Heartland **Environmental Associates, Inc.**

Sample Street Business Complex

3702 West Sample Street
South Bend, Indiana 46619
Saint Joseph County

FID #
VRP ID # 6120801

Quality Assurance Project Plan

Prepared by:

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Abstract:

This document details a quality assurance plan to guide the successful implementation of a Corrective Action Plan to remediate contaminated soil and groundwater at the Sample Street Business Complex in South Bend, Indiana.

August 16, 2013

1.0 PROJECT MANAGEMENT

1.1 Approval Sheet

Nivas Vijay
Heartland Environmental Associates, Inc.
Senior Project Manager

Date

John A. Sill
Heartland Environmental Associates, Inc.
President

Date

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1.2 Distribution List

Each person listed on the approval sheet and each person listed under Project/Task Organization will receive a copy of this Quality Assurance Project Plan (QAPP). Individuals taking part in the project may request additional copies of the QAPP from personnel listed under Section 1.3.

This document has been prepared according to the United States Environmental Protection Agency publication *EPA Requirements for Quality Assurance Project Plans* dated March 2001 (QA/R-5).

1.3 Project/Task Organization

Personnel involved in project implementation are listed in Table 1, and shown as an organization chart in Figure 1.

Table 1: Project Implementation Personnel

Individual	**Role in Project**	**Organizational Affiliation**
Nivas Vijay	Project Manager	Heartland
John R. Barnhart	QA Manager	Heartland
David Nye	O&M, Quarterly Sampling	Heartland

The Heartland Project Manager will be responsible for the following activities:
- Coordinate remedial system implementation with client
- Remedial system implementation oversight
- Oversight of quarterly field data collection
- Oversight of O&M activities
- Maintain official, approved QAPP
- Develop amended QAPP
- Issue quarterly reports to the IDEM

Pace Analytical, Inc. will be responsible for the following activities:
- Perform analysis of quarterly samples, field duplicates, and quality control samples
- Documentation of sample analysis, instrument calibration, and QA/QC analysis

1.4 Problem Definition/Background

1.4.1 Rationale for initiating the project

The Urban Enterprise Association of South Bend, Inc. (UEA) currently owns and operates the Sample Street Business Complex located at 3702 West Sample Street, South Bend, St. Joseph County, Indiana.

The project site was originally developed as the Torrington Company Heaving Bearing Facility in 1928 and utilized for the manufacture of metal bearings. The facility expanded several times, last expanding in 1967. The site historically operated an approximately 333,000 square foot manufacturing facility on 15 acres of property. The site operated two underground storage tank (UST) areas and five storm water and cooling water ponds located at the south end of the property. The site ceased manufacturing operations in September 1983 and began site closure activities in preparation for sale of the property.

Site closure activities included an environmental assessment of the facility. From 1984 through 1991 numerous subsurface soil and groundwater investigations were conducted at the site around the former UST area and in the vicinity of the storm water and cooling water ponds.

These investigations found elevated concentrations of VOCs in pond sediments and pond water samples. Elevated concentrations of VOCs and mineral spirits (light hydrocarbon chemicals) were also found in soil and groundwater borings throughout the site, particularly near the loading dock area located in the southwest portion of the site.

In July 1986, five petroleum and solvent USTs were removed from the site. Confirmation samples showed that high levels of VOCs remained in the soils. Four of the five pond areas were also excavated and approximately 1,700 cubic yards of impacted pond sediments were removed from the site.

Further investigations conducted from 1990 through 1991 found additional groundwater impacts Chemical impacts were also encountered in monitoring wells installed down-gradient from the site source areas. Groundwater sampling also showed the presence of free product light non-aqueaous phase liquid petroleum (LNAPL) near the loading dock area.

High concentrations of metals were found in fill materials at the site. The highest concentration of impacts was in the southwest portion of the site and associated with the cooling water pond identified as Pond 4. Visual chemical impacts were noted down to 5 feet in the area of the pond. Concentrations of cyanide were encountered in these sediments, however no PCBs were present.

In 1992, 960 cubic yards of material were excavated and removed from around Pond 4. Soil sampling results showed that VOC impacts to soil remained at depth.

From 1992 through 1994, pilot testing was performed and a soil vapor extraction (SVE) and air sparging (AS) remediation system was designed to remediate the free product petroleum and VOC impacts to both soil and groundwater. The design called for the construction of two separate remediation systems. The first system was to be installed in the loading dock area and the second system was to be installed in the eastern portion of the site building.

The system was installed in late 1995/ early 1996 and began full time operation midyear 1996. At the time, the Corrective Action Work Plan referred to IDEM Tier II Cleanup Goals as the standard to monitor the effectiveness of the remediation system. No formal consultation with IDEM was conducted as part of the site investigation or remedial design. The annual system effectiveness report for the year 1998 indicated that the system was running efficiently with a 90% run time; however free product petroleum was still present in groundwater monitoring wells at the loading dock and both TCE and PCE were still encountered at elevated concentrations throughout the site. No additional documentation was available after this date regarding the remediation system or pertaining to any system closure.

Based on the lack of documentation, Heartland recommended that the UEA conduct a Limited Phase II ESA in the formerly identified source areas to evaluate for the presence or absence of residual chemical impacts present in the soil and groundwater.

The Limited Phase II EAS was performed in 2011. Ten soil borings were advanced in the southwest loading dock area, in the southern portion of the site, and in the southeastern and eastern portions of the site. Heartland also collected groundwater samples from 10 of the existing groundwater monitoring wells located in the central and southern portion of the site.

Impacts of metals and TPH-ERO were found in some soil samples. No VOC impacts were found in soils. A VOC imapact was found in a groundwater sample from one soil boring. No other soil boring or monitoring well exhibited any VOC impacts to groundwater.

In 2012, the UEA applied for enrollment of the property in the Indiana Voluntary Remediation Program (VRP). In 2012, the facility was formally accepted into the VRP. Consequently, Heartland has prepared a Remediation Work Plan (RWP) for the site. The objective of the RWP is to determine the current status of soil and groundwater contamination at the site and to determine what actions, if any, are needed to conform with the Indiana Remediation Program.

1.4.2 Regulatory information, applicable criteria and action limits

The applicable program default closure levels are the Indiana Remdiation Program Appendix A Default Screening Levels for soil and groundwater. Appendix A Screening Levels are included in Appendix A.

1.5 Project/Task Description

1.5.1 Project overview

The purpose of environmental remediation is to reduce or eliminate exposure of humans and other ecological receptors to contaminants. The purpose of this project has been to define the nature and extent of contaminants; the potential exposure pathways and the risk of exposure; to evaluate the means and costs of remediation; to implement a selected and approved remediation plan; to monitor and evaluate the progress and effectiveness of the selected methodology; to collect quarterly groundwater samples and prepare quarterly monitoring reports; determine when the selected methodology has achieved closure goals; to complete closure sampling; document that closure has been achieved and submit reports; decommission remedial equipment and abandon groundwater monitoring wells.

1.5.2 Project summary and work schedule

This project's major tasks and timeline are outlined in the table below.

Table 2: Schedule of Major Project Tasks

Task Name	Task Description	Start Date	End Date
Site Characterization	Determine the nature and extent of contamination	4/11/2013	4/30/2013
Quarterly Sampling & Reporting	Collect quarterly groundwater samples and prepare quarterly reports for submittal to the IDEM	12/2012	Ongoing
Closure sampling and reporting	Collect closure samples for analysis. Prepare closure report for submittal to the IDEM with full Level IV QA/QC data package	TBD	
Closure acceptance	Abandon monitoring wells. Submit abandonment report to the IDEM.	TBD	

TBD = To Be Determined

1.6 Quality Objectives and Criteria

1.6.1 Detailed performance measures

The primary performance measures utilized in this project are the concentrations of volatile organic compounds (VOCs) in groundwater.

In prior investigations, VOC analysis, as well as heavy metals and total petroleum hydrocarbon analyses were utilized as performance measures to determine the maximum horizontal and vertical extent of the contaminant plume in soils and groundwater.

Confirmatory sampling performed after remedial activities indicates that localized concentrations of heavy metals have been satisfactorly remediated. Recent regulatory changes have eliminated the need to monitor for total petroleum hydrocarbons.

Note that, depending on the selected remedial technology, additional performance measures may be applicable. This QAPP will be revised as performance measures are added or revised.

1.6.2 Quality objectives

The quality objectives establish the measurement performance or acceptance criteria needed to relate the quality of data. These are expressed as the Data Quality Indicators.

- Precision
- Bias
- Representativeness
- Completeness
- Comparability
- Sensitivity (if applicable)

Table 3. Quality Assurance/Quality Control – Soil (SW 846)

QC Sample	Frequency/ Number	Data Quality Indicator (DQI)	Measurement Quality Objective (MQO)	Corrective Action if Out of Control
Equipment Blank	1 per sample location when non-disposable sampling equipment is used	Effectiveness of field decontamination procedures	All analytes < Reporting Limit	All affected data considered biased (High or Unknown) due to possible cross-contamination. Field decontamination procedures should be reviewed.
Field Duplicate	1 per 20 samples	Effectiveness of field sampling procedures	<4 0% Relative Percent Difference (RPD)	All affected data considered biased (High, Low, or Unknown) due to sampling error. Sample collection procedures should be reviewed.
Laboratory Control Sample (LCS)	Per Method and/or Laboratory SOP	Evaluation of laboratory and instrument capability	% Recovery and % RPD as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to laboratory or instrument error.
Internal Std (IS)	Per Method and/or Laboratory SOP	Evaluation of laboratory analysis procedures	% Recovery and Method or Laboratory SOP	All affected data considered estimated (High, Low, or Unknown) due to cross -contamination during transport or storage
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	1 per 20 samples	Evaluation of matrix interferences	<4 0% RPD, % Recovery as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to Matrix Interference.
Method Blank(MB)	Per Method and/or Laboratory SOP	Evaluation of laboratory and instrument conditions	All analytes < Reporting Limit	All affected data considered biased (High or Unknown) due to laboratory or instrument cross-contamination.
Surrogate Spike(SS	Per Method and/or Laboratory SOP	Evaluation of instrument capability	% Recovery and % RPD as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to laboratory or instrument error.

Table 4. Quality Assurance/Quality Control – Groundwater (SW 846)

QC Sample	Frequency/ Number	Data Quality Indicator (DQI)	Measurement Quality Objective (MQO)	Corrective Action if Out of Control
Equipment Blank	1 per sample location when non-disposable sampling equipment used	Effectiveness of field decontamination procedures	All analytes < Reporting Limit	All affected data considered biased (High or Unknown) due to possible cross-contamination. Field decontamination procedures should be reviewed.
Field Duplicate	1 per 20 samples	Effectiveness of field sampling procedures	<20% RPD	All affected data considered biased (High, Low, or Unknown) due to sampling error. Sample collection procedures should be reviewed.
Laboratory Control Sample (LCS)	Per Method and/or Laboratory SOP	Evaluation of laboratory and instrument capability	% Recovery and % RPD as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to laboratory or instrument error.
Internal Std (IS)	Per Method and/or Laboratory SOP	Evaluation of laboratory analysis procedures	% Recovery and Method or Laboratory SOP	All affected data considered estimated (High, Low, or Unknown) due to cross - contamination during transport or storage
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	1 per 20 samples	Evaluation of matrix interferences	<0% RPD, % Recovery as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to Matrix Interference.
Method Blank(MB)	Per Method and/or Laboratory SOP	Evaluation of laboratory and instrument conditions	All analytes < Reporting Limit	All affected data considered biased (High or Unknown) due to laboratory or instrument cross-contamination.
Surrogate Spike(SS	Per Method and/or Laboratory SOP	Evaluation of instrument capability	% Recovery and % RPD as per Method or Laboratory SOP	All affected data considered biased (High, Low, or Unknown) due to laboratory or instrument error.
Trip Blank	1 per 20 samples	Evaluation of sample integrity during transport and storage	All analytes < Reporting Limit	All affected data considered estimated (High, Low, or Unknown) due to cross - contamination during

				transport or storage.

2.0 SPECIAL TRAINING/CERTIFICATION

Heartland will develop and deliver mandatory and voluntary training sessions for all staff to ensure quality data collection, to the extent practicable.

All staff that conduct fieldwork must have successfully completed 40-Hour HAZWOPER (29 CFR 1910.120) training and subsequent 8-Hour HAZWOPER Refresher courses.

The Project Manager is responsible for ensuring that all personnel involved with data generation have the necessary QA training to successfully complete their tasks and functions. The Project Manager will document attendance at all training sessions.

The Project Manager is also responsible for ensuring the self-certification materials sent to facilities clearly document how facilities should properly prepare and submit their data.

2.1 Documents and Records

2.1.1 Report format/information

The format for all data reporting packages will be consistent with the requirements and procedures used for data validation and data assessment described in this QAPP.

2.1.2 Document/record control

The Project Manager will have ultimate responsibility for any and all changes to records and documents. Similar controls will be put in place for electronic records.

The Heartland Quality Assurance Officer shall retain all updated versions of the QAPP and be responsible for distribution of the current version of the QAPP. The Heartland Quality Assurance Officer and the Heartland Project Manager will approve annual updates. The Project Manager shall retain copies of all reports, memoranda, and all correspondence.

2.1.3 Other records/documents

Other records and documents that will be produced in conjunction with this project include:

- Soil Boring and Monitoring Well Logs
- Sampling Data Sheets
- Quarterly Groundwater Monitoring
- No Further Action Request

2.1.4 Storage of project information

Hardcopies of all project files, laboratory reports, QA/QC documentation, worksheets, data forms, correspondence, phone records, or any other records pertaining to this project will be retained in Heartland’s files indefinitely.

2.1.5 Backup of electronic files

All electronic records, including laboratory reports, QA/QC documentation, word processing files, spreadsheets, CADD files, GIS files, pdf files, or any other electronic data pertaining to this project will be stored in Heartland’s central server storage until such time as the project is complete. Central server storage will be backed up nightly and backups will be stored off-site. After completion of the project, the project files will be moved to archival storage and off-site backup storage.

3.0 DATA GENERATION AND ACQUISITION

3.1 Sampling Process Design

Chemical impacts exceeding regulatory limits were discovered in soil and groundwater samples collected from soil borings advanced during environmental site assessments conducted in preparation for a property transaction. Previous soil borings locations and sample intervals were selected in accordance with the regulatory programs that were in effect at those times.

Current confirmatory sampling locations will be selected based on prior investigation sampling results. Locations may be modified depending on site obstructions, utilities, and safety considerations. Soil borings will be advanced using Geoprobe® direct-push technology.

3.1.1 Sampling Methods

3.1.1.1 Soil Boring Equipment

The soil borings will be advanced using Geoprobe® direct-push soil probe. Soil borings will be advanced until no indication of contamination is present or until refusal. Soil samples are collected via plastic lined 2-inch diameter, 4 or 5-foot long bore samplers. Long bore samplers are decontaminated using scrub brushes and Alconox detergent after each interval. After the detergent wash, samplers are rinsed twice with deionized water.

3.1.1.2 Sampling Equipment

To minimize the potential for cross-contamination, all sampling equipment either shall be dedicated disposable equipment or decontaminated between uses. Samplers will don clean new nitrile gloves for each sample collection.

3.1.1.3 Soil Sample Collection

Volatile organic analysis soil samples will be collected using the USEPA 5035A sampling method as documented in the Indiana Department of Environmental Management Office of Land Quality *Supplemental Guidance for Sampling Soil and Waste Samples for Volatile Organic Compounds (VOCs),* dated 3/20/2008.

Sampling methodology will follow Heartland's Standard Operating Procure for Soil Sampling (Appendix B).

3.1.1.4 Groundwater Sample Collection

Groundwater sampling for VOCs will be performed using low-flow sampling techniques using Heartland's Standard Operation Procedure for Low- Flow sampling (Appendix B).

3.2 Sample Handling and Custody

Sample preparation and sample handling will be performed according to Heartland's Standard Operating Procedures (Appendix B). Chain-of-custody will be maintained by the sampler using laboratory-supplied forms. Samples should be shipped as soon as possible after collection so analysis may be performed within the maximum hold time.

3.3 Analytical Methods

Volatile organic chemicals will be analyzed using U.S. EPA Method 8260.

3.4 Quality Control

As required by the IDEM Minimum Data Documentation, one field duplicate sample must be collected for every 20 or fewer sample. Matrix spike and Matrix spike duplicate samples must be collected for each sampling event. A trip blank will be included in each shipment. Rinsate blanks will be collected for reusable and decontaminated sample collection equipment.

4.0 PROJECT ASSESSMENT/OVERSIGHT

The Project Manager is responsible for the assessment and analysis of data collection and laboratory analysis results during the investigative and remedial phases of the project. Assessment metrics to be used during confirmatory sampling include the proper number and types of samples, proper analytic methods, and that submitted documentation meets the minimum requirements of the Indiana RCG Program.

5.0 DATA VALIDATION AND USABILITY

5.1 Data Review, Verification and Validation

Environmental analytical data are subject to verification or validation performed in accordance with established procedures. The data verification process involves checking for common errors associated with analytical data. Common errors include the following:

Holding time missed – The analysis is not initiated or the sample is not extracted within the period required by the standard method.
Incorrect test method – The analysis is not performed according to a method required.
Matrix interference – Analysis is affected by dissolved inorganic/organic materials in the matrix.
Incomplete data package or report – Missing information

Sampling procedure and field notes will be reviewed after each sampling event to determine if standard sample collection and decontamination methodology has been utilized. Field notes will be reviewed for incorrect or missing data.

It will be the duty of each responsible party listed in Section 1.3 to adhere to the procedural requirements of the QAPP and ensure that subordinate personnel do likewise. If deficiencies are detected then proper instruction and or re-training of field personnel may be required.

This QAPP shall govern the operation of the project at all times

This QAPP shall be reviewed at least annually to ensure that the project will achieve all intended purposes. All the responsible persons listed in Section 1.3 shall participate in the review of the QAPP. The Project Manager is responsible for determining that data are of adequate quality to support this project. The project will be modified as directed by the Project Manager. The Project Manager shall be responsible for the implementation of changes to the project and shall document the effective date of all changes made.

The Project Manager shall authorize all changes or deviations in the operation of the project. Significant changes will be noted in the next report to the IDEM, and shall be considered an amendment to the QAPP. All verification and validation methods will be noted in the analysis provided in the final project report.

