direction and velocity of flow in the aquifer. Water levels in monitoring wells will be measured using an electronic water level indicator (e-line) that has been checked for operation prior to mobilization.

PROCEDURE

1. Decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Geomatrix Field Operating Procedure for Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.

2. Unlock and remove the well protective cap or cover and place on clean plastic.

3. Lower the probe slowly into the monitoring well until the audible alarm sounds. This indicates the depth to water has been reached.

4. Move the cable up and down slowly to identify the depth at which the alarm just begins to sound. Measure this depth against the mark on the lip of the well riser used as a surveyed reference point.

5. Read depth from the graduated cable to the nearest 0.01 foot. Do not use inches.

6. Record the water level on the attached Water Level Monitoring Record.

7. Remove the probe from the well slowly, drying the cable and probe with a clean paper wipe. Be sure to repeat decontamination before use in another well.

8. Replace well plug and protective cap or cover. Lock in place as appropriate.

WATER LEVEL MONITORING RECORD

GEOMATRIX

Project Name: _____ Project and Task Number: _____

Date: _____ Measured by: _____ Instrument Used: _____

Note: For your convenience, the following abbreviations may be used.

P = Pumping I = Inaccessible D = Dedicated Pump
ST = Steel Tape ES = Electric Sounder MP = Measuring Point WL = Water Level

Well No.	Time	MP Elevation (feet)	Water Level Below MP (feet)	Water Level Elevation (feet)	Previous Water Level Below MP	Remarks

Forms(PF).007 (Revised 12/95)

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IN-SITU HYDRAULIC CONDUCTIVITY BY SLUG TEST FOR UNCONFINED (WATER TABLE) AQUIFERS

PURPOSE

This procedure describes the performance of slug tests for evaluating the hydraulic characteristics of an aquifer or water-bearing zone. Slug tests are a non-pumping aquifer test. Slug tests are conducted to evaluate aquifer characteristics when pumping tests are not appropriate or practical.

PROCEDURE

1. Record all field data in the Project Field Book.
2. Measure dimensions of the slug, and calculate its volume.
3. Decontaminate slug, water level indicator (e-line) probe and cable, and pressure transducer and cable. Reference the Geomatrix Field Operating Procedure for Sampling Equipment Decontamination.
4. Unlock and remove the protective cap or cover and place on clean plastic.
5. Measure and record the static water level in the well using the e-line. Slug testing should only be performed at monitoring wells that are believed to be at static conditions. Lower the transducer into the well to a depth of at least 10 feet below the water surface. If water levels in the well prohibit this depth of submergence, place the transducer at the bottom of the well.
6. Place the slug into the well and allow the water level to return to its static level.
7. Input necessary functions into the datalogger, including monitoring well identification, date, static level, etc.
8. Simultaneously withdraw the slug and activate the data logger. Slug withdrawal should be rapid, with the slug emerging completely from the water within 2 to 4 seconds of the test start.
9. Continue test until the water level recovers approximately 95 percent of the initial water level change.
10. Stop the data acquisition program, remove the pressure transducer, and decontaminate all equipment as discussed above.

PERFORMANCE OF AQUIFER PUMPING/RECOVERY TESTS

PURPOSE

This section describes the standard operating procedures for performing aquifer pumping/recovery tests using the step-drawdown method and the constant rate discharge method. The objective of these tests is to collect hydraulic information from the water-bearing stratum to estimate hydraulic properties for evaluation of groundwater flow characteristics. Such data may be used in calculations on the fate and transport of contaminants, in groundwater modeling, and in remedial design.

PROCEDURE

Aquifer pumping/recovery tests will include an initial step-drawdown test to evaluate pumping well performance characteristics, a 72-hour constant rate discharge test, and a recovery test. These tests will require the use of a single well for pumping, and one or more additional wells for observation of water table drawdown and recovery. Pumping will be performed using an appropriately-sized downhole electric-powered submersible pump. The wells to be used will be selected based on the specific site assessment requirements. As the work progresses, and if warranted, appropriate revisions may be made by the project manager.

Data and field notes will be recorded on two forms in accordance with the Field Operating Procedures for Documentation Requirements:

- *Daily Field Record* forms are completed for each day of fieldwork (see Field Operating Procedures for Documentation Requirements of Drilling and Well Installation). Weather conditions, proximity of surface water bodies, irrigation, discharge location, volume of pumped/treated water, personnel onsite, or other observations that may affect results of the aquifer testing will be noted.