6.0 PROJECT EVALUATION

Quarterly sampling results will be evaluated each quarter to determine if project sampling goals are being met. Results will be compared to historical concentration trends and to the IDEM RCG Default Closure Levels.

If it is determined that the original objectives have not been met or the objectives have changed, the QAPP process can be repeated. The DQOs are reevaluated, a sample design may be expanded, and new data may be collected and assessed. The Conceptual Site Model can be revised or updated.

Based on the system performance, it may be necessary to adjust or repair the remedial system. In the case of system failure, it may be necessary to evaluate alternative remedial technologies.

7.0 OTHER REQUIREMENTS

All on-site field activities will be conducted in accordance with the Sample Street Business Complex, Health and Safety Plan (HASP). The HASP details field activities conducted in compliance with OHSA requirements and complies with the requirements of 29 CFR 1910.120.

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
Name	CASRN	Residential (mg/kg)	Com/Ind (mg/kg)	Excavation (mg/kg)	Residential (mg/kg)	Residential (ug/L)	Residential (ug/L)	Com/Ind (ug/L)	Residential (ug/m^3)	Com/Ind (ug/m^3)
ALAR	1596-84-5	380 C	960 C	56000 C	0.16 C	37 C			4.8 C	24 C
Acephate	30560-19-1	340 N	2000 C	4200 N	0.28 N	63 N				
Acetaldehyde	75-07-0	120 N	370 N	620 N	0.077 N	19 N			9.4 N	39 N
Acetochlor	34256-82-1	1700 N	12000 N	20000 N	4.3 N	270 N				
Acetone	67-64-1	85000 N	100000 L	100000 L	49 N	12000 N			32000 N	140000 N
Acetone Cyanohydrin	75-86-5	280 N	2100 N	3600 N	0.14 N	34 N			63 N	260 N
Acetonitrile	75-05-8	1200 N	3700 N	6200 N	0.54 N	130 N			63 N	260 N
Acetophenone	98-86-2	2500 S	2500 S	2500 S	9.1 N	1500 N				
Acetylaminofluorene, 2-	53-96-3	1.8 C	4.5 C	260 C	0.013 C	0.14 C			0.019 C	0.094 C
Acrolein	107-02-8	0.21 N	0.65 N	1.1 N	0.00017 N	0.041 N			0.021 N	0.088 N
Acrylamide	79-06-1	3.2 C	34 C	2000 C	0.0018 C	0.43 C			0.096 C	1.2 C
Acrylic Acid	79-10-7	42000 N	100000 L	100000 L	31 N	7700 N			1 N	4.4 N
Acrylonitrile	107-13-1	3.4 C	12 C	120 N	0.002 C	0.45 C			0.36 C	1.8 C
Adiponitrile	111-69-3	100000 L	100000 L	100000 L					6.3 N	26 N
Alachlor	15972-60-8	120 C	310 C	10000 N	0.033 M	2 M				
Aldicarb	116-06-3	85 N	620 N	1000 N	0.075 N	15 N				
Aldicarb Sulfone	1646-88-4	85 N	620 N	1000 N	0.07 N	16 N				
Aldrin	309-00-2	0.41 C	1 C	31 N	0.0069 C	0.0021 C			0.005 C	0.025 C
Ally	74223-64-6	21000 N	100000 L	100000 L	29 N	3800 N				
Allyl Alcohol	107-18-6	420 N	3100 N	5100 N	0.32 N	78 N			0.1 N	0.44 N
Allyl Chloride	107-05-1	2.5 N	7.5 N	13 N	0.013 N	2.1 N			1 N	4.4 N
Aluminum	7429-90-5	100000 L	100000 L	100000 L	1000000 R	16000 N			5.2 N	22 N
Aluminum Phosphide	20859-73-8	43 N	410 N	690 N		6.2 N				
Amdro	67485-29-4	25 N	180 N	310 N	34000 N	4.7 N				
Ametryn	834-12-8	770 N	5500 N	9300 N	2.5 N	120 N				
Aminobiphenyl, 4-	92-67-1	0.32 C	0.82 C	49 C	0.0027 C	0.026 C			0.0041 C	0.02 C
Aminophenol, m-	591-27-5	6900 N	49000 N	82000 N	9.1 N	1200 N				
Aminophenol, p-	123-30-8	1700 N	12000 N	20000 N	2.4 N	310 N				
Amitraz	33089-61-1	210 N	1500 N	2600 N	61 N	5.9 N				
Ammonia	7664-41-7								100 N	440 N
Ammonium Sulfamate	7773-06-0	22000 N	100000 L	100000 L		3100 N				
Aniline	62-53-3	600 N	3000 C	7300 N	0.75 N	110 N			1 N	4.4 N
Anthraquinone, 9,10-	84-65-1	170 C	430 C	2000 N	2.5 C	12 C				
Antimony (metallic)	7440-36-0	43 N	410 N	690 N	5.4 N	6 N				
Antimony Pentoxide	1314-60-9	55 N	510 N	860 N		7.5 N				
Antimony Potassium Tartrate	11071-15-1	98 N	920 N	1500 N		13 N				
Antimony Tetroxide	1332-81-6	43 N	410 N	690 N		6 N				
Antimony Trioxide	1309-64-4	100000 L	100000 L	100000 L					0.21 N	0.88 N
Apollo	74115-24-5	1100 N	8000 N	13000 N	220 N	180 N				
Aramite	140-57-8	270 C	690 C	39000 C	6.1 C	27 C			3.4 C	17 C
Arsenic, Inorganic	7440-38-2	5.5 C	16 C	430 N	5.9 M	10 M			0.0057 C	0.029 C
Arsine	7784-42-1	0.38 N	3.6 N	6.1 N		0.054 N			0.052 N	0.22 N
Assure	76578-14-8	770 N	5500 N	9300 N	29 N	93 N				
Asulam	3337-71-1	4300 N	31000 N	52000 N	4 N	780 N				
Atrazine	1912-24-9	29 C	75 C	4200 C	0.039 M	3 M				
Auramine	492-80-8	7.7 C	20 C	1200 C	0.12 C	0.67 C			0.097 C	0.49 C
Avermectin B1	65195-55-3	34 N	250 N	420 N	220 N	6.3 N				
Azobenzene	103-33-3	71 C	230 C	11000 C	0.15 C	1 C			0.78 C	4 C
Barium	7440-39-3	21000 N	100000 L	100000 L	1700 M	2000 M			0.52 N	2.2 N

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
Name	CASRN	Residential (mg/kg)	Com/Ind (mg/kg)	Excavation (mg/kg)	Residential (mg/kg)	Residential (ug/L)	Residential (ug/L)	Com/Ind (ug/L)	Residential (ug/m^3)	Com/Ind (ug/m^3)
Baygon	114-26-1	340 N	2500 N	4200 N	0.39 N	61 N				
Bayleton	43121-43-3	2500 N	18000 N	31000 N	6.9 N	430 N				
Baythroid	68359-37-5	2100 N	15000 N	26000 N	450 N	87 N				
Benefin	1861-40-1	25000 N	100000 L	100000 L	790 N	1200 N				
Benomyl	17804-35-2	4300 N	31000 N	52000 N	13 N	750 N				
Bentazon	25057-89-0	2500 N	18000 N	31000 N	1.9 N	440 N				
Benzaldehyde	100-52-7	1200 S	1200 S	1200 S	6.7 N	1500 N				
Benzene	71-43-2	15 C	54 C	750 N	0.051 M	5 M	24 C	120 C	3.1 C	16 C
Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	17 N	120 N	200 N		3.1 N				
Benzenethiol	108-98-5	110 N	1000 N	1300 S	0.17 N	13 N				
Benzidine	92-87-5	0.007 C	0.075 C	4.2 C	0.000047 C	0.00092 C			0.00014 C	0.0018 C
Benzoic Acid	65-85-0	100000 L	100000 L	100000 L	270 N	58000 N				
Benzotrichloride	98-07-7	0.69 C	2.2 C	93 C	0.0011 C	0.026 C				
Benzyl Alcohol	100-51-6	8500 N	62000 N	100000 L	7.3 N	1500 N				
Benzyl Chloride	100-44-7	14 C	49 C	190 N	0.017 C	0.77 C			0.5 C	2.5 C
Beryllium and compounds	7440-41-7	220 N	2000 N	3300 N	63 M	4 M			0.01 C	0.051 C
Bidrin	141-66-2	8.5 N	62 N	100 N	0.0075 N	1.6 N				
Bifenox	42576-02-3	770 N	5500 N	9300 N	11 N	75 N				
Biphenthrin	82657-04-3	1300 N	9200 N	15000 N	21000 N	230 N				
Biphenyl, 1,1'-	92-52-4	71 N	210 N	210 S	0.17 N	0.83 N			0.42 N	1.8 N
Bis(2-chloro-1-methylethyl) ether	108-60-1	64 C	220 C	1000 S	0.023 C	3.1 C			2.4 C	12 C
Bis(2-chloroethoxy)methane	111-91-1	250 N	1800 N	3100 N	0.22 N	47 N				
Bis(2-chloroethyl)ether	111-44-4	2.9 C	10 C	750 C	0.00063 C	0.12 C			0.074 C	0.37 C
Bis(2-ethylhexyl)phthalate	117-81-7	490 C	1200 C	20000 N	29 M	6 M			10 C	51 C
Bis(chloromethyl)ether	542-88-1	0.0011 C	0.0039 C	0.5 C	2.9E-06 C	0.00062 C			0.00039 C	0.002 C
Bisphenol A	80-05-7	4300 N	31000 N	52000 N	880 N	580 N				
Boron And Borates Only	7440-42-8	22000 N	100000 L	100000 L	200 N	3100 N			21 N	88 N
Boron Trifluoride	7637-07-2	4300 N	41000 N	69000 N		620 N			14 N	57 N
Bromate	15541-45-4	13 C	41 C	1700 C	1.6 M	10 M				
Bromo-2-chloroethane, 1-	107-04-0	0.34 C	1.2 C	140 C	0.00037 C	0.065 C			0.041 C	0.2 C
Bromobenzene	108-86-1	420 N	680 S	680 S	0.73 N	54 N			63 N	260 N
Bromochloromethane	74-97-5	220 N	680 N	1100 N	0.41 N	83 N			42 N	180 N
Bromodichloromethane	75-27-4	3.8 C	14 C	930 S	0.43 M	80 M			0.66 C	3.3 C
Bromoform	75-25-2	870 C	2200 C	20000 N	0.42 M	80 M			22 C	110 C
Bromomethane	74-83-9	10 N	32 N	54 N	0.035 N	7 N			5.2 N	22 N
Bromophos	2104-96-3	430 N	3100 N	5200 N	2.2 N	26 N				
Bromoxynil	1689-84-5	1700 N	12000 N	20000 N	5.3 N	310 N				
Bromoxynil Octanoate	1689-99-2	1700 N	12000 N	20000 N	17 N	100 N				
Butadiene, 1,3-	106-99-0	0.76 C	2.6 C	14 N	0.0017 C	0.16 C			0.81 C	4.1 C
Butanol, N-	71-36-3	8500 N	62000 N	100000 L	6.2 N	1500 N				
Butyl Benzyl Phthlate	85-68-7	3600 C	9100 C	100000 L	41 C	140 C				
Butyl alcohol, sec-	78-92-2	100000 L	100000 L	100000 L	130 N	31000 N			31000 N	130000 N
Butylate	2008-41-5	4300 N	31000 N	52000 N	6.6 N	340 N				
Butylated hydroxyanisole	25013-16-5	34000 C	86000 C	100000 L	130 C	3400 C			430 C	2200 C
Butylbenzene, n-	104-51-8	110 S	110 S	110 S	50 N	780 N				
Butylphthalyl Butylglycolate	85-70-1	85000 N	100000 L	100000 L	7300 N	16000 N				
Cacodylic Acid	75-60-5	1700 N	12000 N	20000 N		310 N				
Cadmium (Diet)	7440-43-9	98 N	800 N	1300 N						
Cadmium (Water)	7440-43-9				7.5 M	5 M			0.014 C	0.068 C

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
		Residential	Com/Ind	Excavation	Residential	Residential	Residential	Com/Ind	Residential	Com/Ind
Name	CASRN	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(ug/L)	(ug/L)	(ug/m^3)	(ug/m^3)
Caprolactam	105-60-2	43000 N	100000 L	100000 L	38 N	7700 N				
Captafol	2425-06-1	45 C	110 C	2000 N	0.12 C	3.5 C			0.57 C	2.9 C
Captan	133-06-2	2900 C	7500 C	100000 L	3.8 C	270 C			37 C	190 C
Carbaryl	63-25-2	8500 N	62000 N	100000 L	25 N	1400 N				
Carbofuran	1563-66-2	430 N	3100 N	5200 N	0.31 M	40 M				
Carbon Disulfide	75-15-0	740 S	740 S	740 S	4.2 N	720 N			730 N	3100 N
Carbon Tetrachloride	56-23-5	8.5 C	30 C	460 S	0.039 M	5 M	5.7 C	28 C	4.1 C	20 C
Carbosulfan	55285-14-8	850 N	6200 N	10000 N	77 N	160 N				
Carboxin	5234-68-4	8500 N	62000 N	100000 L	16 N	1500 N				
Ceric oxide	1306-38-3	100000 L	100000 L	100000 L					0.94 N	3.9 N
Chloral Hydrate	302-17-0	8500 N	62000 N	100000 L	6.1 N	1500 N				
Chloramben	133-90-4	1300 N	9200 N	15000 N	1.1 N	230 N				
Chloranil	118-75-2	17 C	43 C	2500 C	0.028 C	1.7 C				
Chlordane	12789-03-6	22 C	65 C	680 N	2.7 M	2 M			0.24 C	1.2 C
Chlordecone (Kepone)	143-50-0	0.69 C	1.7 C	100 C	0.021 C	0.03 C			0.0053 C	0.027 C
Chlorfenvinphos	470-90-6	60 N	430 N	730 N	0.47 N	8.6 N				
Chlorimuron, Ethyl-	90982-32-4	1700 N	12000 N	20000 N	2.1 N	300 N				
Chlorine	7782-50-5	11000 N	91000 N	100000 L	16 N	1600 N			0.15 N	0.64 N
Chlorine Dioxide	10049-04-4	3200 N	30000 N	51000 N		470 N			0.21 N	0.88 N
Chlorite (Sodium Salt)	7758-19-2	3200 N	31000 N	52000 N		1000 M				
Chloro-1,1-difluoroethane, 1-	75-68-3	1200 S	1200 S	1200 S	990 N	100000 N			52000 N	220000 N
Chloro-1,3-butadiene, 2-	126-99-8	0.13 C	0.47 C	65 C	0.0017 C	0.16 C			0.081 C	0.41 C
Chloro-2-methylaniline HCl, 4-	3165-93-3	15 C	37 C	2200 C	0.015 C	1.3 C				
Chloro-2-methylaniline, 4-	95-69-2	69 C	170 C	3100 N	0.076 C	6.7 C			0.32 C	1.6 C
Chloroacetaldehyde, 2-	107-20-0	25 C	64 C	3800 C	0.01 C	2.5 C				
Chloroacetic Acid	79-11-8	170 N	1200 N	2000 N	0.24 M	60 M				
Chloroacetophenone, 2-	532-27-4	60000 N	100000 L	100000 L					0.031 N	0.13 N
Chloroaniline, p-	106-47-8	34 C	86 C	4200 N	0.027 C	3.2 C				
Chlorobenzene	108-90-7	410 N	760 S	760 S	1.4 M	100 M			52 N	220 N
Chlorobenzilate	510-15-6	62 C	160 C	9100 C	0.18 C	2.7 C			0.78 C	4 C
Chlorobenzoic Acid, p-	74-11-3	2500 N	18000 N	31000 N	2 N	390 N				
Chlorobenzotrifluoride, 4-	98-56-6	120 S	120 S	120 S	1.8 N	26 N			310 N	1300 N
Chlorobutane, 1-	109-69-3	730 S	730 S	730 S	3.9 N	480 N				
Chlorodifluoromethane	75-45-6	1700 S	1700 S	1700 S	810 N	100000 N			52000 N	220000 N
Chloroform	67-66-3	4.1 C	15 C	1800 N	0.44 M	80 M			1.1 C	5.3 C
Chloromethane	74-87-3	170 N	500 N	840 N	0.98 N	190 N			94 N	390 N
Chloromethyl Methyl Ether	107-30-2	0.27 C	0.94 C	110 C	0.00024 C	0.056 C			0.035 C	0.18 C
Chloronaphthalene, Beta-	91-58-7	180 S	180 S	180 S	57 N	550 N				
Chloronitrobenzene, o-	88-73-3	22 C	57 C	3000 N	0.038 C	2 C			0.01 N	0.044 N
Chloronitrobenzene, p-	100-00-5	85 N	620 N	1000 N	0.26 N	14 N			0.63 N	2.6 N
Chlorophenol, 2-	95-57-8	550 N	5100 N	8600 N	1.2 N	71 N				
Chloropicrin	76-06-2	2.9 N	8.8 N	15 N	0.0049 N	0.83 N			0.42 N	1.8 N
Chlorothalonil	1897-45-6	1300 N	5600 C	15000 N	8.7 C	190 C			27 C	140 C
Chlorotoluene, o-	95-49-8	910 S	910 S	910 S	3.5 N	180 N				
Chlorotoluene, p-	106-43-4	250 S	250 S	250 S	3.7 N	190 N				
Chlorozotocin	54749-90-5	0.028 C	0.072 C	4.2 C	0.000012 C	0.0028 C			0.00035 C	0.0018 C
Chlorpropham	101-21-3	17000 N	100000 L	100000 L	40 N	2200 N				
Chlorpyrifos	2921-88-2	85 N	620 N	1000 N	1.8 N	6.2 N				
Chlorpyrifos Methyl	5598-13-0	850 N	6200 N	10000 N	8.2 N	89 N				