PERFORMANCE OF AQUIFER PUMPING/RECOVERY TESTS

- An *Aquifer Test Data* form (attached) is completed for each well observed during the test, during both drawdown and recovery phases. Alternatively, a data logger may be used in each well, and the set-up parameters determined by the project hydrogeologist should be recorded on a form developed for this purpose. If a data logger is used, data should be transferred to a computer as soon as possible after collection. As data is collected, it will be checked periodically in the field for accuracy and completeness. All data entries will include the date and time that the measurement was made.

STEP-DRAWDOWN TEST

The step-drawdown aquifer test is initially performed to estimate a maximum sustainable discharge rate for the pumping well. Water level measurements will be collected in the pumped well and the observation wells using electric sounders or a steel tape, and will be recorded for the appropriate well.

The pumping phase of the step-drawdown test will consist of:

(1) pumping the well at least three successively higher pumping rates (steps) specified by the responsible professional, with an approximate duration of two to four hours per step;

(2) periodically measuring the water levels in the pumped well and observation wells during each step; and

(3) measuring the instantaneous and cumulative discharge from the pumped well using a flow meter or other appropriate means.

The maximum water-level drawdown will be approximately 50% of the available drawdown. A relatively constant pumping rate will be maintained during each step. The rate will be checked periodically (at least hourly) and adjusted, if necessary. The accuracy of the flow meter also may be verified periodically by comparing the flow rate obtained by timing a revolution of the sweep needle on the flow meter with the flow rate obtained by timing the filling of a container of known volume.

PERFORMANCE OF AQUIFER PUMPING/RECOVERY TESTS

The recovery phase of the step-drawdown test will begin immediately after the pump is shut off, at the completion of the final step of the pumping phase. Recovery water-level measurements will be made periodically in the pumped well and observation wells. Water level measurements will conclude when one of the following is satisfied:

(1) 95% of the induced drawdown has recovered; or

(2) the water level in the pumped well has changed less than 0.05 foot for at least 2 hours.

CONSTANT RATE DISCHARGE TEST

Test Duration

The pumping test will be conducted long enough (estimated minimum of 72 hours) to allow the influence of local hydraulic boundaries, if present, to be observed. The duration of the recovery period will be determined when one of the following have been met:

1) the recovery period is equivalent to the planned pumping period;

2) 95 percent of the induced drawdown has been recovered in all wells;

3) the water level in all wells has not changed more than 0.05 foot for at least two hours; or,

4) the hydrogeologist determines that extension of the recovery period would not result in collection of additional useful.

AQUIFER TEST DATA

GEOMATRIX

Well No.: ________ Project Name: ________ Project No.: ________

Owner ________ Address ________ County ________ State ______

Date ________ Company Performing Test ________ Measured By ________

Well No. ________ Distance from Pumping Well ________ Type of Test ________ Test No. ______

Pumping Well _____ Observation Well _____ Measurement Equipment ________

TIME DATA

Pump on: Date________ Time________ (t_o)

Pump off: Date________ Time________ (t'_o)

Duration of aquifer test:

Pumping ________ Recovery ________

WATER LEVEL DATA

Static Water Level ________

Measuring Point ________

Elevation of Measuring Point ________

DISCHARGE DATA

How Q Measured ________

Depth of Pump/Air Line ________

Previous Pumping? Yes ______ No ______

Duration ________ End ________

Date	Clock Time	Time Since Pump Started (t)	Time Since Pump Stopped (t')	t/t'	Water Level Measurement	Correction or Conversion	Water Level	Water Level Change (s or s')	Discharge Measurement	Discharge Rate	Recorded By	COMMENTS ON FACTORS AFFECTING TEST DATA

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FIELD OPERATING PROCEDURE
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RCRA Facility Investigation of Reading, Ohio, Facility

ELECTROMAGNETIC (EM) SURVEY–
EM61 TIME DOMAIN ELECTROMAGNETIC SURVEY

PURPOSE

This procedure describes a method for EM geophysical surveys to identify possible buried materials that may be a source of chemical impact during the field investigation.

PROCEDURE

The GEONICS EM61 High Sensitivity Metal Detector (EM61) and solid state data logger will be used for surveying the near surface (0 to 11 feet) for the presence of metallic or metal-containing objects. The EM61 is a portable time-domain EM unit. The device detects both ferrous and nonferrous metals.

The EM61 generates a primary EM field at a rate of 150 pulses per second. After each transmitted pulse, the transmitter turns off and the induced EM field is allowed to decay. The receivers are then turned on; measuring the strength of this decayed secondary EM field between each pulse. Because EM fields decay much more rapidly in normal soils than in metals, the EM61 instrument is relatively insensitive to terrain conductivity and is highly sensitive to metals.

Data will be stored on a digital data logger and archived to a laptop computer. Data will be processed using GEOSOFT software and plotted as profile lines, gridded, filtered and color-contoured. Anomalous responses will be annotated and discussed in a report. The report will include a color-contoured map of the EM61 survey results showing any buried USTs, metallic pipes and metallic fill material present.

FIELD PROCEDURE

1. Lay out the survey grid across the area of interest. Grid lines may be placed by tape and measure. The grid lines will be parallel and 3 feet apart.

ELECTROMAGNETIC (EM) SURVEY–

EM61 TIME DOMAIN ELECTROMAGNETIC SURVEY

2. Align the trailer-mounted EM61 over the first grid line. Activate the unit.

3. Pull the unit along the grid lines. The odometer will automatically trigger a reading and data acquisition on 0.66-foot intervals.

4. Repeat for additional grid lines.

5. Have the corners of the grid located by survey.

ELECTROMAGNETIC (EM) SURVEY–
EM31 FREQUENCY DOMAIN ELECTROMAGNETIC SURVEY

PURPOSE

This procedure describes a method for EM geophysical surveys to map variations in electrical conductivity of near subsurface materials.

PROCEDURE

The GEONICS EM31 Frequency Domain transmitter (EM31) and solid state data logger will be used to map the lateral extent of electrically conductive material such as lime sludge fill or construction and demolition debris. The EM31 is capable of exploring material to a depth of approximately 12 feet below ground surface.

The EM31 simultaneously records the quadrature and in-phase components of the electromagnetic fields generated by the device's transmitter.

- The quadrature component data are measurements of the apparent terrain conductivity. A terrain conductivity map of the study site should provide information concerning variations in conductive fill material, lithology and/or pore fluid.
- The in-phase component is sensitive to the presence of highly conductive material and is generally considered the metal detection mode. Buried metal within 12 below surface such as steel drums, storage tanks or metallic pipes can be mapped in this mode.

Terrain conductivity and in-phase data will be recorded and stored on portable digital logging equipment. The data logger will then be interfaced to a laptop computer where data are stored and backed-up on floppy disks. Data analysis will require the use of a variety of software programs where data will be interpreted in both profile and plan format. The results of the EM survey will be color-contoured and presented in plan view. Two color-contoured maps will be provided of the EM31 survey results; a map of terrain conductivity and a map of in-phase (metal detection) results.

ELECTROMAGNETIC (EM) SURVEY–

EM31 FREQUENCY DOMAIN ELECTROMAGNETIC SURVEY

FIELD PROCEDURE

1. Lay out the survey grid across the area of interest. Grid lines may be placed by tape and measure. The grid lines will be parallel and 12 feet apart.

2. Align the trailer-mounted EM31 over the first grid line. Activate the unit.

3. Pull the unit along the grid lines. The odometer will automatically trigger a reading and data acquisition on either 2 or 3-foot intervals.

4. Repeat for additional grid lines.

5. Have the corners of the grid located by survey.

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
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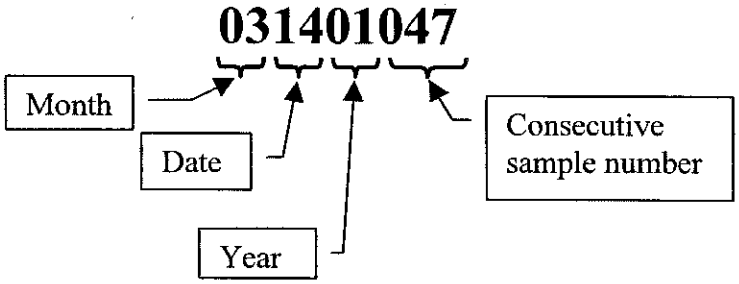
SAMPLE LABELING, STORAGE, AND SHIPMENT

PURPOSE

The collection and analysis of samples of environmental media, including soils, groundwater, surface water, and sediment, are the central activities of the field investigation. These samples must be properly labeled to preserve its identity, and properly stored and shipped in a manner that preserves its integrity and chain of custody. This procedure presents methods for these activities.