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure						Ground Water				Vapor Exposure							
		Direct Contact						Soil MTG		Tap		Ground Water				Indoor Air			
		Residential (mg/kg)		Com/Ind (mg/kg)		Excavation (mg/kg)		Residential (mg/kg)		Residential (ug/L)		Residential (ug/L)		Com/Ind (ug/L)		Residential (ug/m^3)		Com/Ind (ug/m^3)	
Name	CASRN																		
Chlorsulfuron	64902-72-3	4300	N	31000	N	52000	N	13	N	770	N								
Chlorthiophos	60238-56-4	69	N	490	N	820	N	1	N	2	N								
Chromium(III), Insoluble Salts	16065-83-1	100000	L	100000	L	100000	L		R		N								
Chromium(VI)	18540-29-9	4.1	C	56	C	2400	C	0.12	C	0.31	C					0.00011	C	0.0015	C
Chromium, Total	7440-47-3							1000000	R	100	M								
Cobalt	7440-48-4	32	N	300	N	520	N	4.3	N	4.7	N					0.0027	C	0.014	C
Coke Oven Emissions	8007-45-2															0.015	C	0.2	C
Copper	7440-50-8	4300	N	41000	N	69000	N	920	M	1300	M								
Cresol, m-	108-39-4	4300	N	31000	N	52000	N	12	N	720	N					630	N	2600	N
Cresol, o-	95-48-7	4300	N	31000	N	52000	N	12	N	720	N					630	N	2600	N
Cresol, p-	106-44-5	430	N	3100	N	5200	N	1.2	N	72	N					630	N	2600	N
Cresol, p-chloro-m-	59-50-7	8500	N	62000	N	100000	L	26	N	1100	N								
Cresols	1319-77-3	11000	N	50000	S	50000	S	11	N	670	N					630	N	2600	N
Crotonaldehyde, trans-	123-73-9	4.8	C	15	C	630	C	0.0014	C	0.35	C								
Cumene	98-82-8	270	S	270	S	270	S	13	N	390	N					420	N	1800	N
Cupferron	135-20-6	31	C	78	C	4600	C	0.11	C	3.1	C					0.39	C	1.9	C
Cyanazine	21725-46-2	8.1	C	21	C	1200	C	0.0071	C	0.76	C								
Cyanides																			
~Calcium Cyanide	592-01-8	4300	N	41000	N	69000	N			620	N								
~Copper Cyanide	544-92-3	550	N	5100	N	8600	N			78	N								
~Cyanide (CN-)	57-12-5	2200	N	20000	N	34000	N	40	M	200	M								
~Cyanogen	460-19-5	4300	N	41000	N	69000	N	130	N	620	N								
~Cyanogen Bromide	506-68-3	9800	N	92000	N	100000	L			1400	N								
~Cyanogen Chloride	506-77-4	5500	N	51000	N	86000	N	160	N	780	N								
~Hydrogen Cyanide	74-90-8	66	N	610	N	1000	N	0.28	N	1.4	N					0.83	N	3.5	N
~Potassium Cyanide	151-50-8	5500	N	51000	N	86000	N			770	N								
~Potassium Silver Cyanide	506-61-6	22000	N	100000	L	100000	L			2400	N								
~Silver Cyanide	506-64-9	11000	N	100000	N	100000	L			1300	N								
~Sodium Cyanide	143-33-9	4300	N	41000	N	69000	N			200	M								
~Thiocyanate	463-56-9	22	N	200	N	340	N	0.013	N	3.1	N								
~Zinc Cyanide	557-21-1	5500	N	51000	N	86000	N			780	N								
Cyclohexane	110-82-7	120	S	120	S	120	S	270	N	13000	N					6300	N	26000	N
Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	290	C	750	C	42000	C	2.4	C	21	C								
Cyclohexanone	108-94-1	100000	L	100000	L	100000	L	360	N	77000	N					730	N	3100	N
Cyclohexylamine	108-91-8	17000	N	100000	L	100000	L	16	N	3000	N								
Cyhalothrin/karate	68085-85-8	430	N	3100	N	5200	N	1100	N	78	N								
Cypermethrin	52315-07-8	850	N	6200	N	10000	N	510	N	160	N								
Cyromazine	66215-27-8	640	N	4600	N	7900	N	0.62	N	120	N								
DDD	72-54-8	28	C	72	C	4200	C	13	C	2.8	C					0.35	C	1.8	C
DDE, p,p'-	72-55-9	20	C	51	C	3000	C	9.4	C	2	C					0.25	C	1.3	C
DDT	50-29-3	24	C	70	C	720	N	13	C	2	C					0.25	C	1.3	C
Dacthal	1861-32-1	850	N	6200	N	10000	N	2.3	N	93	N								
Dalapon	75-99-0	2500	N	18000	N	31000	N	0.83	M	200	M								
Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	600	N	4300	N	7300	N	1200	N	110	N								
Demeton	8065-48-3	3.4	N	25	N	42	N			0.52	N								
Di(2-ethylhexyl)adipate	103-23-1	5700	C	14000	C	100000	L	580	M	400	M								
Diallate	2303-16-4	110	C	280	C	16000	C	0.14	C	4.6	C								
Diazinon	333-41-5	60	N	430	N	730	N	0.99	N	7.9	N								
Dibromo-3-chloropropane, 1,2-	96-12-8	0.076	C	0.69	C	44	N	0.0017	M	0.2	M					0.0016	C	0.02	C

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
		Residential	Com/Ind	Excavation	Residential	Residential	Residential	Com/Ind	Residential	Com/Ind
Name	CASRN	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(ug/L)	(ug/L)	(ug/m^3)	(ug/m^3)
Dibromobenzene, 1,4-	106-37-6	850 N	6200 N	10000 N	1.9 N	98 N				
Dibromochloromethane	124-48-1	9.5 C	33 C	800 S	0.43 M	80 M			0.9 C	4.5 C
Dibromoethane, 1,2-	106-93-4	0.48 C	1.7 C	180 C	0.00028 M	0.05 M			0.041 C	0.2 C
Dibromomethane (Methylene Bromide)	74-95-3	35 N	110 N	180 N	0.039 N	7.9 N			4.2 N	18 N
Dibutyl Phthalate	84-74-2	8500 N	62000 N	100000 L	34 N	670 N				
Dibutyltin Compounds	NA	25 N	180 N	310 N		4.7 N				
Dicamba	1918-00-9	2500 N	18000 N	31000 N	2.3 N	440 N				
Dichloro-2-butene, 1,4-	764-41-0	0.097 C	0.35 C	49 C	0.00011 C	0.012 C			0.0058 C	0.029 C
Dichloro-2-butene, cis-1,4-	1476-11-5	0.097 C	0.35 C	49 C	0.00011 C	0.012 C			0.0058 C	0.029 C
Dichloro-2-butene, trans-1,4-	110-57-6	0.097 C	0.35 C	49 C	0.00011 C	0.012 C			0.0058 C	0.029 C
Dichloroacetic Acid	79-43-6	140 C	340 C	4200 N	0.25 M	60 M				
Dichlorobenzene, 1,2-	95-50-1	380 S	380 S	380 S	12 M	600 M			210 N	880 N
Dichlorobenzene, 1,4-	106-46-7	34 C	120 C	17000 C	1.4 M	75 M			2.2 C	11 C
Dichlorobenzidine, 3,3'-	91-94-1	15 C	38 C	2200 C	0.14 C	1.1 C			0.072 C	0.36 C
Dichlorobenzophenone, 4,4'-	90-98-2	770 N	5500 N	9300 N	17 N	140 N				
Dichlorodifluoromethane	75-71-8	130 N	400 N	670 N	5.7 N	190 N			100 N	440 N
Dichloroethane, 1,1-	75-34-3	46 C	170 C	1700 S	0.14 C	24 C	110 C	550 C	15 C	77 C
Dichloroethane, 1,2-	107-06-2	6 C	22 C	250 N	0.028 M	5 M	43 C	210 C	0.94 C	4.7 C
Dichloroethylene, 1,1-	75-35-4	340 N	1100 N	1200 S	0.05 M	7 M	300 N	1300 N	210 N	880 N
Dichloroethylene, 1,2- (Mixed Isomers)	540-59-0	980 N	1300 S	1300 S	0.76 N	130 N				
Dichloroethylene, 1,2-cis-	156-59-2	220 N	2000 N	2400 S	0.41 M	70 M				
Dichloroethylene, 1,2-trans-	156-60-5	210 N	690 N	1200 N	0.59 M	100 M			63 N	260 N
Dichlorophenol, 2,4-	120-83-2	250 N	1800 N	3100 N	0.83 N	35 N				
Dichlorophenoxy Acetic Acid, 2,4-	94-75-7	970 N	7700 N	13000 N	0.36 M	70 M				
Dichlorophenoxy)butyric Acid, 4-(2,4-	94-82-6	690 N	4900 N	8200 N	0.72 N	91 N				
Dichloropropane, 1,2-	78-87-5	13 C	47 C	120 N	0.033 M	5 M			2.4 C	12 C
Dichloropropane, 1,3-	142-28-9	1500 S	1500 S	1500 S	2 N	290 N				
Dichloropropanol, 2,3-	616-23-9	250 N	1800 N	3100 N	0.2 N	47 N				
Dichloropropene, 1,3-	542-75-6	24 C	83 C	570 N	0.029 C	4.1 C			6.1 C	31 C
Dichlorvos	62-73-7	24 C	59 C	520 N	0.014 C	2.3 C			0.29 C	1.5 C
Dicyclopentadiene	77-73-6	43 N	130 N	130 S	0.83 N	12 N			7.3 N	31 N
Dieldrin	60-57-1	0.42 C	1.1 C	52 N	0.012 C	0.015 C			0.0053 C	0.027 C
Diesel Engine Exhaust	NA								0.081 C	0.41 C
Diethanolamine	111-42-2	100000 L	100000 L	100000 L					3.1 N	13 N
Diethyl Phthalate	84-66-2	69000 N	100000 L	100000 L	90 N	11000 N				
Diethylene Glycol Monobutyl Ether	112-34-5	2500 N	18000 N	30000 N	2.1 N	470 N			0.1 N	0.44 N
Diethylene Glycol Monoethyl Ether	111-90-0	5000 N	36000 N	61000 N	3.8 N	940 N			0.31 N	1.3 N
Diethylformamide	617-84-5	85 N	620 N	1000 N	0.065 N	16 N				
Diethylstilbestrol	56-53-1	0.02 C	0.049 C	2.9 C	0.0047 C	0.00043 C			0.00024 C	0.0012 C
Difenzoquat	43222-48-6	6900 N	49000 N	82000 N		1200 N				
Diflubenzuron	35367-38-5	1700 N	12000 N	20000 N	5 N	220 N				
Difluoroethane, 1,1-	75-37-6	1400 S	1400 S	1400 S	560 N	83000 N			42000 N	180000 N
Dihydrosafrole	94-58-6	150 C	390 C	23000 C	0.36 C	15 C			1.9 C	9.4 C
Diisopropyl Ether	108-20-3	2300 S	2300 S	2300 S	7.6 N	1500 N			730 N	3100 N
Diisopropyl Methylphosphonate	1445-75-6	530 S	530 S	530 S	6.8 N	1200 N				
Dimethipin	55290-64-7	1700 N	12000 N	20000 N	1.4 N	310 N				
Dimethoate	60-51-5	17 N	120 N	200 N	0.014 N	3.1 N				
Dimethoxybenzidine, 3,3'-	119-90-4	490 C	1200 C	70000 C	1.1 C	47 C				
Dimethyl methylphosphonate	756-79-6	4100 C	10000 C	62000 N	1.6 C	390 C				

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
		Residential (mg/kg)	Com/Ind (mg/kg)	Excavation (mg/kg)	Residential (mg/kg)	Residential (ug/L)	Residential (ug/L)	Com/Ind (ug/L)	Residential (ug/m^3)	Com/Ind (ug/m^3)
Name	CASRN									
Dimethylamino azobenzene [p-]	60-11-7	1.5 C	3.7 C	220 C	0.0037 C	0.043 C			0.019 C	0.094 C
Dimethylaniline HCl, 2,4-	21436-96-4	12 C	30 C	1700 C	0.013 C	1.1 C				
Dimethylaniline, 2,4-	95-68-1	34 C	86 C	2000 N	0.036 C	3.2 C				
Dimethylaniline, N,N-	121-69-7	220 N	830 S	830 S	0.19 N	27 N				
Dimethylbenzidine, 3,3'-	119-93-7	0.62 C	1.6 C	91 C	0.0074 C	0.056 C				
Dimethylformamide	68-12-2	8500 N	62000 N	100000 L	6.5 N	1600 N			31 N	130 N
Dimethylhydrazine, 1,1-	57-14-7	8.5 N	61 N	100 N	0.0072 N	1.6 N			0.0021 N	0.0088 N
Dimethylhydrazine, 1,2-	540-73-8	0.012 C	0.031 C	1.8 C	5.5E-06 C	0.0012 C			0.00015 C	0.00077 C
Dimethylphenol, 2,4-	105-67-9	1700 N	12000 N	20000 N	6.4 N	270 N				
Dimethylphenol, 2,6-	576-26-1	52 N	370 N	620 N	0.2 N	8.1 N				
Dimethylphenol, 3,4-	95-65-8	85 N	620 N	1000 N	0.33 N	14 N				
Dimethylterephthalate	120-61-6	5.5 S	5.5 S	5.5 S	7.3 N	1400 N				
Dimethylvinylchloride	513-37-1	150 C	380 C	22000 C	0.18 C	15 C			1.9 C	9.4 C
Dinitro-o-cresol, 4,6-	534-52-1	6.9 N	49 N	82 N	0.041 N	1.2 N				
Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5	170 N	1200 N	2000 N	11 N	17 N				
Dinitrobenzene, 1,2-	528-29-0	8.5 N	62 N	100 N	0.028 N	1.5 N				
Dinitrobenzene, 1,3-	99-65-0	8.5 N	62 N	100 N	0.027 N	1.5 N				
Dinitrobenzene, 1,4-	100-25-4	8.5 N	62 N	100 N	0.027 N	1.5 N				
Dinitrophenol, 2,4-	51-28-5	170 N	1200 N	2000 N	0.67 N	30 N				
Dinitrotoluene Mixture, 2,4/2,6-	25321-14-6	10 C	25 C	1500 C	0.025 C	0.92 C				
Dinitrotoluene, 2,4-	121-14-2	22 C	55 C	2000 N	0.054 C	2 C			0.27 C	1.4 C
Dinitrotoluene, 2,6-	606-20-2	85 N	620 N	1000 N	0.41 N	15 N				
Dinitrotoluene, 2-Amino-4,6-	35572-78-2	210 N	2000 N	3200 N	0.46 N	30 N				
Dinitrotoluene, 4-Amino-2,6-	19406-51-0	210 N	1900 N	3200 N	0.46 N	30 N				
Dinoseb	88-85-7	85 N	620 N	1000 N	1.2 M	7 M				
Dioxane, 1,4-	123-91-1	69 C	170 C	10000 C	0.028 C	6.7 C			3.2 C	16 C
Dioxins										
~Hexachlorodibenzo-p-dioxin, Mixture	NA	0.0013 C	0.0039 C	0.18 C	0.0031 C	0.00011 C			0.000019 C	0.000094 C
~TCDD, 2,3,7,8-	1746-01-6	6E-05 C	0.0002 C	0.0014 N	0.0003 M	0.00003 M			6.4E-07 C	3.2E-06 C
Diphenamid	957-51-7	2500 N	18000 N	31000 N	92 N	470 N				
Diphenyl Sulfone	127-63-9	69 N	490 N	820 N	0.53 N	11 N				
Diphenylamine	122-39-4	2100 N	15000 N	26000 N	8.9 N	240 N				
Diphenylhydrazine, 1,2-	122-66-7	8.5 C	22 C	1300 C	0.043 C	0.67 C			0.11 C	0.56 C
Diquat	85-00-7	180 N	1400 N	2200 N	7.5 M	20 M				
Direct Black 38	1937-37-7	0.92 C	2.3 C	140 C	880 C	0.091 C			0.012 C	0.058 C
Direct Blue 6	2602-46-2	0.92 C	2.3 C	140 C	2900 C	0.091 C			0.012 C	0.058 C
Direct Brown 95	16071-86-6	1 C	2.6 C	150 C		0.1 C			0.013 C	0.065 C
Disulfoton	298-04-4	3.4 N	25 N	42 N	0.014 N	0.38 N				
Dithiane, 1,4-	505-29-3	850 N	6200 N	10000 N	1.5 N	150 N				
Diuron	330-54-1	170 N	1200 N	2000 N	0.23 N	28 N				
Dodine	2439-10-3	340 N	2500 N	4200 N	6.4 N	62 N				
EPTC	759-94-4	410 S	410 S	410 S	3.1 N	290 N				
Endosulfan	115-29-7	520 N	3700 N	6200 N	21 N	78 N				
Endothall	145-73-3	1700 N	12000 N	20000 N	0.48 M	100 M				
Endrin	72-20-8	25 N	180 N	310 N	1.6 M	2 M				
Epichlorohydrin	106-89-8	28 N	88 N	150 N	0.0088 N	2 N			1 N	4.4 N
Epoxybutane, 1,2-	106-88-7	240 N	720 N	1200 N	0.19 N	42 N			21 N	88 N
Ethephon	16672-87-0	430 N	3100 N	5200 N	0.33 N	78 N				
Ethion	563-12-2	43 N	310 N	520 N	0.13 N	3.2 N				

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
		Residential	Com/Ind	Excavation	Residential	Residential	Residential	Com/Ind	Residential	Com/Ind
Name	CASRN	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(ug/L)	(ug/L)	(ug/m^3)	(ug/m^3)
Ethoxyethanol Acetate, 2-	111-15-9	8500 N	62000 N	100000 L	6.3 N	1500 N			63 N	260 N
Ethoxyethanol, 2-	110-80-5	34000 N	100000 L	100000 L	25 N	6200 N			210 N	880 N
Ethyl Acetate	141-78-6	11000 S	11000 S	11000 S	59 N	14000 N				
Ethyl Acrylate	140-88-5	180 C	600 C	2500 S	0.062 C	14 C				
Ethyl Chloride	75-00-3	2100 S	2100 S	2100 S	120 N	21000 N			10000 N	44000 N
Ethyl Ether	60-29-7	10000 S	10000 S	10000 S	14 N	3100 N				
Ethyl Methacrylate	97-63-2	1100 S	1100 S	1100 S	2 N	420 N			310 N	1300 N
Ethyl-p-nitrophenyl Phosphonate	2104-64-5	0.85 N	6.2 N	10 N	0.041 N	0.066 N				
Ethylbenzene	100-41-4	76 C	270 C	480 S	16 M	700 M			9.7 C	49 C
Ethylene Cyanohydrin	109-78-4	2500 N	18000 N	31000 N	1.9 N	470 N				
Ethylene Diamine	107-15-3	7700 N	55000 N	93000 N	6.4 N	1400 N				
Ethylene Glycol	107-21-1	100000 L	100000 L	100000 L	130 N	31000 N			420 N	1800 N
Ethylene Glycol Monobutyl Ether	111-76-2	8500 N	62000 N	100000 L	6.2 N	1500 N			1700 N	7000 N
Ethylene Oxide	75-21-8	2.4 C	8.3 C	950 C	0.0018 C	0.44 C			0.28 C	1.4 C
Ethylene Thiourea	96-45-7	6.9 N	49 N	82 N	0.0054 N	1.2 N			1.9 C	9.4 C
Ethyleneimine	151-56-4	0.11 C	0.27 C	15 C	0.000044 C	0.01 C			0.0013 C	0.0065 C
Ethylphthalyl Ethyl Glycolate	84-72-0	100000 L	100000 L	100000 L	2000 N	45000 N				
Express	101200-48-0	690 N	4900 N	8200 N	1 N	130 N				
Fenamiphos	22224-92-6	21 N	150 N	260 N	0.068 N	3.4 N				
Fenpropathrin	39515-41-8	2100 N	15000 N	26000 N	42 N	46 N				
Fluometuron	2164-17-2	1100 N	8000 N	13000 N	2.9 N	190 N				
Fluoride	16984-48-8	4300 N	41000 N	69000 N		620 N			14 N	57 N
Fluorine (Soluble Fluoride)	7782-41-4	6600 N	61000 N	100000 L	12000 M	4000 M			14 N	57 N
Fluridone	59756-60-4	6900 N	49000 N	82000 N	2500 N	1100 N				
Flurprimidol	56425-91-3	1700 N	12000 N	20000 N	24 N	260 N				
Flutolanil	66332-96-5	5200 N	37000 N	62000 N	77 N	720 N				
Fluvalinate	69409-94-5	850 N	6200 N	10000 N	4700 N	160 N				
Folpet	133-07-3	2000 C	4900 C	100000 L	0.8 C	170 C				
Fomesafen	72178-02-0	36 C	91 C	5300 C	0.22 C	3.4 C				
Fonofos	944-22-9	170 N	1200 N	2000 N	0.69 N	18 N				
Formaldehyde	50-00-0	17000 N	100000 L	100000 L	13 N	3100 N			1.9 C	9.4 C
Formic Acid	64-18-6	69000 N	100000 L	100000 L	57 N	14000 N			0.31 N	1.3 N
Fosetyl-AL	39148-24-8	100000 L	100000 L	100000 L		47000 N				
Furans										
~Dibenzofuran	132-64-9	110 N	170 S	170 S	2.1 N	5.8 N				
~Furan	110-00-9	110 N	1000 N	1700 N	0.11 N	15 N				
Furazolidone	67-45-8	1.8 C	4.5 C	260 C	0.0069 C	0.18 C				
Furfural	98-01-1	250 N	1800 N	3100 N	0.2 N	46 N			52 N	220 N
Furium	531-82-8	4.5 C	11 C	670 C	0.012 C	0.44 C			0.057 C	0.29 C
Furmecyclox	60568-05-0	220 C	570 C	33000 C	0.2 C	9.6 C			2.8 C	14 C
Glufosinate, Ammonium	77182-82-2	34 N	250 N	420 N	0.028 N	6.3 N				
Glutaraldehyde	111-30-8	100000 L	100000 L	100000 L					0.083 N	0.35 N
Glycidyl	765-34-4	34 N	250 N	420 N	0.025 N	6.3 N			1 N	4.4 N
Glyphosate	1071-83-6	8500 N	62000 N	100000 L	2.8 M	700 M				
Goal	42874-03-3	250 N	1800 N	3100 N	38 N	24 N				
Guthion	86-50-0	250 N	1800 N	3100 N	0.26 N	43 N			10 N	44 N
Haloxyfop, Methyl	69806-40-2	4.3 N	31 N	52 N	0.13 N	0.58 N				
Harmony	79277-27-3	1100 N	8000 N	13000 N	1.2 N	200 N				
Heptachlor	76-44-8	1.5 C	3.8 C	220 C	0.66 M	0.4 M			0.019 C	0.094 C

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure						Ground Water				Vapor Exposure					
		Direct Contact						Soil MTG		Tap		Ground Water		Indoor Air			
		Residential		Com/Ind		Excavation		Residential		Residential		Residential	Com/Ind	Residential		Com/Ind	
Name	CASRN	(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(ug/L)		(ug/L)	(ug/L)	(ug/m^3)		(ug/m^3)	
Heptachlor Epoxide	1024-57-3	0.74	C	1.9	C	13	N	0.082	M	0.2	M			0.0094	C	0.047	C
Hexabromobenzene	87-82-1	170	N	1200	N	2000	N	3.6	N	31	N						
Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2	17	N	120	N	200	N			3.1	N						
Hexachlorobenzene	118-74-1	4.2	C	11	C	630	C	0.25	M	1	M			0.053	C	0.27	C
Hexachlorobutadiene	87-68-3	85	N	220	C	1000	N	0.1	C	2.6	C			1.1	C	5.6	C
Hexachlorocyclohexane, Alpha-	319-84-6	1.1	C	2.7	C	160	C	0.0072	C	0.062	C			0.014	C	0.068	C
Hexachlorocyclohexane, Beta-	319-85-7	3.8	C	9.6	C	560	C	0.026	C	0.22	C			0.046	C	0.23	C
Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	7.3	C	21	C	410	N	0.023	M	0.2	M			0.078	C	0.4	C
Hexachlorocyclohexane, Technical	608-73-1	3.8	C	9.6	C	560	C	0.026	C	0.22	C			0.048	C	0.24	C
Hexachlorocyclopentadiene	77-47-4	520	N	3700	N	6200	N	3.1	M	50	M			0.21	N	0.88	N
Hexachloroethane	67-72-1	60	N	430	C	730	N	0.062	N	5.1	N			2.2	C	11	C
Hexachlorophene	70-30-4	25	N	180	N	310	N	130	N	4.7	N						
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	78	C	240	C	4700	N	0.046	C	6.1	C						
Hexamethylene Diisocyanate, 1,6-	822-06-0	4.8	N	14	N	24	N	0.0041	N	0.021	N			0.01	N	0.044	N
Hexane, N-	110-54-3	140	S	140	S	140	S	34	N	250	N			730	N	3100	N
Hexanedioic Acid	124-04-9	100000	L	100000	L	100000	L	150	N	31000	N						
Hexanone, 2-	591-78-6	290	N	1400	N	2300	N	0.16	N	34	N			31	N	130	N
Hexazinone	51235-04-2	2800	N	20000	N	34000	N	4.6	N	500	N						
Hydrazine	302-01-2	2.9	C	9.5	C	400	C			0.22	C			0.005	C	0.025	C
Hydrazine Sulfate	10034-93-2	2.9	C	9.5	C	400	C			0.22	C			0.005	C	0.025	C
Hydrogen Chloride	7647-01-0	100000	L	100000	L	100000	L							21	N	88	N
Hydrogen Fluoride	7664-39-3	4300	N	41000	N	69000	N			620	N			15	N	61	N
Hydrogen Sulfide	7783-06-4	100000	L	100000	L	100000	L							2.1	N	8.8	N
Hydroquinone	123-31-9	110	C	290	C	17000	C	0.15	C	11	C						
Imazalil	35554-44-0	1100	N	8000	N	13000	N	48	N	140	N						
Imazaquin	81335-37-7	21000	N	100000	L	100000	L	380	N	3800	N						
Iodine	7553-56-2	1100	N	10000	N	17000	N			160	N						
Iprodione	36734-19-7	3400	N	25000	N	42000	N	3.5	N	570	N						
Iron	7439-89-6	77000	N	100000	L	100000	L	5600	N	11000	N						
Isobutyl Alcohol	78-83-1	10000	S	10000	S	10000	S	19	N	4600	N						
Isophorone	78-59-1	7100	C	18000	C	100000	L	4.4	C	670	C			2100	N	8800	N
Isopropalin	33820-53-0	1300	N	9200	N	15000	N	110	N	230	N						
Isopropanol	67-63-0	100000	L	100000	L	100000	L							7300	N	31000	N
Isopropyl Methyl Phosphonic Acid	1832-54-8	8500	N	62000	N	100000	L	6.9	N	1600	N						
Isoxaben	82558-50-7	4300	N	31000	N	52000	N	31	N	560	N						
JP-7	NA	100000	L	100000	L	100000	L			630	N			310	N	1300	N
Kerb	23950-58-5	6400	N	46000	N	79000	N	18	N	900	N						
Lactofen	77501-63-4	170	N	1200	N	2000	N	18	N	19	N						
Lead Compounds																	
~Lead acetate	301-04-2	24	C	62	C	3500	C			2.4	C			0.3	C	1.5	C
~Lead and Compounds	7439-92-1	400	N	1300	N	970		270	M	15	M						
~Lead subacetate	1335-32-6	180	C	450	C	26000	C			18	C			2.2	C	11	C
~Tetraethyl Lead	78-00-2	0.0085	N	0.062	N	0.1	N	0.000069	N	0.00099	N						
Linuron	330-55-2	170	N	1200	N	2000	N	0.46	N	26	N						
Lithium	7439-93-2	220	N	2000	N	3400	N	190	N	31	N						
Londax	83055-99-6	17000	N	100000	L	100000	L	16	N	3100	N						
MCPA	94-74-6	43	N	310	N	520	N	0.03	N	5.7	N						
MCPB	94-81-5	850	N	6200	N	10000	N	1.3	N	160	N						
MCPP	93-65-2	85	N	620	N	1000	N	0.071	N	12	N						

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
Name	CASRN	Residential (mg/kg)	Com/Ind (mg/kg)	Excavation (mg/kg)	Residential (mg/kg)	Residential (ug/L)	Residential (ug/L)	Com/Ind (ug/L)	Residential (ug/m^3)	Com/Ind (ug/m^3)
Malathion	121-75-5	1700 N	12000 N	20000 N	1.6 N	300 N				
Maleic Anhydride	108-31-6	8500 N	61000 N	100000 N	6.1 N	1500 N			0.73 N	3.1 N
Maleic Hydrazide	123-33-1	43000 N	100000 L	100000 L	32 N	7800 N				
Malononitrile	109-77-3	8.5 N	62 N	100 N	0.0066 N	1.6 N				
Mancozeb	8018-01-7	2500 N	18000 N	31000 N	13 N	470 N				
Maneb	12427-38-2	430 N	3100 N	5200 N	2.2 N	78 N				
Manganese (Diet)	7439-96-5									
Manganese (Non-diet)	7439-96-5	2500 N	23000 N	39000 N	420 N	320 N			0.052 N	0.22 N
Mephosfolan	950-10-7	7.7 N	55 N	93 N	0.041 N	1.4 N				
Mepiquat Chloride	24307-26-4	2500 N	18000 N	31000 N	3.1 N	470 N				
Mercury Compounds										
~Mercuric Chloride (and other Mercury salts)	7487-94-7	32 N	310 N	520 N	2.1 M	2 M			0.031 N	0.13 N
~Mercury (elemental)	7439-97-6	3.1 S	3.1 S	3.1 S	2.1 M	2 M			0.31 N	1.3 N
~Methyl Mercury	22967-92-6	11 N	100 N	170 N		1.6 N				
~Phenylmercuric Acetate	62-38-4	6.9 N	49 N	82 N	0.0075 N	1.2 N				
Merphos	150-50-5	2.5 N	18 N	31 N	0.92 N	0.47 N				
Merphos Oxide	78-48-8	2.5 N	18 N	31 N	0.006 N	0.061 N				
Metalaxyl	57837-19-1	5200 N	37000 N	62000 N	5.1 N	920 N				
Methacrylonitrile	126-98-7	4.5 N	18 N	30 N	0.0034 N	0.75 N			0.73 N	3.1 N
Methamidophos	10265-92-6	4.3 N	31 N	52 N	0.0033 N	0.78 N				
Methanol	67-56-1	43000 N	100000 L	100000 L	32 N	7800 N			4200 N	18000 N
Methidathion	950-37-8	85 N	620 N	1000 N	0.073 N	15 N				
Methomyl	16752-77-5	2100 N	15000 N	26000 N	1.7 N	390 N				
Methoxy-5-nitroaniline, 2-	99-59-2	140 C	350 C	20000 C	0.089 C	13 C			1.7 C	8.8 C
Methoxychlor	72-43-5	430 N	3100 N	5200 N	43 M	40 M				
Methoxyethanol Acetate, 2-	110-49-6	690 N	4900 N	8200 N	0.53 N	130 N			1 N	4.4 N
Methoxyethanol, 2-	109-86-4	430 N	3100 N	5200 N	0.32 N	78 N			21 N	88 N
Methyl Acetate	79-20-9	29000 S	29000 S	29000 S	66 N	16000 N				
Methyl Acrylate	96-33-3	3200 N	6800 S	6800 S	2 N	460 N				
Methyl Ethyl Ketone (2-Butanone)	78-93-3	28000 S	28000 S	28000 S	21 N	4900 N			5200 N	22000 N
Methyl Hydrazine	60-34-4	85 N	610 N	1000 N	0.073 N	16 N			0.021 N	0.088 N
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	3400 S	3400 S	3400 S	4.5 N	1000 N			3100 N	13000 N
Methyl Isocyanate	624-83-9	100000 L	100000 L	100000 L					1 N	4.4 N
Methyl Methacrylate	80-62-6	2400 S	2400 S	2400 S	6.1 N	1400 N			730 N	3100 N
Methyl Parathion	298-00-0	21 N	150 N	260 N	0.11 N	3.4 N				
Methyl Phosphonic Acid	993-13-5	5200 N	37000 N	62000 N	3.8 N	940 N				
Methyl Styrene (Mixed Isomers)	25013-15-4	350 N	380 S	380 S	0.99 N	31 N			42 N	180 N
Methyl methanesulfonate	66-27-3	69 C	170 C	10000 C	0.028 C	6.8 C			0.87 C	4.4 C
Methyl tert-Butyl Ether (MTBE)	1634-04-4	600 C	2200 C	8900 S	0.54 C	120 C			94 C	470 C
Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2	17 N	120 N	200 N	0.037 N	3.1 N				
Methyl-5-Nitroaniline, 2-	99-55-8	760 C	1900 C	20000 N	0.78 C	70 C				
Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	0.83 C	2.1 C	120 C	0.00056 C	0.081 C			0.01 C	0.051 C
Methylaniline Hydrochloride, 2-	636-21-5	52 C	130 C	7700 C	0.043 C	5 C			0.66 C	3.3 C
Methylarsonic acid	124-58-3	850 N	6200 N	10000 N		160 N				
Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7	17 N	120 N	200 N		3.1 N				
Methylbenzene-1,4-diamine sulfate, 2-	615-50-9	17 N	120 N	200 N		3.1 N				
Methylcholanthrene, 3-	56-49-5	0.073 C	0.78 C	46 C	0.38 C	0.0098 C			0.0015 C	0.019 C
Methylene Chloride	75-09-2	150 C	530 C	3300 S	0.025 M	5 M			52 C	260 C
Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	17 C	170 C	2000 N	0.32 C	1.4 C			0.022 C	0.29 C

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure						Ground Water				Vapor Exposure							
		Direct Contact						Soil MTG		Tap		Ground Water				Indoor Air			
		Residential (mg/kg)		Com/Ind (mg/kg)		Excavation (mg/kg)		Residential (mg/kg)		Residential (ug/L)		Residential (ug/L)		Com/Ind (ug/L)		Residential (ug/m^3)		Com/Ind (ug/m^3)	
Name	CASRN																		
Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	150	C	370	C	22000	C	0.66	C	6	C					1.9	C	9.4	C
Methylenebisbenzenamine, 4,4'-	101-77-9	4.2	C	11	C	630	C	0.037	C	0.41	C					0.053	C	0.27	C
Methylenediphenyl Diisocyanate	101-68-8	100000	L	100000	L	100000	L									0.63	N	2.6	N
Methylstyrene, Alpha-	98-83-9	500	S	500	S	500	S	19	N	580	N								
Metolachlor	51218-45-2	13000	N	92000	N	100000	L	49	N	2100	N								
Metribuzin	21087-64-9	2100	N	15000	N	26000	N	2.3	N	380	N								
Mineral oils	8012-95-1	100000	L	100000	L	100000	L	36000	N	47000	N								
Mirex	2385-85-5	0.38	C	0.96	C	56	C	0.53	C	0.037	C					0.0048	C	0.024	C
Molinate	2212-67-1	170	N	1200	N	2000	N	0.26	N	23	N								
Molybdenum	7439-98-7	550	N	5100	N	8600	N	32	N	78	N								
Monochloramine	10599-90-3	11000	N	100000	N	100000	L			1600	N								
Monomethylaniline	100-61-8	170	N	1200	N	2000	N	0.22	N	30	N								
N,N'-Diphenyl-1,4-benzenediamine	74-31-7	25	N	180	N	310	N	5.6	N	2.7	N								
Naled	300-76-5	170	N	1200	N	2000	N	0.28	N	31	N								
Naphtha, High Flash Aromatic (HFAN)	64724-95-6	3200	N	31000	N	52000	N			140	N					100	N	440	N
Naphthylamine, 2-	91-59-8	3.8	C	9.6	C	560	C	0.034	C	0.33	C								
Napropamide	15299-99-7	8500	N	62000	N	100000	L	170	N	1300	N								
Nickel Carbonyl	13463-39-3	5200	N	44000	N	73000	N			670	N					0.052	N	0.22	N
Nickel Oxide	1313-99-1	5300	N	47000	N	79000	N			780	N					0.1	N	0.44	N
Nickel Refinery Dust	NA	5200	N	44000	N	73000	N			760	N					0.052	N	0.22	N
Nickel Soluble Salts	7440-02-0	2100	N	20000	N	32000	N	17000	N	300	N					0.094	C	0.39	N
Nickel Subsulfide	12035-72-2	5.3	C	17	C	720	C			0.39	C					0.051	C	0.22	N
Nitrate	14797-55-8	100000	L	100000	L	100000	L			10000	M								
Nitrite	14797-65-0	11000	N	100000	N	100000	L			1000	M								
Nitroaniline, 2-	88-74-4	850	N	6000	N	9900	N	1.3	N	150	N					0.052	N	0.22	N
Nitroaniline, 4-	100-01-6	340	C	860	C	4200	N	0.28	C	33	C					6.3	N	26	N
Nitrobenzene	98-95-3	67	C	240	C	2000	N	0.016	C	1.2	C					0.61	C	3.1	C
Nitrocellulose	9004-70-0	100000	L	100000	L	100000	L	210000	N	47000000	N								
Nitrofurantoin	67-20-9	6000	N	43000	N	73000	N	9.5	N	1100	N								
Nitrofurazone	59-87-0	5.2	C	13	C	770	C	0.0094	C	0.52	C					0.066	C	0.33	C
Nitroglycerin	55-63-0	8.5	N	62	N	100	N	0.013	N	1.5	N								
Nitroguanidine	556-88-7	8500	N	62000	N	100000	L	7.7	N	1600	N								
Nitromethane	75-52-5	69	C	250	C	2700	N	0.024	C	5.4	C					2.7	C	14	C
Nitropropane, 2-	79-46-9	0.18	C	0.64	C	89	C	0.000094	C	0.018	C					0.009	C	0.045	C
Nitroso-N-ethylurea, N-	759-73-9	0.06	C	0.64	C	38	C	0.000038	C	0.0079	C					0.0012	C	0.016	C
Nitroso-N-methylurea, N-	684-93-5	0.013	C	0.14	C	8.4	C	0.000008	C	0.0018	C					0.00028	C	0.0036	C
Nitroso-di-N-butylamine, N-	924-16-3	1.2	C	4	C	200	C	0.00097	C	0.024	C					0.015	C	0.077	C
Nitroso-di-N-propylamine, N-	621-64-7	0.97	C	2.5	C	140	C	0.0014	C	0.093	C					0.012	C	0.061	C
Nitrosodiethanolamine, N-	1116-54-7	2.4	C	6.2	C	350	C	0.00097	C	0.24	C					0.03	C	0.15	C
Nitrosodiethylamine, N-	55-18-5	0.011	C	0.11	C	6.7	C	0.00001	C	0.0014	C					0.00022	C	0.0029	C
Nitrosodimethylamine, N-	62-75-9	0.032	C	0.34	C	8.2	N	0.000021	C	0.0042	C					0.00069	C	0.0088	C
Nitrosodiphenylamine, N-	86-30-6	1400	C	3500	C	100000	L	11	C	100	C					9.4	C	47	C
Nitrosomethylethylamine, N-	10595-95-6	0.31	C	0.78	C	46	C	0.00017	C	0.03	C					0.0039	C	0.019	C
Nitrosomorpholine [N-]	59-89-2	1	C	2.6	C	150	C	0.00049	C	0.1	C					0.013	C	0.065	C
Nitrosopiperidine [N-]	100-75-4	0.73	C	1.8	C	110	C	0.00076	C	0.071	C					0.009	C	0.045	C
Nitrosopyrrolidine, N-	930-55-2	3.2	C	8.2	C	490	C	0.0025	C	0.32	C					0.04	C	0.2	C
Nitrotoluene, m-	99-08-1	8.5	N	62	N	100	N	0.024	N	1.3	N								
Nitrotoluene, o-	88-72-2	41	C	130	C	1500	S	0.051	C	2.7	C								
Nitrotoluene, p-	99-99-0	340	N	1100	C	4200	N	0.69	C	37	C								