SAMPLE LABELING PROCEDURE

1. Assign each sample retained for analysis a unique 9-digit identification code. This code will be formatted as follows



2. Consecutive sample numbers will indicate the individual sample's sequence in the total set of samples collected during the investigation. The sample number above, for example, would indicate the 47th sample retained for analysis during the field investigation, collected on March 14, 2001.

3. Affix a non-removable (when wet) label to each sample container. The following information will be written on the label with black or blue ink that will not smudge when wet:

   - Project number
   - Sample ID (see Step 1 above)
   - Date of sample collection
   - Time of sample collection (military time only)
   - Specify "grab" or "composite" sample with an "X"
   - Sampler initials

SAMPLE LABELING, STORAGE, AND SHIPMENT

- Sampler initials
- Preservative(s) (if applicable)
- Analytes for analysis (if practicable)

4. Record all sample label information in the Project Field Book, keyed to the sample identification number. In addition, add information regarding the matrix, sample location, depth, etc. to provide a complete description of the sample.

SAMPLE STORAGE PROCEDURE

1. Immediately after collection, placement in the proper container, and labeling, place samples to be retained for chemical analysis into resealable plastic bags.

2. Place bagged samples into an ice chest filled approximately half-full of bagged ice.

3. Maintain samples in an ice chest or in an alternative location (e.g. sample refrigerator) as approved by the Geomatrix Field Team Leader until time of shipment. Periodically drain melt water off coolers and replenish ice.

4. Ship samples on a daily basis, unless otherwise directed by the Geomatrix Field Team Leader.

5. Maintain appropriate custody procedures on coolers and other sample storage containers at all times. These procedures are discussed in detail in the Quality Assurance Project Plan.

SAMPLE SHIPPING PROCEDURE

1. Fill out the chain-of-custody form completely (see attached example) with all relevant information. The white original goes with the samples and should be placed in a resealable plastic bag and taped inside the sample cooler lid; the sampler should retain the copy.

2. Place a layer of inert cushioning material such as bubble pack in the bottom of cooler.

3. Place each bottle in a bubble wrap sleeve or other protective wrap. To the extent practicable, then place each bottle in a resealable plastic bag.

SAMPLE LABELING, STORAGE, AND SHIPMENT

4. Place bottles in cooler with volatile organic analysis (VOA) vials near the center of the cooler.

5. Pack bottles with ice in plastic bags. At packing completion, cooler should be at least 50 percent ice, by volume. Coolers should be completely filled, so that samples do not move excessively during shipping.

6. Tape cooler drain closed and wrap cooler completely with strapping tape in two or more locations to secure lid.

7. Place laboratory label address and overnight delivery waybill sleeves on cooler lid.

8. Place custody seal tape across the front or side seam between the lid and cooler body.

9. Sign the custody seal tape with an indelible soft-tip marker, then cover with an additional wrap of transparent strapping tape.

10. Place "Fragile" and "This Side Up" labels on all four sides of the cooler. "This Side Up" labels are yellow labels with a black arrow with the arrow head pointing toward the cooler lid.

11. For coolers shipped by overnight delivery, retain a copy of the shipping waybill, and attach to the chain-of-custody documentation.

CHAIN-OF-CUSTODY RECORD

Nº

Date:

Page of

Project No.:

Samplers (Signatures):

Date	Time	Sample Number	EPA Method 8010	EPA Method 8020	EPA Method 8020 (BTEX only)	EPA Method 8240	EPA Method 8270	TPH as gasoline	TPH as diesel													Cooled	Soil (S), Water (W), or Vapor (V)	Acidified	Number of containers

ANALYSES

REMARKS

Additional Comments

Turnaround time:

Results to:

Total No. of containers:

Relinquished by (signature):	Date:	Relinquished by (signature):	Date:	Relinquished by (signature):	Date:
Printed Name:	Time:	Printed Name:	Time:	Printed Name:	Time:
Company:		Company:		Company:	
Received by (signature):	Date:	Received by (signature):	Date:	Received by (signature):	Date:
Printed Name:	Time:	Printed Name:	Time:	Printed Name:	Time:
Company:		Company:		Company:	

Method of Shipment:

Laboratory Comments and Log No.:

GEOMATRIX

Forms(PF).012b (Revised 12/95)

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

PURPOSE

The purpose of these documentation requirements is to document the procedures used for drilling and installing wells in order to ensure the quality of the data obtained from these operations. Geomatrix field technical personnel will be responsible for developing and maintaining documentation for quality control of field operations. At least one field professional will monitor each major operation (e.g. one person per drilling rig) to document and record field procedures for quality control. These procedures provide a description of the format and information for this documentation.

PROCEDURE

Project Field Book

Personnel assigned by the Geomatrix Field Team Leader or Project Manager will maintain a Project Field Book for all site activities. These Field Books will be started upon initiation of any site activities to document the field investigation process. The Field Books will meet the following criteria:

- Permanently bound, with nominal 8.5-inch by 11-inch gridded pages.
- Water resistant paper.
- Pages must be pre-numbered or numbered in the field, front and back.

Notations in the field book will be in black or blue ink that will not smudge when wet. Information that may be recorded in the Field Book includes:

- Time and date of all entries.
- Name and location of project site, and project job number.
- Listing of key project, client and agency personnel and telephone numbers.
- Date and time of daily arrivals and departures, name of person keeping the log, names and affiliation of persons on site, purpose of visit (if applicable), weather conditions, outline of project activities to be completed.

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

- Details of any variations to the procedures/protocols presented in the RFI Work Plan or Field Operating Procedures, and the basis for the change.
- Field-generated data relating to implementation of the field program, including sample locations, sample descriptions, field measurements, instrument calibration, etc.
- Record of all photographs taken in the field, including date, time, photographer, site location and orientation, sequential number of photograph, and roll number.

Upon completion of the site activities, the Field Books will be placed in the project files.

Borehole Log Form

An example of this form is attached to this Field Operating Procedure. One form will be completed for every boring by the Geomatrix field person overseeing the drilling. At a minimum, these forms will include:

- Project name, location, and number.
- Boring number.
- Drilling method.
- Drilling dates.
- Sampling method.
- Sample descriptions, to meet the requirements of the Unified Soil Classification System (USCS) for soils and the Unified Rock Classification System (URCS) for rock.
- Results of headspace analyses.
- Blow counts for sampler penetration.
- Drilling rate, rig chatter, and other drilling-related information.

All depths recorded on Boring Log Forms will be expressed in increments of tenths of feet, and not in inches.

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

Monitoring Well Construction Log

An example of this form is attached to this Field Operating Procedure. One form will be completed for every boring by the Geomatrix field person overseeing the well installation. At a minimum, these forms will include:

- Project name, location, and number.
- Well number.
- Installation dates.
- Dimensions and depths of the various well components illustrated in the Monitoring Well Construction Diagram (reference the Geomatrix Field Operating Procedures for Monitoring Well Installation). These include the screened interval, bottom caps or plugs, centralizers, and the tops and bottoms of the various annular materials.
- Drilling rate, rig chatter, and other drilling related information.

All depths recorded on Monitoring Well Construction Logs will be expressed in tenths of feet, and not in inches.

Daily Drilling Report Form

This form should be used to summarize all drilling activities. One form should be completed for each rig for each day. These forms will include summaries of:

- Footage drilled, broken down by diameter (e.g. 200 feet of 6-inch diameter hole, 50 feet of 10-inch diameter hole).
- Footage of well and screen installed, broken down by diameter.
- Quantities of materials used, including sand, cement, bentonite, centralizers, protective casings, traffic covers, etc. recorded by well or boring location.
- Active time (hours), and activity (drilling, decontamination, development, well installation, surface completions, etc.).

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

- Down-time (hours) and reason.
- Mobilizations and other events.
- Other quantities that will be the basis for drilling invoices.

The form should be signed daily by both the Geomatrix field supervisor and the driller's representative, and provided to the Geomatrix Field Team Leader.

Other Project Field Forms

Well purging/well development forms, test pit logs, environmental sampling field data sheets, water level monitoring forms, and well testing (slug test or pumping test) forms. Refer to specific guidelines for form descriptions.

PROJECT:	Log of Boring No.	
BORING LOCATION:	ELEVATION AND DATUM:	
DRILLING CONTRACTOR:	DATE STARTED:	DATE FINISHED:
DRILLING METHOD:	TOTAL DEPTH:	MEASURING POINT:
DRILLING EQUIPMENT:	DEPTH TO WATER: FIRST	COMPL.
SAMPLING METHOD:	LOGGED BY:	
HAMMER WEIGHT: DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/Foot	OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react. w/HCl. geo. inter. Surface Elevation:	REMARKS

B-1 (12/95)

Project No.	Geomatrix Consultants	Figure

B-1 (Blank)

PROJECT:

Log of Boring No.

DEPTH (feet)	SAMPLES			OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react. w/HCl. geo. inter.	REMARKS
	Sample No.	Sample	Blows/ Foot			

B-2 (12/95)

Project No.	Geomatrix Consultants	Figure

B-2 (Blank)

PROJECT:	Log of Well No.	
BORING LOCATION:	ELEVATION AND DATUM:	
DRILLING CONTRACTOR:	DATE STARTED:	DATE FINISHED:
DRILLING METHOD:	TOTAL DEPTH:	SCREEN INTERVAL:
DRILLING EQUIPMENT:	DEPTH TO WATER: FIRST / COMPL.	CASING:
SAMPLING METHOD:	LOGGED BY:	
HAMMER WEIGHT: / DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/Foot	OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react. w/HCl. geo. inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

W-1 (12/95)

Project No.	Geomatrix Consultants	Figure

W-1 (Blank)

PROJECT:

Log of Well No.

DEPTH (feet)	SAMPLES			OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react. w/HCl. geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot			

W-2 (12/95)

Project No.	Geomatrix Consultants	Figure

W-2 (Blank)

GEOMATRIX CONSULTANTS, INC.
FIELD OPERATING PROCEDURE
Morton International, Inc.
RCRA Facility Investigation of Reading, Ohio, Facility

MANAGEMENT OF INVESTIGATION-DERIVED WASTE

PURPOSE

The purpose of these guidelines is to ensure the proper holding, storage, transportation, and disposal of materials that may contain hazardous wastes. Investigation-derived waste (IDW) include the following:

- Drill cuttings, discarded soil samples, drilling mud solids, and used sample containers.
- Well development and purge waters and discarded groundwater samples.
- Decontamination waters and associated solids.
- Soiled disposable personal protective equipment (PPE).
- Used disposable sampling equipment.
- Used plastic sheeting and aluminum foil.
- Other equipment or materials that either contain or have been in contact with potentially-impacted environmental media.

Because these materials may contain regulated chemical constituents, they must be managed as a solid waste. This management may be terminated if characterization analytical results indicate the absence of these constituents.

PROCEDURE

1. Contain all investigation-derived wastes in Department of Transportation (DOT)-approved 55-gallon drums, roll-off boxes, or other containers suitable for the wastes.

2. Contain wastes from separate borings or wells in separate containers (i.e. do not combine wastes from several borings/wells in a single container, unless it is a container used specifically for transfer purposes, or unless specific permission to do so has been provided by the Geomatrix Field Team Leader. Unused samples from surface sample locations within a given area may be combined.

3. To the extent practicable, separate solids from drilling muds, decontamination waters, and similar liquids. Place solids within separate containers.

4. Transfer all waste containers to a staging area. Access to this area will be controlled. Waste containers must be transferred to the staging area as soon as practicable after the generating activity is complete.

5. Pending transfer, all containers will be covered and secured when not immediately attended.

MANAGEMENT OF INVESTIGATION-DERIVED WASTE

6. Label all containers with regard to contents, origin, date of generation, using the label attached to these Field Operating Procedures. Use indelible ink for all labeling.

7. Collect samples for waste characterization purposes, or use boring/well sample analytical data for characterization.

8. For wastes determined to be hazardous in character, be aware of accumulation time limitations. Coordinate the disposal of these wastes with the Morton Plant Manager.