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
		Residential	Com/Ind	Excavation	Residential	Residential	Residential	Com/Ind	Residential	Com/Ind
Name	CASRN	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(ug/L)	(ug/L)	(ug/m^3)	(ug/m^3)
Nonane, n-	111-84-2	6.9 S	6.9 S	6.9 S	1.3 N	4.6 N			210 N	880 N
Norflurazon	27314-13-2	3400 N	25000 N	42000 N	77 N	600 N				
Nustar	85509-19-9	60 N	430 N	730 N	27 N	8.3 N				
Octabromodiphenyl Ether	32536-52-0	250 N	1800 N	3100 N	190 N	47 N				
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra (HMX)	2691-41-0	5300 N	49000 N	83000 N	20 N	780 N				
Octamethylpyrophosphoramide	152-16-9	170 N	1200 N	2000 N	0.15 N	31 N				
Oryzalin	19044-88-3	4300 N	31000 N	52000 N	23 N	620 N				
Oxadiazon	19666-30-9	430 N	3100 N	5200 N	7.1 N	35 N				
Oxamyl	23135-22-0	2100 N	15000 N	26000 N	0.88 M	200 M				
Paclobutrazol	76738-62-0	1100 N	8000 N	13000 N	7 N	170 N				
Paraquat Dichloride	1910-42-5	380 N	2800 N	4700 N	19 N	70 N				
Parathion	56-38-2	520 N	3700 N	6200 N	6.6 N	65 N				
Pebulate	1114-71-2	4300 N	31000 N	52000 N	6.7 N	420 N				
Pendimethalin	40487-42-1	3400 N	25000 N	42000 N	30 N	130 N				
Pentabromodiphenyl Ether	32534-81-9	170 N	1200 N	2000 N	27 N	31 N				
Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9	8.5 N	62 N	100 N	1.4 N	1.6 N				
Pentachlorobenzene	608-93-5	69 N	490 N	820 N	0.35 N	2.3 N				
Pentachloroethane	76-01-7	76 C	190 C	11000 C	0.054 C	5.6 C				
Pentachloronitrobenzene	82-68-8	27 C	66 C	3100 N	0.24 C	1 C				
Pentachlorophenol	87-86-5	12 C	27 C	2000 C	0.2 M	1 M			4.8 C	24 C
Pentaerythritol tetranitrate (PETN)	78-11-5	170 N	1200 N	2000 N	0.9 N	30 N				
Pentane, n-	109-66-0	390 S	390 S	390 S	200 N	2100 N			1000 N	4400 N
Perchlorates										
~Ammonium Perchlorate	7790-98-9	77 N	720 N	1200 N		11 N				
~Lithium Perchlorate	7791-03-9	77 N	720 N	1200 N		11 N				
~Perchlorate and Perchlorate Salts	14797-73-0	77 N	720 N	1200 N		15 M				
~Potassium Perchlorate	7778-74-7	77 N	720 N	1200 N		11 N				
~Sodium Perchlorate	7601-89-0	77 N	720 N	1200 N		11 N				
Permethrin	52645-53-1	4300 N	31000 N	52000 N	3700 N	780 N				
Phenacetin	62-44-2	3100 C	7800 C	100000 L	1.7 C	300 C			39 C	190 C
Phenmedipham	13684-63-4	21000 N	100000 L	100000 L	320 N	3000 N				
Phenol	108-95-2	25000 N	100000 L	100000 L	52 N	4500 N			210 N	880 N
Phenothiazine	92-84-2	43 N	310 N	520 N	0.2 N	3.2 N				
Phenylenediamine, m-	108-45-2	520 N	3700 N	6200 N	0.5 N	94 N				
Phenylenediamine, o-	95-54-5	140 C	370 C	21000 C	0.075 C	14 C				
Phenylenediamine, p-	106-50-3	17000 N	100000 L	100000 L	16 N	3000 N				
Phenylphenol, 2-	90-43-7	3500 C	8900 C	100000 L	71 C	260 C				
Phorate	298-02-2	17 N	120 N	200 N	0.052 N	2.3 N				
Phosgene	75-44-5	0.46 N	1.4 N	2.4 N					0.31 N	1.3 N
Phosmet	732-11-6	1700 N	12000 N	20000 N	1.3 N	290 N				
Phosphates, Inorganic										
~Aluminum metaphosphate	13776-88-0	100000 L	100000 L	100000 L		760000 N				
~Ammonium polyphosphate	68333-79-9	100000 L	100000 L	100000 L		760000 N				
~Calcium pyrophosphate	7790-76-3	100000 L	100000 L	100000 L		760000 N				
~Diammonium phosphate	7783-28-0	100000 L	100000 L	100000 L		760000 N				
~Dicalcium phosphate	7757-93-9	100000 L	100000 L	100000 L		760000 N				
~Dimagnesium phosphate	7782-75-4	100000 L	100000 L	100000 L		760000 N				
~Dipotassium phosphate	7758-11-4	100000 L	100000 L	100000 L		760000 N				
~Disodium phosphate	7558-79-4	100000 L	100000 L	100000 L		760000 N				

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
		Residential	Com/Ind	Excavation	Residential	Residential	Residential	Com/Ind	Residential	Com/Ind
Name	CASRN	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(ug/L)	(ug/L)	(ug/m^3)	(ug/m^3)
~Monoaluminum phosphate	13530-50-2	100000 L	100000 L	100000 L		760000 N				
~Monoammonium phosphate	7722-76-1	100000 L	100000 L	100000 L		760000 N				
~Monocalcium phosphate	7758-23-8	100000 L	100000 L	100000 L		760000 N				
~Monomagnesium phosphate	7757-86-0	100000 L	100000 L	100000 L		760000 N				
~Monopotassium phosphate	7778-77-0	100000 L	100000 L	100000 L		760000 N				
~Monosodium phosphate	7558-80-7	100000 L	100000 L	100000 L		760000 N				
~Polyphosphoric acid	8017-16-1	100000 L	100000 L	100000 L		760000 N				
~Potassium tripolyphosphate	13845-36-8	100000 L	100000 L	100000 L		760000 N				
~Sodium acid pyrophosphate	7758-16-9	100000 L	100000 L	100000 L		760000 N				
~Sodium aluminum phosphate (acidic)	7785-88-8	100000 L	100000 L	100000 L		760000 N				
~Sodium aluminum phosphate (anhydrous)	10279-59-1	100000 L	100000 L	100000 L		760000 N				
~Sodium aluminum phosphate (tetrahydrate)	10305-76-7	100000 L	100000 L	100000 L		760000 N				
~Sodium hexametaphosphate	10124-56-8	100000 L	100000 L	100000 L		760000 N				
~Sodium polyphosphate	68915-31-1	100000 L	100000 L	100000 L		760000 N				
~Sodium trimetaphosphate	7785-84-4	100000 L	100000 L	100000 L		760000 N				
~Sodium tripolyphosphate	7758-29-4	100000 L	100000 L	100000 L		760000 N				
~Tetrapotassium phosphate	7320-34-5	100000 L	100000 L	100000 L		760000 N				
~Tetrasodium pyrophosphate	7722-88-5	100000 L	100000 L	100000 L		760000 N				
~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5	100000 L	100000 L	100000 L		760000 N				
~Tricalcium phosphate	7758-87-4	100000 L	100000 L	100000 L		760000 N				
~Trimagnesium phosphate	7757-87-1	100000 L	100000 L	100000 L		760000 N				
~Tripotassium phosphate	7778-53-2	100000 L	100000 L	100000 L		760000 N				
~Trisodium phosphate	7601-54-9	100000 L	100000 L	100000 L		760000 N				
Phosphine	7803-51-2	32 N	310 N	520 N		4.7 N			0.31 N	1.3 N
Phosphoric Acid	7664-38-2	100000 L	100000 L	100000 L		760000 N			10 N	44 N
Phosphorus, White	7723-14-0	2.2 N	20 N	34 N	0.023 N	0.31 N				
Phthalic Acid, P-	100-21-0	85000 N	100000 L	100000 L	110 N	15000 N				
Phthalic Anhydride	85-44-9	100000 L	100000 L	100000 L	130 N	30000 N			21 N	88 N
Picloram	1918-02-1	6000 N	43000 N	73000 N	2.8 M	500 M				
Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3	8.5 N	62 N	100 N	0.02 N	1.5 N				
Pirimiphos, Methyl	29232-93-7	850 N	6200 N	10000 N	1.7 N	91 N				
Polybrominated Biphenyls	59536-65-1	0.22 C	0.57 C	7.3 N		0.022 C			0.0028 C	0.014 C
Polychlorinated Biphenyls (PCBs)										
~Aroclor 1016	12674-11-2	5.5 N	37 N	63 N	2.1 N	1.1 N			1.2 C	6.1 C
~Aroclor 1221	11104-28-2	2 C	5.4 C	390 C	0.015 C	0.043 C			0.043 C	0.21 C
~Aroclor 1232	11141-16-5	2 C	5.4 C	73 S	0.015 C	0.043 C			0.043 C	0.21 C
~Aroclor 1242	53469-21-9	3.1 C	7.4 C	460 C	1.1 C	0.34 C			0.043 C	0.21 C
~Aroclor 1248	12672-29-6	3.1 C	7.4 C	460 C	1 C	0.34 C			0.043 C	0.21 C
~Aroclor 1254	11097-69-1	1.5 N	7.4 C	18 N	1.6 N	0.31 N			0.043 C	0.21 C
~Aroclor 1260	11096-82-5	3.1 C	7.4 C	460 C	4.8 C	0.34 C			0.043 C	0.21 C
~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.5 C	3.8 C	30 N	2.4 C	0.17 C			0.021 C	0.11 C
~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.5 C	3.8 C	30 N	1.4 C	0.17 C			0.021 C	0.11 C
~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	1.5 C	3.8 C	30 N	1.5 C	0.17 C			0.021 C	0.11 C
~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	1.5 C	3.8 C	30 N	1.5 C	0.17 C			0.021 C	0.11 C
~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	0.0015 C	0.0038 C	0.03 N	0.0014 C	0.00017 C			0.000021 C	0.00011 C
~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.5 C	3.8 C	30 N	0.89 C	0.17 C			0.021 C	0.11 C
~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.5 C	3.8 C	30 N	0.87 C	0.17 C			0.021 C	0.11 C
~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.5 C	3.8 C	30 N	0.89 C	0.17 C			0.021 C	0.11 C
~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	1.5 C	3.8 C	30 N	0.89 C	0.17 C			0.021 C	0.11 C

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
Name	CASRN	Residential (mg/kg)	Com/Ind (mg/kg)	Excavation (mg/kg)	Residential (mg/kg)	Residential (ug/L)	Residential (ug/L)	Com/Ind (ug/L)	Residential (ug/m^3)	Com/Ind (ug/m^3)
~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	0.0005 C	0.0011 C	0.0088 N	0.00027 C	0.000052 C			6.4E-06 C	0.000032 C
~Polychlorinated Biphenyls (high risk)	1336-36-3	3.1 C	7.4 C	460 C					0.043 C	0.21 C
~Polychlorinated Biphenyls (low risk)	1336-36-3				1.6 M	0.5 M			0.24 C	1.2 C
~Polychlorinated Biphenyls (lowest risk)	1336-36-3								1.2 C	6.1 C
~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	0.48 C	1.1 C	8.8 N	0.16 C	0.052 C			0.0064 C	0.032 C
~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	0.15 C	0.38 C	3 N	0.053 C	0.017 C			0.0021 C	0.011 C
Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9	100000 L	100000 L	100000 L					0.63 N	2.6 N
Polynuclear Aromatic Hydrocarbons (PAHs)										
~Acenaphthene	83-32-9	4800 N	33000 N	55000 N	82 N	400 N				
~Anthracene	120-12-7	24000 N	100000 L	100000 L	860 N	1300 N				
~Benz[a]anthracene	56-55-3	2.1 C	21 C	1300 C	2.1 C	0.29 C			0.087 C	1.1 C
~Benzo(j)fluoranthene	205-82-3	5.3 C	13 C	800 C	13 C	0.56 C			0.22 C	1.1 C
~Benzo[a]pyrene	50-32-8	0.21 C	2.1 C	130 C	4.7 M	0.2 M			0.0087 C	0.11 C
~Benzo[b]fluoranthene	205-99-2	2.1 C	21 C	1300 C	7 C	0.29 C			0.087 C	1.1 C
~Benzo[k]fluoranthene	207-08-9	21 C	210 C	13000 C	68 C	2.9 C			0.087 C	1.1 C
~Chrysene	218-01-9	210 C	2100 C	100000 L	210 C	29 C			0.87 C	11 C
~Dibenz[a,h]anthracene	53-70-3	0.21 C	2.1 C	130 C	2.2 C	0.029 C			0.008 C	0.1 C
~Dibenzo(a,e)pyrene	192-65-4	0.53 C	1.3 C	80 C	15 C	0.056 C			0.022 C	0.11 C
~Dimethylbenz(a)anthracene, 7,12-	57-97-6	0.006 C	0.062 C	3.7 C	0.017 C	0.00086 C			0.00014 C	0.0017 C
~Fluoranthene	206-44-0	3200 N	22000 N	37000 N	1400 N	630 N				
~Fluorene	86-73-7	3200 N	22000 N	37000 N	81 N	220 N				
~Indeno[1,2,3-cd]pyrene	193-39-5	2.1 C	21 C	1300 C	23 C	0.29 C			0.087 C	1.1 C
~Methylnaphthalene, 1-	90-12-0	310 C	390 S	390 S	1 C	9.7 C				
~Methylnaphthalene, 2-	91-57-6	370 S	370 S	370 S	2.8 N	27 N				
~Naphthalene	91-20-3	50 C	180 C	1000 N	0.092 C	1.4 C	91 C	460 C	0.72 C	3.6 C
~Nitropyrene, 4-	57835-92-4	5.3 C	13 C	800 C	0.55 C	0.16 C			0.22 C	1.1 C
~Pyrene	129-00-0	2400 N	17000 N	28000 N	190 N	87 N				
Prochloraz	67747-09-5	45 C	110 C	6700 C	0.32 C	3.2 C				
Profluralin	26399-36-0	520 N	3700 N	6200 N	23 N	19 N				
Prometon	1610-18-0	1300 N	9200 N	15000 N	1.8 N	190 N				
Prometryn	7287-19-6	340 N	2500 N	4200 N	1.4 N	45 N				
Propachlor	1918-16-7	1100 N	8000 N	13000 N	2.3 N	190 N				
Propanil	709-98-8	430 N	3100 N	5200 N	0.7 N	63 N				
Propargite	2312-35-8	1700 N	12000 N	20000 N	180 N	120 N				
Propargyl Alcohol	107-19-7	170 N	1200 N	2000 N	0.13 N	31 N				
Propazine	139-40-2	1700 N	12000 N	20000 N	4.6 N	260 N				
Propham	122-42-9	1700 N	12000 N	20000 N	3.4 N	270 N				
Propiconazole	60207-90-1	1100 N	8000 N	13000 N	11 N	160 N				
Propionaldehyde	123-38-6	110 N	340 N	570 N	0.069 N	17 N			8.3 N	35 N
Propyl benzene	103-65-1	260 S	260 S	260 S	20 N	530 N			1000 N	4400 N
Propylene	115-07-1	100000 L	100000 L	100000 L					3100 N	13000 N
Propylene Glycol	57-55-6	100000 L	100000 L	100000 L	1300 N	310000 N				
Propylene Glycol Dinitrate	6423-43-4	80 N	240 N	400 N	0.0037 N	0.57 N			0.28 N	1.2 N
Propylene Glycol Monoethyl Ether	1569-02-4	60000 N	100000 L	100000 L	45 N	11000 N				
Propylene Glycol Monomethyl Ether	107-98-2	60000 N	100000 L	100000 L	44 N	11000 N			2100 N	8800 N
Propylene Oxide	75-56-9	28 C	90 C	2500 N	0.0097 C	2.3 C			6.6 C	33 C
Pursuit	81335-77-5	21000 N	100000 L	100000 L	68 N	3900 N				
Pydrin	51630-58-1	2100 N	15000 N	26000 N	4900 N	390 N				
Pyridine	110-86-1	110 N	1000 N	1700 N	0.1 N	15 N				

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
		Residential	Com/Ind	Excavation	Residential	Residential	Residential	Com/Ind	Residential	Com/Ind
Name	CASRN	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(ug/L)	(ug/L)	(ug/m^3)	(ug/m^3)
Quinalphos	13593-03-8	43 N	310 N	520 N	0.65 N	3.8 N				
Quinoline	91-22-5	2.2 C	5.7 C	330 C	0.014 C	0.21 C				
Refractory Ceramic Fibers	NA	100000 L	100000 L	100000 L					31 N	130 N
Resmethrin	10453-86-8	2500 N	18000 N	31000 N	600 N	48 N				
Ronnel	299-84-3	4300 N	31000 N	52000 N	55 N	300 N				
Rotenone	83-79-4	340 N	2500 N	4200 N	490 N	47 N				
Safrole	94-59-7	7.3 C	78 C	4600 C	0.0076 C	0.62 C			0.15 C	1.9 C
Savey	78587-05-0	2100 N	15000 N	26000 N	7.2 N	81 N				
Selenious Acid	7783-00-8	550 N	5100 N	8600 N		78 N				
Selenium	7782-49-2	550 N	5100 N	8600 N	5.3 M	50 M			21 N	88 N
Selenium Sulfide	7446-34-6	550 N	5100 N	8600 N		78 N			21 N	88 N
Sethoxydim	74051-80-2	7700 N	55000 N	93000 N	140 N	780 N				
Silica (crystalline, respirable)	7631-86-9	100000 L	100000 L	100000 L					3.1 N	13 N
Silver	7440-22-4	550 N	5100 N	8600 N	12 N	71 N				
Simazine	122-34-9	57 C	140 C	5200 N	0.039 M	4 M				
Sodium Acifluorfen	62476-59-9	1100 N	8000 N	13000 N	32 N	200 N				
Sodium Azide	26628-22-8	430 N	4100 N	6900 N		62 N				
Sodium Diethyldithiocarbamate	148-18-5	25 C	64 C	3800 C		2.5 C				
Sodium Fluoride	7681-49-4	5500 N	51000 N	86000 N		780 N			14 N	57 N
Sodium Fluoroacetate	62-74-8	1.7 N	12 N	20 N	0.0013 N	0.31 N				
Sodium Metavanadate	13718-26-8	110 N	1000 N	1700 N		16 N				
Stirofos (Tetrachlorovinphos)	961-11-5	280 C	720 C	31000 N	1.4 C	24 C				
Strontium, Stable	7440-24-6	66000 N	100000 L	100000 L	6600 N	9300 N				
Strychnine	57-24-9	25 N	180 N	310 N	1 N	4.6 N				
Styrene	100-42-5	870 S	870 S	870 S	2.2 M	100 M			1000 N	4400 N
Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9	69 N	490 N	820 N	1.5 N	13 N				
Sulfuric Acid	7664-93-9	100000 L	100000 L	100000 L					1 N	4.4 N
Systhane	88671-89-0	2100 N	15000 N	26000 N	86 N	350 N				
TCMTB	21564-17-0	2500 N	18000 N	31000 N	51 N	370 N				
Tebuthiuron	34014-18-1	6000 N	43000 N	73000 N	6.3 N	1100 N				
Temephos	3383-96-8	1700 N	12000 N	20000 N	1200 N	310 N				
Terbacil	5902-51-2	1100 N	8000 N	13000 N	1.2 N	200 N				
Terbufos	13071-79-9	2.1 N	15 N	26 N	0.0079 N	0.18 N				
Terbutryn	886-50-0	85 N	620 N	1000 N	0.28 N	10 N				
Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1	8.5 N	62 N	100 N	0.85 N	1.6 N				
Tetrachlorobenzene, 1,2,4,5-	95-94-3	25 N	180 N	310 N	0.11 N	1.2 N				
Tetrachloroethane, 1,1,1,2-	630-20-6	27 C	93 C	680 S	0.038 C	5 C			3.3 C	17 C
Tetrachloroethane, 1,1,2,2-	79-34-5	7.8 C	28 C	1900 S	0.0052 C	0.66 C	63 C	310 C	0.42 C	2.1 C
Tetrachloroethylene	127-18-4	7.7 C	26 C	170 S	0.045 M	5 M	11 C	55 C	4.1 C	21 C
Tetrachlorophenol, 2,3,4,6-	58-90-2	2500 N	18000 N	31000 N	21 N	170 N				
Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	0.34 C	0.86 C	49 C	0.0023 C	0.034 C				
Tetraethyl Dithiopyrophosphate	3689-24-5	43 N	310 N	520 N	0.078 N	5.3 N				
Tetrafluoroethane, 1,1,1,2-	811-97-2	1100 S	1100 S	1100 S	1900 N	170000 N			83000 N	350000 N
Tetryl (Trinitrophenylmethylnitramine)	479-45-8	340 N	2500 N	4200 N	12 N	63 N				
Thallium (Soluble Salts)	7440-28-0	1.1 N	10 N	17 N	2.9 M	2 M				
Thiobencarb	28249-77-6	850 N	6200 N	10000 N	8.3 N	120 N				
Thiodiglycol	111-48-8	7600 N	68000 N	100000 L	4.4 N	1100 N				
Thiofanox	39196-18-4	25 N	180 N	310 N	0.028 N	4.1 N				
Thiophanate, Methyl	23564-05-8	6900 N	49000 N	82000 N	21 N	1200 N				

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
		Residential	Com/Ind	Excavation	Residential	Residential	Residential	Com/Ind	Residential	Com/Ind
Name	CASRN	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(ug/L)	(ug/L)	(ug/m^3)	(ug/m^3)
Thiram	137-26-8	430 N	3100 N	5200 N	2.2 N	76 N				
Tin	7440-31-5	66000 N	100000 L	100000 L	47000 N	9300 N				
Titanium Tetrachloride	7550-45-0	100000 L	100000 L	100000 L					0.1 N	0.44 N
Toluene	108-88-3	820 S	820 S	820 S	14 M	1000 M			5200 N	22000 N
Toluene-2,5-diamine	95-70-5	8.5 N	62 N	100 N	0.0099 N	1.6 N				
Toluidine, p-	106-49-0	36 C	91 C	5300 C	0.029 C	3.4 C				
Toxaphene	8001-35-2	6.2 C	16 C	910 C	9.3 M	3 M			0.076 C	0.38 C
Tralomethrin	66841-25-6	640 N	4600 N	7900 N	920 N	120 N				
Tri-n-butyltin	688-73-3	25 N	180 N	310 N	2 N	4.7 N				
Triallate	2303-17-5	1100 N	8000 N	13000 N	3.9 N	87 N				
Triasulfuron	82097-50-5	850 N	6200 N	10000 N	3.4 N	160 N				
Tribromobenzene, 1,2,4-	615-54-3	430 N	3100 N	5200 N	2.2 N	78 N				
Tributyl Phosphate	126-73-8	760 C	1900 C	10000 N	4.4 C	45 C				
Tributyltin Compounds	NA	25 N	180 N	310 N		4.7 N				
Tributyltin Oxide	56-35-9	25 N	180 N	310 N	4600 N	4.4 N				
Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1	910 S	910 S	910 S	2600 N	53000 N			31000 N	130000 N
Trichloroacetic Acid	76-03-9	97 C	250 C	14000 C	0.25 M	60 M				
Trichloroaniline HCl, 2,4,6-	33663-50-2	240 C	590 C	35000 C	1.3 C	23 C				
Trichloroaniline, 2,4,6-	634-93-5	2.5 N	18 N	31 N	0.054 N	0.3 N				
Trichlorobenzene, 1,2,3-	87-61-6	69 N	150 S	150 S	0.31 N	5.2 N				
Trichlorobenzene, 1,2,4-	120-82-1	87 N	270 N	400 S	4.1 M	70 M			2.1 N	8.8 N
Trichloroethane, 1,1,1-	71-55-6	640 S	640 S	640 S	1.4 M	200 M	13000 N	54000 N	5200 N	22000 N
Trichloroethane, 1,1,2-	79-00-5	2.2 N	6.8 N	11 N	0.032 M	5 M	11 N	46 N	0.21 N	0.88 N
Trichloroethylene	79-01-6	6.2 N	20 N	34 N	0.036 M	5 M	9.1 N	38 N	2.1 N	8.8 N
Trichlorofluoromethane	75-69-4	1100 N	1200 S	1200 S	14 N	1100 N			730 N	3100 N
Trichlorophenol, 2,4,5-	95-95-4	8500 N	62000 N	100000 L	67 N	890 N				
Trichlorophenol, 2,4,6-	88-06-2	85 N	620 N	1000 N	0.68 N	9 N			7.8 C	40 C
Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5	850 N	6200 N	10000 N	0.99 N	120 N				
Trichlorophenoxypropionic acid, -2,4,5	93-72-1	690 N	4900 N	8200 N	0.55 M	50 M				
Trichloropropane, 1,1,2-	598-77-6	550 N	1300 S	1300 S	0.61 N	78 N				
Trichloropropane, 1,2,3-	96-18-4	0.07 C	0.95 C	37 N	0.000056 C	0.0065 C			0.31 N	1.3 N
Trichloropropene, 1,2,3-	96-19-5	1.1 N	3.3 N	5.5 N	0.0061 N	0.62 N			0.31 N	1.3 N
Tridiphane	58138-08-2	250 N	1800 N	3100 N	6.7 N	47 N				
Triethylamine	121-44-8	170 N	520 N	880 N	0.091 N	15 N			7.3 N	31 N
Trifluralin	1582-09-8	640 N	2200 C	7900 N	15 C	22 C				
Trimethyl Phosphate	512-56-1	340 C	860 C	10000 N	0.15 C	34 C				
Trimethylbenzene, 1,2,3-	526-73-8	74 N	220 N	290 S	0.29 N	10 N			5.2 N	22 N
Trimethylbenzene, 1,2,4-	95-63-6	87 N	220 S	220 S	0.44 N	15 N			7.3 N	31 N
Trimethylbenzene, 1,3,5-	108-67-8	180 S	180 S	180 S	2.5 N	87 N				
Trinitrobenzene, 1,3,5-	99-35-4	3100 N	27000 N	46000 N	33 N	460 N				
Trinitrotoluene, 2,4,6-	118-96-7	50 N	420 N	710 N	0.89 N	7.6 N				
Triphenylphosphine Oxide	791-28-6	1700 N	12000 N	20000 N	23 N	280 N				
Tris(2-chloroethyl)phosphate	115-96-8	340 C	860 C	7300 N	0.64 C	33 C				
Tris(2-ethylhexyl)phosphate	78-42-2	2100 C	5400 C	100000 L	21000 C	210 C				
Uranium (Soluble Salts)	NA	320 N	3100 N	5200 N	270 M	30 M			0.31 N	1.3 N
Urethane	51-79-6	1.7 C	17 C	1000 C	0.00094 C	0.21 C			0.033 C	0.42 C
Vanadium Pentoxide	1314-62-1	920 N	7500 N	13000 N		110 N			0.0029 C	0.015 C
Vanadium and Compounds	NA	550 N	5200 N	8800 N	1600 N	78 N				
Vernolate	1929-77-7	85 N	620 N	1000 N	0.13 N	8.3 N				

Table A-6: Screening Level Summary Table - 2012

Chemical		Soil Exposure			Ground Water		Vapor Exposure			
		Direct Contact			Soil MTG	Tap	Ground Water		Indoor Air	
Name	CASRN	Residential (mg/kg)	Com/Ind (mg/kg)	Excavation (mg/kg)	Residential (mg/kg)	Residential (ug/L)	Residential (ug/L)	Com/Ind (ug/L)	Residential (ug/m^3)	Com/Ind (ug/m^3)
Vinclozolin	50471-44-8	2100 N	15000 N	26000 N	5.2 N	340 N				
Vinyl Acetate	108-05-4	1400 N	2800 S	2800 S	1.7 N	410 N			210 N	880 N
Vinyl Bromide	593-60-2	1.5 C	5.6 C	32 N	0.0086 C	1.5 C			0.76 C	3.8 C
Vinyl Chloride	75-01-4	0.84 C	17 C	660 N	0.014 M	2 M	2 C	35 C	1.6 C	28 C
Warfarin	81-81-2	25 N	180 N	310 N	0.093 N	4.4 N				
Xylene, P-	106-42-3	390 S	390 S	390 S	3.7 N	190 N			100 N	440 N
Xylene, m-	108-38-3	390 S	390 S	390 S	3.7 N	190 N			100 N	440 N
Xylene, o-	95-47-6	430 S	430 S	430 S	3.7 N	190 N			100 N	440 N
Xylenes	1330-20-7	260 S	260 S	260 S	200 M	10000 M			100 N	440 N
Zinc Phosphide	1314-84-7	32 N	310 N	520 N		4.7 N				
Zinc and Compounds	7440-66-6	32000 N	100000 L	100000 L		4700 N				
Zineb	12122-67-7	4300 N	31000 N	52000 N	45 N	780 N				

C = Carcinogenic endpoint
L = Capped at 100,000 mg/kg (soil direct contact only)
M = Set to maximum contaminant limit (MCL; ground water only) or based on MCL (migration to ground water)
N = Noncarcinogenic endpoint
R = Capped at 1,000,000 mg/kg (migration to ground water only)
S = Capped at soil saturation limit

Table A-7: Recreational Soil Direct Contact Screening Levels - 2012

Chemical		Trail (mg/kg)	Athletic Field (mg/kg)	Community Park (mg/kg)
Name	CASRN			
Arsenic, Inorganic	7440-38-2	500	80	30
Benzene	71-43-2	1800*	1070	420
Benzo(a)pyrene	50-32-8	5	3	1
Ethylbenzene	100-41-4	480*	480*	480*
Lead and Compounds	7439-92-1	400	400	400
Toluene	108-88-3	820*	820*	820*
Xylenes	1330-20-7	260*	260*	260*

*Soil saturation limit

Standard Operating Procedures (SOP) Table of Contents

Heartland Environmental Associates, Inc.

Standard Operating Procedures
Field Equipment Operation

Rev. January 2013

1.0 Purpose

1.1 The purpose of this document is to describe the standard operating procedures (SOPs) for the equipment typically used by Heartland employees in field activities.

1.2 Field equipment operating procedures summarized in this SOP include the a Dissolved Oxygen (DO) test kit (Section 3.0), oil/water level meters (Section 4.0), Photo-Ionization Detectors (PID) (Section 5.0) and the Flame-Ionization Detector (FIDs) (Section 6.0). Operating activities for any new piece of equipment obtained for general use by the field personnel will be added to this SOP or a separate SOP will be prepared, if necessary.

2.0 General Equipment Usage Guidelines

2.1 Prior to using any piece of equipment, make sure you are confident with the operations of that particular piece of equipment. Operating instructions for similar pieces of equipment may differ. If you are unsure how to operate any piece of equipment, please refer to this SOP or check with your Project Manager. Errors in the field due to improper use of equipment once in the field cannot be fixed.

2.2 It is the responsibility of the field staff and Project Manager to make sure the piece of equipment required for any particular activity is available on the day it is needed. If necessary, make sure the equipment is adequately re-charged the day before use.

2.3 If any piece of equipment does not seem to be operating properly or if it is broken while being used by you, please let a Project Manager or appropriate person know so it can be fixed before the next person tries to use it.

3.0 Dissolved Oxygen Measurements—Portable DO Test Kit

3.1 **Dissolved Oxygen Measurements (DO)**—measures DO in groundwater at natural attenuation remediation sites during groundwater monitoring activities. Microorganisms that typically consume petroleum or organic compounds in the subsurface also utilize DO as food. Typically, at a natural attenuation site, it would be best if a high DO level was present in groundwater upgradient from the impacted area. Without considering any other variables, this means it is feasible for natural attenuation to occur at the site. In a well with very high BTEX concentrations or free product, it is likely there will be very low DO levels.

3.2 **Test Kit Procedures**—A DO Test Kit (i.e. Hach) is used to measure DO levels in groundwater between 0.2 milligrams/liter (mg/L) and 20 mg/L.

3.2.1 High Range Test (4-20 mg/L)

3.2.1.1 Fill bottle (with line) with water (second bailer); add reagents 1 and 2; close stopper (make sure there are no air bubbles); if bubbles are present in the bottle, you must start over.

3.2.1.2 Shake bottle; flocculation (formation of solids) will occur; if brownish-orange this indicates oxygen is present.

3.2.1.3 Allow floc (solids) to settle below line.

3.2.1.4 Shake bottle again and allow floc to settle again.

3.2.1.5 Remove stopper and add reagent 3; once again, there should be no air bubbles; if air bubbles are present, start over.

3.2.1.6 Shake again; floc will dissolve; yellowish color will be present if dissolved oxygen is revealed.

3.2.1.7 Fill thin, plastic tube to top and pour into other bottle.

3.2.1.8 Add sodium thiosulfate one drop at a time; swirl bottle after each drop; add drops until sample becomes colorless; one drop = 1 mg/L; record measurement in field book.

3.2.2 Low Range Test (0.2 to 4 mg/L)

3.2.2.1 Take remaining sample from bottle with line; pour off water until water level is at line in bottle.

3.2.2.2 Add sodium thiosulfate one drop at a time; swirl after each drop; add drops until sample becomes colorless; one drop = 0.2 mg/L; record measurement in field book.