9. Dispose of investigation-derived wastes as follows:

   - Soil, water, and other environmental media for which analysis does not detect organic constituents, and for which inorganic constituents are at levels consistent with background, may be spread on Morton Property or otherwise treated as a non-waste material.

   - Soils, water, and other environmental media in which organic compounds are detected or metals are present above background will be disposed as industrial waste. Alternate disposition must be consistent with applicable State and Federal laws.

Personal protective equipment, disposable bailers, and similar equipment may be disposed as municipal waste, unless waste characterization results mandate disposal as industrial wastes.

PENDING ANALYSIS

Contents

- ☐ Soil Cuttings
- ☐ Drilling Mud
- ☐ Excavation Soil
- ☐ Purge Water
- ☐ Decon Water
- ☐ Other _____

_____

Drum ID #_____

Source/Location _____

_____

_____

_____

_____

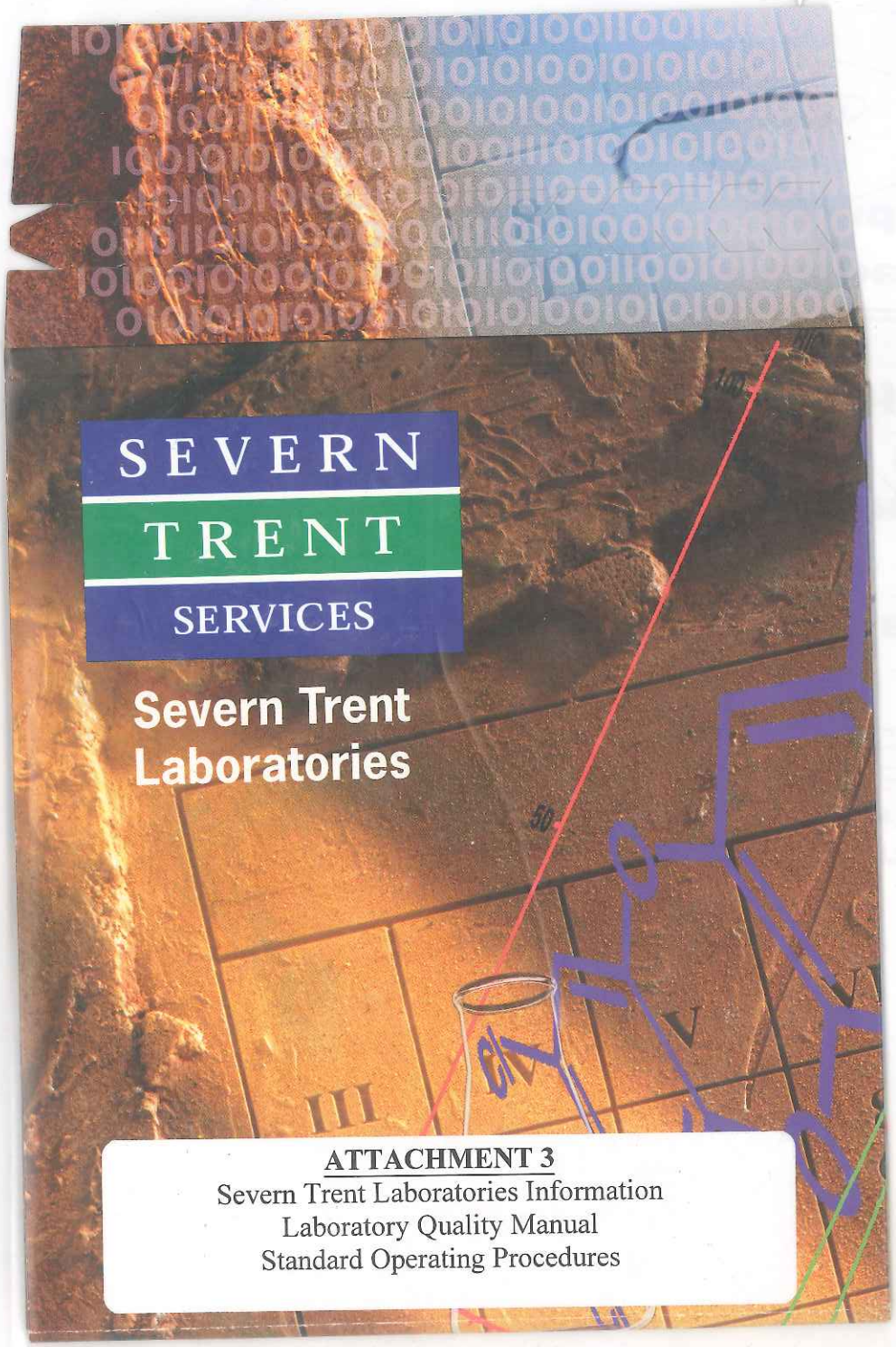
Date_____ Contact_____ Project #_____

GEOMATRIX CONSULTANTS
1214 West Sixth Street, Suite 201
Austin, TX 78703
512 494-0333