3.2.3 The Test Kit does not require any batteries or re-charging.

4.0 Water Level Meters and Oil/Water Interface Probes

4.1 **Free Product/Water Level Measurements**—Water level meters and oil/water interface probes for the measurement of static water levels and free product in monitoring wells will be commonly utilized. The depths to static water in monitoring wells are utilized to create groundwater flow maps, calculate hydraulic gradients, and determine purge volumes.

4.2 **Free Product**—Free product (i.e., gasoline, diesel fuel, etc) floats on water. Therefore, free product can be measured separately from natural groundwater. It is very important to inform the project manager of the presence of any free product at the site. The presence of free product presents great risk to potential receptors.

4.3 Water level meters do not detect free product. At free product sites (current or historical), use an oil/water interface probe only.

4.4 Water Level Meter and Oil/Water Interface Probe Operations

4.4.1 Turn probe on. Slowly lower probe into well. Upon contact with oil/water, the probes will make a beeping noise. Consult the specific probes operating manual to confirm proper reading of the probe is being conducted.

4.4.2 Upon completion of collecting water levels at the site, make sure to turn off the water level meter and decontaminate it.

4.4.3 Oil/water probes are commonly powered by a 9-volt battery. Prior to use, make sure batteries are working. Upon completion, make sure the meter is turned off.

5.0 Photo-Ionization Detectors (PIDs)

5.1 **How It Operates –** PIDs operate on the principal of a chemical compound’s ionization potential. A pump pulls the air sample past an ultraviolet (UV) light source. This causes ionization of the chemical producing an electrical current measured in electron volts (eV). This is called the chemical’s ionization potential (IP). Chemicals that have an IP greater that the instrument’s UV light source (i.e., 10.2 eV or 11.7 eV), will not respond properly or at all.

5.2 The PIDs are used to detect, measure, and provide a direct reading of the concentration of a variety of vaporized, volatile constituents (i.e., petroleum compounds). The PID measures the vapors in parts per million by volume (ppmv). The equipment measures total organic vapor concentrations but does not measure the concentrations of any individual compounds.

5.3 PID readings are used in a variety of situations including the following: directing UST over-excavation activities, to determine which samples should be submitted for laboratory analysis during soil borings, and to check for organic vapors in potential sensitive receptors such as utility manholes.

5.4 The 10.2 eV probe is typically used to measure organic vapors typical of petroleum hydrocarbons (e.g., benzene = 9.24 eV). The 11.7 eV HNu probe is typically used to measure organic vapors typical of chlorinated solvents (e.g., TCE = 11.00 eV).

5.5 Use of the 11.7 eV lamp does provide the greatest range of detectible chemicals. However, it requires constant maintenance and frequent replacement. Consequently, the more durable 10.2 eV lamp is most often used. The 10.2 eV lamp is suitable for most petroleum hydrocarbon sites but the 11.7 eV lamp must be used on chlorinated solvent sites.

5.6 PIDs are good qualitative field-screening tools used during drilling or excavations but are not accurate for measuring off-gases from remediation systems. Most PIDs are limited to 2000 ppmv and PIDs cannot detect methane (IP = 12.98 eV).

5.7 **Charging Requirements**—PIDs require charging between each use. If you know you will be using a PID, make sure that the piece of equipment is charged the day prior to using the equipment. When charging, make sure you know if the probe needs to be attached or not. Generally, charging the equipment overnight prior to being used the next day is sufficient.

5.8 PID Operation Procedures

5.8.1 Attach the probe to the PID. This can be tricky on some models. Use care aligning the prongs in the probe cord with the socket. Do not force it.

5.8.2 Conduct a battery check on the PID. For the datalogger, press the battery check button. For the regular PID, turn the switch to BATT position. The needle on the meter will go to the green zone if the battery is fully charged.

5.8.3 Calibrate the instrument. The MiniRAE Light is calibrated using a standard two-point calibration. The instrument is first zeroed using a clean air source or carbon-filtered air source to set the first point. The span calibration uses a 100-ppm isobutylene calibration gas. Follow the manufacturer’s directions included in the operating manual.

5.8.4 Make sure the instrument is still zeroed.

5.8.5 Record in the field book that the instrument was calibrated, calibration gas used/concentration, and span setting.

5.8.6 The PID will automatically display the concentration of vapors on the readout display.

5.8.7 If during use you are unsure if the PID is still working listen for the motor running. If you are still unsure, hold a solvent-based Magic Marker near the probe tip. If the meter deflects upscale, the instrument is working (This may cause the PID to have to be re-calibrated).

5.8.8 When taking headspace measurements from soil samples in a baggie, allow sample enough time for contaminants to volatilize. If very cold, place the samples in a warmer environment. Do not allow dirt to get into probe.

5.8.9 When complete with screening, be sure to turn probe off and carefully remove the probe.

5.8.10 Remember to report all readings in ppmv as isobutylene (calibration gas used).

5.9 The datalogger provides the user with various features that are typically not used for the activities described in this SOP. If the use of these features is required, please refer to the PIDs operating manual that should be located in the case.

6.0 Flame-Ionization Detector (FIDs)

6.1 The flame ionization detector (FID) designed to measure trace quantities of organic materials in the air. The FID is an almost universal detector for organic compounds with the sensitivity to measure in the ppmv range in the presence of atmospheric moisture, nitrogen oxides, carbon monoxide, and carbon dioxide.

6.2 **How it Operates –** FIDs operate in much the same way as the PID, but a hydrogen flame is used to cause ionization of the chemical rather than the uV lamp. Since a flame is used, FIDs work over a wider range of organic species up to 15.4 eV. Most FIDs are factory calibrated to methane.

6.3 FID Operating Procedures (Note this procedure reflects that of commonly utilized FIDs. Prior to the onset of field activities, personnel should review specific operating manuals to confirm any differences in FID operation from unit to unit)

6.3.1 Connect the Probe/Readout Assembly to the Assembly by attaching the sample line and electronic jack to the respective ports. Connect the probe to the probe handle.

6.3.2 Move the Instrument/Battery switch to the “BATT” position. The meter needle should move to within the Battery Check range indicating the battery has more than 4 house of operating life.

6.3.3 Move the Instrument/Battery switch to the “ON” position and **allow 5 minutes for warm-up**.

6.3.4 Turn the pump switch “ON”. Move the Calibrate Switch to “X1” and adjust the meter reading to zero using the Calibrate Adjust knob.

6.3.5 Open the hydrogen tank valve (H_2 TANK) **two turns** and observe the pressure reading on the H_2 Tank pressure gauge. Each 150 psi represents approximately 1 hour of operating time.

6.3.6 Open the hydrogen supply valve (H_2 SUPPLY) **one or two turns** and observe the reading on the H_2 Supply pressure gauge. The reading should be between 8 and 12 psi.

6.3.7 **After approximately one minute**, depress the Igniter Button until the hydrogen flame lights. The meter needle will move upscale quickly when the flame lights and then return to 0. Do not depress the igniter for more than 6 seconds. If the flame does not light, try again after one minute.

6.3.8 Use the Calibrate Adjust knob to “zero” out the FID. The FID is now ready for use.

6.3.9 Use the Calibration switch for the appropriate range based on the concentrations being screened. (1x, 10x or 100x).

6.3.10 If the flame goes out during use, re-ignite using the same procedures as above.

6.4 Shut Down Procedures

6.4.1 Close the Hydrogen Tank Valve.

6.4.2 Close the Hydrogen Supply Valve.

6.4.3 Move Instrument Switch to “OFF”.

6.4.4 Wait 5 seconds and move Pump Switch to “OFF”.

6.5 Fuel Refilling Procedures

6.5.1 The hydrogen fuel will require re-filling on occasion. This should be done only by a person designated by the Equipment Manager. Fuel Refilling Procedures are located in the Instruction Manual. If the hydrogen tank requires refilling, notify the Equipment Manager.

6.6 Battery Charging Procedures

6.6.1 Plug charger connector into mating connector on battery cover and insert AC plug into wall plug.

6.6.2 Move the battery charger switch to the “ON” position. The lamp above the switch button should illuminate.

6.6.3 The meter on the front panel of the charger indicates the Battery charge condition. When fully charged, the pointer will be in line with the “battery OK” below the scale. Approximately one hour of charging time is required for each hour of operation. An overnight charge is recommended prior to each use.

6.7 FID Calibration Procedures

6.7.1 The FIDs should be calibrated in the office on a regular basis. Should field calibration be required, refer to the instruction manual.

Standard Operating Procedures
Field Notes

Rev. January 2013

Purpose

1.1 The purpose of this document is to describe the standard operating procedures used to document field work and data collection activities.

What is a Field Logbook?

1.2 The field logbook is a controlled evidentiary document and is maintained accordingly. Field logbooks provide a means for recording all field work and data collection activities at a site as they occur.

Why is a Field Logbook Important?

1.3 A field logbook is the primary form of documentation for a site. Project reports, client/regulator correspondence, site base maps, boring logs, and flow maps all rely directly on your entries in the field logbook. Entries into the logbook will be as descriptive and detailed as possible so that a particular situation can be reconstructed without reliance on memory alone. Logbooks often become evidence in lawsuits, so keep to the facts only.

General Guidelines

1.4 All field logbook entries are made with ink (no pencils, please; preferably w/permanent ink) and are legibly written with clear, plain, and concise language.

1.5 All entries will be factual and objective.

1.6 No erasures are permitted. If an entry is incorrect, the data will be crossed out with a single strike mark, initialed, and dated.

1.7 Entries will be organized into easily understandable tables, diagrams, sketches, and/or maps when needed to better document field activities.

1.8 Site maps will be sketched on graph paper

1.9 All collected measurements and samples are recorded.

1.10 Only one project will be entered per field logbook.

1.11 Each page is signed, dated, and numbered

1.12 No blank lines between entries

1.13 Blank pages/sections are marked as such (e.g., “This page/section Intentionally left blank”)

1.14 Each entry is identified by time using military or 24-hour format (e.g., 4:15 PM is 16:15)

1.15 Weather conditions and significant changes are recorded

1.16 Additional data sheets are referenced in logbook (e.g., system O&M logs, site maps, photo logs, field sheets)

1.17 Logbooks are returned to the proper storage location after completing field work. The Project Manager must indicate the location.

1.18 Don't lose the fieldbook!

Specific Guidelines

1.19 For new field books, enter the project name, location, cross streets, project number, and site contact name and phone number on the cover/inside cover of the field book. Projects using multiple field logbooks will be labeled in consecutive order such as "Book 1 of 2" or "Book 2 of 2."

1.20 First, enter the following basic information:

1.20.1 Project/Client Name

1.20.2 Field personnel on site

1.20.3 Other personnel/visitors on site

1.20.4 Equipment/Procedures used

1.20.5 Weather conditions (e.g., wind direction, cloud cover, temperature, etc.)

1.20.6 Purpose of site visit

1.20.7 Arrival time at site

1.21 Second, make entries to document the field activities for the day such as:

1.21.1 Description of samples, drilling and/or other field activities

1.21.2 Sample number, location, depth, and size

1.21.3 Field observations-indicate the obvious-what's there-what's not

1.21.4 Enter the arrival/departure time of personnel/visitors at site w/affiliation

1.21.5 Enter the arrival/departure time of subcontractors and the name of their personnel

1.21.6 Indicate that the Site Health & Safety Plan was reviewed/signed or the Tailgate Safety Meeting was held

1.21.7 Immediately call the project manager whenever site conditions warrant such as accidents, emergencies, unanticipated visitors (clients/regulators)

1.21.8 Record any emergencies and/or accidents that occurred on site including details leading up to the incident and the solution/results

1.21.9 Document phone conversations w/Project Manager or others when decisions are made in the field

1.22 Finally, enter the date and logbook page number at the top of each page

1.23 At the end of the day, give the Project Manager a copy of the field notes, chain-of-custody, equipment rental sheets, site maps, system O&M logs, etc.

Checklist for Specific Tasks

1.24 Soil Borings:

1.24.1 Boring number

- 1.24.2 Boring location
- 1.24.3 Total depth
- 1.24.4 Soil type
- 1.24.5 Moisture
- 1.24.6 Munsell Color Code
- 1.24.7 Blow Counts
- 1.24.8 PID Reading
- 1.24.9 Soil Description
- 1.24.10 Depth water encountered during drilling, depth to water upon completion
- 1.24.11 Surface elevation
- 1.24.12 Number of waste drums
- 1.24.13 Drum No. where soil from each boring is placed
- 1.24.14 Subcontractor/name/type of equipment used
- 1.24.15 Drilling subcontractor and driller’s name
- 1.24.16 Decontamination Procedures

1.25 Monitoring Wells:

- 1.25.1 Boring diameter
- 1.25.2 Well Number
- 1.25.3 Depth water encountered during drilling
- 1.25.4 Drilling subcontractor and driller’s name
- 1.25.5 Type of drill rig
- 1.25.6 Borehole diameter (from diameter of augers used)
- 1.25.7 Well diameter
- 1.25.8 Well material (PVC, Stainless steel)
- 1.25.9 Well diameter (2”, 4”, etc.)
- 1.25.10 Well construction (screen/blank interval, total depth etc.)
- 1.25.11 Number of waste drums’
- 1.25.12 Drum No. where soil from each well is placed
- 1.25.13 Decontamination Procedures

1.26 Groundwater Sampling:

- 1.26.1 Well number
- 1.26.2 Depth to water/product
- 1.26.3 Product thickness
- 1.26.4 Total well depth

1.26.5 Purge volume

1.26.6 Dissolved oxygen levels

1.26.7 Temperature/conductivity/pH

1.26.8 Well Diameter

1.26.9 Decontamination Procedures

Miscellaneous Guidelines

1.27 Photographs will be taken of new sites or during significant field tasks at each site per Project Manager instructions

1.28 It helps to paste a reduced copy of the site map in the back of the field book for reference. Also list well depths and elevations in back of fieldbook

1.29 Site maps will be sketched on graph paper for ease in creating the CADD base map for the site

Heartland Environmental Associates, Inc.

Standard Operating Procedures
Monitoring Well Development

Rev. January 2013

1.0 Purpose

1.1 The purpose of this document is to describe the standard operating procedures (SOPs) used to properly develop a groundwater-monitoring well.

2.0 Why is Development of a Monitoring Well Important?

2.1 A groundwater monitoring well must be properly developed in order to remove silt, sand, drill cuttings, drilling fluids and other soil components (fines) encountered during boring and installation. The monitoring well is developed so that a representative water sample can be obtained from the monitoring well. A monitoring well must be developed prior to the initial sampling event.

3.0 Monitoring Well Development Equipment

3.1 Surge Block

3.2 Extensions to the surge block, in 5 foot sections

3.3 Water Level Indicator

3.4 Bailer/Pump

3.5 Buckets

3.6 Field Book

3.7 DOT Approved 55-gallon drum(s)

3.8 Keys to well lock, if applicable

4.0 Monitoring Well Development Procedure

4.1 Monitoring well development is normally initiated at least 48 hours following monitoring well installation if a rigorous well development method is utilized (i.e., surging, jetting, air or water lifting). This time period is required to allow the well construction materials (grout, cement, etc.) to properly set. If a less rigorous method is used (i.e., bailing, over pumping), development can be initiated shortly after installation. Development methods utilized will be dependent upon site conditions, but will generally be the surge and purge method.

4.2 Initiate monitoring well development with the removal of the expandable cap on the well casing, and allow the static water level in the well to equilibrate.

4.3 Obtain water level measurements from each well using a water level meter.

4.3.1 Obtain the static water level measurement, turn off the water level meter, and extend the water level meter to the bottom of the well to obtain the total depth of the well.

4.3.2 DO NOT let the water level meter slam the bottom of the well.

4.3.3 Decontaminate the water level meter before proceeding to the next well.

4.3.4 Record the water depth and the total well depth in the site field book. Note if soil materials are observed on the water level meter (bentonite, PVC, etc.).

4.4 Calculate the amount of water in the monitoring well. For additional information, please refer to the monitoring well gauging and sampling SOPs.

4.4.1 A monitoring well is properly developed following the removal of a minimum of 10 well volumes from each well or until the well is silt free and the water is clear.

4.4.2 The calculation to determine 10 well volumes is as follows:

4.4.2.1 Subtract the static water level from the total depth of the well to yield the total feet of the water column in the well.

4.4.2.2 Multiply feet of water by the appropriate conversion factor. (0.16 gallons/foot for a 2 inch well, 0.65 gallons/foot for a 4 inch well). The resultant number is the total well volume in gallons of water.

4.4.2.3 Multiply this number by 10. The result gives you the minimum 10 well volumes required to develop the well.

4.5 **EXAMPLE:**

4.5.1 2 inch monitoring well;

4.5.2 Well Depth is 20.00 feet

4.5.3 Water Level is 15.00 feet

4.5.4 20.00 feet – 15.00 feet = 5.00 feet water column

4.5.5 5.00 feet x 0.16 gallons/foot= 0.8064 gallons/water column

4.5.6 .80 * 10 = 8.0 Gallons

4.6 Set up the surge block and extensions

4.6.1 Lower the surge block into the well, connecting the 5-foot extensions onto the surge block as it is lowered into the well, until enough sections are extending out of the well for development. Be careful not to strip or cross-thread the threads on the extension sections.

  - 4.6.2 Surge the well by moving the surge block in a continuous up and down motion (i.e., plunging the toilet) starting at the top section of the screened interval (submerged) and slowing proceeding to the bottom section. Avoid lifting or otherwise moving the well casing.
  - 4.6.3 The surging of the well creates a “vacuum”, pulling the water in through the well screen and sand pack (pulling the surge block up) and dispersing the water (pushing the surge block down). Surging is generally continued for five minutes.
  - 4.6.4 Remove the surge block immediately following surging. DO NOT allow the surge block to “sit” in the well for any extended length of time. The surge block could become lodged in the well casing preventing removal.
  - 4.6.5 Remove all well surging equipment from the well, disconnecting each section of the surge block connectors.
  - 4.6.6 Decontaminate the surge block, bailers, pumps and all sections prior to surging the next well.
- 4.7 Purge a minimum of 10 well volumes from the well by either utilizing a disposable bailer or by using the development pump.
  - 4.7.1 Place purge water into buckets or 55-gallon drums.
  - 4.7.2 Observe the appearance of the water, (i.e., silty, sandy, murky, clear, etc.) and record the water appearance in the site field book.
  - 4.7.3 Continue removing water from the well until a minimum of 10 well volumes are removed, or until the water begins to clear and is silt free.
  - 4.7.4 Empty the development water from the buckets into labeled a 55-gallon drum(s).
- 4.8 If the well goes dry before obtaining 10 well volumes, allow the well to recharge (return to original gauged depth).
  - 4.8.1 Once the well is allowed to recharge, it may be necessary to repeat the surge procedure.
  - 4.8.2 Begin removing the water from the well in order to obtain a total water removal of 10 well volumes or until the water is clear and silt free.
- 4.9 Repeat surging/purging the well if necessary (i.e., turbid water, less than 10 well volumes removed, etc.).
- 4.10 When this process is complete, move to the next well and begin the development process again.