ATTACHMENT 3

SEVERN TRENT LABORATORIES INFORMATION
LABORATORY QUALITY MANUAL
STANDARD OPERATING PROCEDURES

(PROVIDED ON ATTACHED CD-Rom DISC)



ATTACHMENT 3

Severn Trent Laboratories Information
Laboratory Quality Manual
Standard Operating Procedures

STL STANDARD OPERATING PROCEDURES
CROSS REFERENCED TO METHODS SPECIFED IN QAPP

Morton Facility

Reading, Ohio

Parameter	Matrix	Method	Protocol	SOP# Analysis	SOP# Preparation
VOC	water	8260B	SW-846	CORP-MS-0002NC	NA
SVOC	water	8270C	SW-846	CORP-MS-0001NC	CORP-OP-0001NC
PCBs	water	8081A	SW-846	CORP-GC-0001NC	CORP-OP-0001NC
Pesticides	water	8082	SW-846	CORP-GC-0001NC	CORP-OP-0001NC
Dioxins/Furans	water	8280A	SW-846	SAC-ID-0008	NA
Metals	water	6010B	SW-846	CORP-MT-0001NC	CORP-IP-0003NC
Cyanide	water	9012A	SW-846	NC-WC-0031	NC-WC-0032
Mercury	water	7470A	SW-846	CORP-MT-0005NC	NA
Chloride	water	325.3 or 300.0	40 CFR 136	NC-WC-0020 or NC-WC-0084	NA
Alkalinity	water	310.1	40 CFR 136	NC-WC-0012	NA
Ammonia-Nitrogen	water	350.1	40 CFR 136	NC-WC-0038	NA
Nitrate/Nitrite	water	353.2	40 CFR 136	NC-WC-0001	NA
Phosphate	water	365.2	40 CFR 136	NC-WC-0050	NA
Phosphorous	water	365.2	40 CFR 136	NC-WC-0050	NA
Sulfide	water	376.1	40 CFR 136	NC-WC-0060	NA
TDS	water	160.1	40 CFR 136	NC-WC-0055	NA
TOC	water	415.1	40 CFR 136	NC-WC-0017	NA
TSS	water	160.2	40 CFR 136	NC-WC-0054	NA
VOC	soil/sediment	8260B	SW-846	CORP-MS-0002NC	NA
SVOC	soil/sediment	8270C	SW-846	CORP-MS-0001NC	CORP-OP-0001NC
PCBs	soil/sediment	8081A	SW-846	CORP-GC-0001NC	CORP-OP-0001NC
Pesticides	soil/sediment	8082	SW-846	CORP-GC-0001NC	CORP-OP-0001NC
Dioxins/Furans	soil	8280A	SW-846	SAC-ID-0008	NA
Metals	soil/sediment	6010B	SW-846	CORP-MT-0001NC	CORP-IP-0002NC
Cyanide	soil/sediment	9012A	SW-846	NC-WC-0031	NC-WC-0032
Mercury	soil/sediment	7471A	SW-846	CORP-MT-0007NC	NA
Sulfide	soil/sediment	376.1	40 CFR 136	NC-WC-0060	NA
Atterberg Limits	soil	D4318	ASTM D4318	LM-SL-D4318	NA
CEC	soil	9081	SW-846	LM-SL-D2937	NA
Grain Size	soil	4822	ASTM D421, 422	LM-SL-D422	NA
Moisture Content	soil	D2216-90	ASTM D2216	LM-SL-D2216	NA
pH	soil	9045C	ASTM D2976	NC-WC-0010	NA
TOC	soil	Walkley Black	Walkley Black	NC-WC-0018	NA

NA - prep is not applicable or contained in the analytical SOP.