4.11 When monitoring well development is complete for all wells, close the wells and secure the site.

  4.11.1 Properly decontaminant all equipment used, and dispose of disposable equipment used.

  4.11.2 Close and label the drum(s) containing the purge water.

5.0 Miscellaneous Guidelines for Well Development

5.1 Remember to take notes in the site field book as indicated in the Field Note SOP.

5.2 Document the procedure used during the well development.

5.3 Record equipment used to develop well (bailer or pump).

5.4 Describe the appearance of the water prior to developing and again after development is complete.

5.5 Describe and explain the reason(s) if any procedures were modified.

5.6 DO NOT allow the equipment to slam the bottom of the well.

5.7 Remove the surge block immediately following surging. DO NOT allow the surge block to “sit” in the well for any extended length of time. The surge block could become lodged in the well casing preventing removal. Removal of a lodged surge block can be accomplished by rotating clockwise and lifting simultaneously.

5.8 Decontaminate the reusable equipment (surge block, bailer, pump, etc.) prior to moving to the next well.

5.9 Maintain the monitoring well development equipment in good condition.

5.10 Use safety cones when working in traffic areas.

Heartland Environmental Associates, Inc.

Standard Operating Procedures
Soil Borings / Soil and Groundwater Sampling

Rev. March 2013

1.0 Purpose

The purpose of this document is to describe the standard operating procedures (SOPs) for push probe soil boring oversight and sampling activities.

The procedures discussed in this SOP are limited primarily to the advancement of soil borings using push probe technology (e.g., Geoprobe®) or hand augers. Soil borings can be completed using a hollow stem auger and/or rotary drill rig. However, rotary drill rigs are typically used for the installation of monitoring wells and will thus be described in the SOP entitled "Monitoring Well Installation."

2.0 What Are Soil Borings and Why Are They Important?

Soil borings are discrete, vertical holes advanced into the subsurface. The environmental professional advances soil borings for the following purposes:

1. To determine the soil lithology in a discrete location.
2. For the collection of soil samples that can be submitted for laboratory analysis of chemical parameters. These soil samples are used to determine the presence/absence or nature and extent of chemical impacts at a site.
3. For the collection of soil samples that can be submitted for laboratory analysis of geotechnical parameters. These soil samples are used to evaluate the hydrogeologic and geochemical conditions of site-specific soil at a site.
4. For the collection of groundwater samples that can be submitted for laboratory analysis of chemical parameters. These water samples are used to determine the presence/absence or nature and extent of chemical impacts at a site.
5. For the installation of piezometers or monitoring wells. (This SOP is limited to procedures associated with soil borings only. The SOP entitled "Monitoring Well Installation" describes procedures associated with the installation of piezometers and monitoring wells.)

3.0 Equipment Needed for Soil Borings

The following equipment is needed to complete soil borings:

1. Site-specific field book with site map, pen

2. Safety cones
3. Water level meter/oil-water interface probe
4. Decontamination equipment
5. Nitrile gloves
6. Metal detector and shovel (during snow conditions)
7. Utility locate confirmation number
8. Site Health and Safety Plan
9. Soil sample screening device (i.e., HNu PID, OVA or Mini-RAE)
10. Ziplock baggies
11. Soil boring log sheet
12. Munsell color chart and other soil description material
13. Water sampling device (i.e., disposable bailer, peristaltic pump, Teflon bailer)
14. Sample containers (including pre-cleaned laboratory preserved containers)
15. Sample labels, chain-of-custody, tape, etc.
16. Cooler (including ice)
17. Sample filter (if necessary)

4.0 Before You Leave the Office

Below you leave, a certain level of planning should take place in order for a soil boring investigation to be successfully completed. Both the Project Manager and the field personnel have certain responsibilities that must be completed prior to the soil-boring event.

4.1 The Project Manager has the following responsibilities:

Must provide the following information (preferably in writing) to the field staff:

1. Site location and site map
2. Project Number
3. Labor hours budgeted for soil boring activities
4. Number of soil borings, including locations and preferred IDs
5. Depth to completion (e.g., water table, below water table, etc.)
6. Soil sampling requirements (what, where, how many, etc.)

7. Laboratory analyses requirements, laboratory data quality objectives, requested laboratory turn-around-time, and laboratory to be used for the project
8. Health and safety issues
9. Drilling subcontractor and time of arrival
10. Storage of soil cuttings (if appropriate)
11. Contact name at the site
12. Notify the client/site manager (or appropriate personnel) of the date and scope of soil boring activities.
13. Notify the appropriate utility locate service (e.g., Indiana811 in Indiana, JULIE in Illinois, Miss Dig in Michigan) at least two full business days prior to commencing the soil boring activities. Any non-member utilities (typically local water and sewer provider) need to be contacted separately.
14. Make sure the drilling contractor is aware of the surface to be drilled (e.g., asphalt or concrete). Some drillers require special bits to penetrate concrete.

4.2 The Field Personnel have the following responsibilities:

1. Make sure all necessary equipment is available.
2. Make sure screening device (e.g., HNu PID, OVA or Mini-RAE) is fully charged, calibrated (See Field Equipment SOP), and operational.
3. Make sure the Project Manager provides the information listed above and that the objectives of the soil borings are fully understood.

5.0 Soil Boring Procedures (Push Probe)

1. Record the company name of the drilling subcontractor and the name of the driller in the field book.
2. Locate the preferred soil boring locations; consider aboveground and underground utilities. Go over these locations with the drilling subcontractor to make sure you both are comfortable with them.
   - The locations of soil borings are **generally** flexible and can be moved within a few feet. However, any significant movement or elimination of a boring should be discussed with the Project Manager.
   - If you are unsure about the location of an underground utility, probe the location with a hand-held probe.

- Be sure to add any utilities that were previously not mapped to the site map and provide this information to the Project Manager.
- Drillers can sometimes be lazy. Do not let a driller talk you out of a boring because he or she says it cannot be done. If the boring is near utilities, probe potential locations with a hand-help probe or dig by hand if possible. If it is too wet, check with the Project Manager before abandoning the boring.
- If you hit a utility, notify the Project Manager immediately.

3. In areas of high vehicle traffic, it is necessary to use safety cones or barriers to protect the driller and yourself.
4. The Project Manager should inform you what boring identification numbers for the borings to be completed at the site. Refer to the site sampling and analysis plan for site-specific sampling protocol. Borings should be completed in sequential order. If a boring is abandoned, do not skip the boring identification number; change the numbers of the remaining borings.
5. Push-probe technology is just as its sounds. Pressure is applied to push a tube into the subsurface. The diameter of the tube is usually approximately 2-3”. Soil borings completed using a push probe are typically referred to as Geoprobe® borings. A Geoprobe® can be mounted on several types of vehicles including a pick-up truck, box truck, all-terrain vehicle (ATV) or pull-behind skid (typically used for indoor borings).
6. During the completion of the soil boring, the drilling contractor will provide you with soil samples as you proceed vertically into the subsurface. These are collected continuously at intervals of 2 or 4 feet, referred to as micro or macro sampling, respectively. If the Project Manager prefers a certain sampling interval, he should request this upon scheduling the Geoprobe®, otherwise, the drilling contractor will likely use a sampling interval they normally use and this will vary between contractors.
7. Regardless of the sampling interval provided by the drilling contractor, soil borings should be described in two-foot intervals. The collection of soil samples is described in Section 6. Unless instructed otherwise by the Project Manager, soil samples should be classified and logged as described in the SOP entitled “Field Description of Soils.” The appropriate gloves should be worn while classifying the soil from the soil boring.
8. Continue the soil boring to the depth requested by the Project Manager. Although the driller will provide you with the information, be aware of the total depth of the boring in case the driller makes a mistake. Remember, you are in charge not the drillers.
9. Generally, soil borings are completed to the depth at which groundwater is first encountered. Any deviations from the instructions of the Project Manager should be discussed with the Project Manager.

10. If the push probe experiences “refusal” (wouldn’t go any further), this should be documented on the boring log and in the field book. Also, document the likely cause of the refusal, such as the case when drilling in soil with large cobbles or very hard clay. If refusal occurs before achieving the depth requested by the Project Manager, notify the Project Manager before proceeding to the next boring.
11. Document the depth at which groundwater is encountered on the boring log and in the field book. Collect a groundwater sample from the boring at this time as described in Section 7. If the soil boring is left open for a period of time, record the water level again to determine if the water level in the boring has changed. If soils have low permeability, the collection of a groundwater sample may require the boring be left open for several hours or more. Make sure no surface water enters the boring prior to sample collection.
12. Upon collection of the groundwater sample from the boring, the driller should fill the boring hole with bentonite. Normally, bentonite pellets or chips are used for backfilling of soil borings. The bentonite backfill can be hydrated using tap water.
13. Measure the location of the soil boring using known and mapped features at the site. If instructed by the Project Manager, survey the elevation of the ground surface at the soil boring as described in the SOP entitled “Surveying Procedures.”

6.0 Push Probe Soil Borings – Soil Sample Collection Procedures

This section discusses general soil sample collection procedures during the completion of a push probe soil boring. The Project Manager should provide you with specific information regarding the number of samples to collect, the depth of the samples, analytical requirements, etc. Specific information regarding the depth and number of soil samples is not included in this information because these requirements are highly site-specific.

Soil samples are provided to you by the driller using the following procedure:

1. The driller advances the push probe vertically into the subsurface by the overall sample interval. (2 to 4 feet)
2. The driller then removes the rods from the subsurface one at a time. These rods are generally screwed together.
3. The sample tube is lined with a plastic liner. The soil sample is encased within this plastic liner. Once the driller removes the push tube from the subsurface, the plastic liner is removed from the tube and cut open by the driller.
4. The driller will then hand you the entire 2’ or 4’ sample. If the sample is a 4’ section, the sample should be split at an appropriate location into two 2’ intervals.
5. Keep in mind that the boring will be open between the time when the driller removes the rods and pushes the tube into the next sample interval. During this time, material from the sites of the boring will fall into the bottom of boring. This “waste” material is usually

easily identified and should not be considered as part of the actual sample interval at depth.

The following information should also be recorded in the field book or the boring log for each 2' sample interval during the completion of the soil boring.

- Sample Interval and Number (i.e.; 0-2' is Sample 1, 2-4' is Sample 2, etc)
- Time of collection for each 2' sample interval
- Percentage of recovery of each 2' interval (i.e.; 10% or 80% recovery). It is not uncommon for very poor recovery during soil borings.

For VOC samples, the sample should be collected from an undisturbed portion of the soil interval using the 5035A sampling protocol. 5035A samples may be collected using the Terra Core™ or the En Core™ sampler.

6.1 Terra Core™ Sampling Procedure

The Terra Core™ is a single use soil sample collection and transfer tool for soil sampling as described in USEPA SW-846 Method 5035. It is designed to easily take soil samples and transfer them to the appropriate containers for in-field chemical preservation. The Terra Core™ sampling tool is designed to collect moderately fine-grained samples of sand, silt, or clay. Due to grain size, it will not be possible to collect samples with a grain size larger than the core barrel. Un-cohesive soils may run out of the Terra Core™ sampling tool upon withdrawal from the soil core. With care, un-cohesive samples may still be collected by upending the device on withdrawal and then tilting the device into the sampling vial. However, this should be noted in the field book and boring log.

Terra Core™ sampling kits typically consist of:

1. The Terra Core™ single use sampling tool – a T-handle shape plastic tool for collecting 5-grams of soil and transferring the soil to a sample vial.

2. Two tared (weighed) 40-mL sampling vials with 5-mL each of Ultra Pure Blank Water and magnetic stir bars (Some laboratories may provide kits with sodium bisulfate preservative or no preservative at all. Consult with the Project Manager to make sure the proper kits are used).

3. One tared 40-mL sampling vial with 5-mL of methanol preservative.

4. One soil moisture sampling vial, usually 2-oz HDPE plastic or glass, but may be 4-oz capacity. Some kits may only provide a 40-mL unpreserved glass vial for soil moisture determinations.

To minimize loss of VOCs, soils must be retrieved and sampled as quickly as possible. Care must be taken to limit exposure and disaggregation of the soil. Collect soil sample immediately on opening the core barrel. Collection should be performed before lithologic logging. Sampling personnel should be ready to take samples immediately after the core is retrieved. Drill rig personnel should adjust their pace accordingly to allow collection of samples.

Upon opening the core barrel, a fresh surface should be scraped clean on the soil core. Have ready the sampling vials containing the appropriate preservatives. With the plunger seated in the handle, push the Terra Core™ into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 grams of soil. If the surface of a soil core has been exposed for more than a minute or two (due to an unforeseen delay, field screening to determine the interval to be sampled, etc.), a fresh surface should be scraped just prior to collecting the Terra Core™ sample.

Wipe all soil or debris from the outside of the Terra Core™ sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.

Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body, place the mouth of the sampler into the 40ml VOA vial, and extrude the sample by pushing the plunger down. Quickly cap the 40ml VOA vial before proceeding to the next vial. When capping the 40ml VOA vial, be sure to remove any soil or debris from the threads of the vial.

Collect the soil moisture sample last. Place at least 2 soil plugs into the soil moisture vial (a minimum of 10-grams of soil is required for a soil moisture determination). Label each vial with the sample ID, the time of collection, the sample date, the sampler’s initials, and the project ID. Place the sample vials in the 5035A kit carrier and place the carrier into a secure cooler with ice. It is important to label each vial individually, not just the carrier. The vials will be removed from the carrier at the laboratory and individual labels are necessary to prevent confusion. Record sample details in the field book and boring log.

If a second core is obtained before the first core has been logged, the second core should be sampled before finishing the logging of the first core. Do not use intermediate storage containers to hold soil for extended periods prior to sampling by Method 5035A.

6.2 En Core™ Sampling Procedure

The En Core™ sampling device is a disposable plastic sampling device, typically with a capacity of 5 grams, used to obtain undisturbed, unconsolidated material samples. No separate sampling kit is required. The sampling device containing the soil sample is submitted to the laboratory for analysis.

Remove the En Core™ sampler and cap from package and attach the T-handle to the sampler body. Make sure that the sampler is locked into the T-Handle before sampling.

Scrape the soil core surface to expose a fresh surface. Push the sampler into the freshly exposed soil until the O-ring is visible within the hole on the side of the T-handle. If the O-ring is not visible within this window, then the sampler is not full.

Extract the sampler and wipe the sampler sides with a clean paper towel or Kimwipe so that the sampler cap can be tightly attached.

While still locked into the T-handle, push the sampler cap on the head of the sampler with a twisting motion to secure it to the sampler body.

Remove the sampler from the T-handle and rotate the sampler stem counterclockwise until the stem locks in place to retain the sample within the sampler body.

Place the capped sampler into the re-sealable package and label the package with the sample ID, the time of collection, the sample date, the sampler’s initials, and the project ID.

Collect a soil moisture sample in a separate 2 or 4 oz. glass jar using a disposable plastic spoon or knife.

Place the sampler package in a secure cooler with ice. Record sample details in the field book and boring log.

6.3 Field Screening

The soil core should also be screened for organic vapors unless informed otherwise. A portion of each sample interval should be placed in a Ziplock baggie. The baggie should be sealed and labeled with the boring I.D. and the sample depth interval.

During cold weather conditions, place the Ziplock baggie with soil in a vehicle or warm place to allow the ambient temperature within the baggie to equilibrate.

Once the temperature within the baggie has been allowed sufficient time to equilibrate, open the baggie and screen the headspace within the baggie with the appropriate screening instrument (see the SOP entitled “Field Equipment Operation”). The screening value should be recorded in the field book and on the separate boring log sheet.

Based on the instruction provided by the Project Manager, collect the appropriate samples for laboratory analysis and record these submitted intervals on the boring logs and in the field book. If the volume of soil provided by the soil boring is insufficient, notify the Project Manager before eliminating a particular sample analysis. The soil samples should be properly labeled and stored in a secure, iced cooler as described in the SOP entitled “Sample Handling.”

Any extra soil may need to be drummed depending on the site and contaminant concentrations. This should be discussed with the Project Manager prior to leaving the office.

Again, generally, saturated soil samples are not collected (samples below the water level). **Do not collect a saturated soil sample unless specifically instructed by the Project Manager**.

7.0 Push Probe Borings – Groundwater Sample Collection

Water samples are typically collected from push probe soil borings in order to determine the extent of impacts at a site. Soil boring water samples are typically used to determine the placement of monitoring wells at the site.

Record the depth at which groundwater is encountered during completion of the soil boring in the field book and on the boring log.

Water samples from soil borings are typically collected using a peristaltic pump or a micro-bailer.

The Project Manager and the sampler should be aware of the following when collecting water samples from soil borings:

- Excessive solids may be present in the water sample. The solids can affect the metals concentrations in a water sample and can make it difficult to collect a VOC or BTEX/MTBE water sample requiring an acid preservative. In extreme cases, it may be necessary to eliminate the preservative from a soil boring water sample container in order to achieve zero headspace in the sample container. This reduces the holding time and should be discussed with the Project Manager as necessary.
- Order of sample collection. When sampling for multiple analytes, the sample procedure is to sample for the most volatile to the least volatile. VOCs would be sampled first, followed by SVOCs, PCBs, and metals. Sample collection shall follow the following protocol.

Sample Constituent (in order of collection)	Sample Method (SW-846)*	Sample Container Requirements	Sample Preservative Requirements	Additional Comments
1. Volatile Organic Compounds (VOCs)	8260	3 - 40 mL vials	HCl - lab prepared	No air bubbles, ice to 4°C
2a. Semi-Volatile Organic Compounds (SVOCs)	8270	1 - 1 liter, amber glass or 2 - 100 mL vials	None	Ice to <6°C
2b. Polynuclear Aromatic Hydrocarbons (PNAs or PAHs)	8270 SIM	2 - 100 mL vials	None	Ice to 4°C

Sample Constituent (in order of collection)	Sample Method (SW-846)*	Sample Container Requirements	Sample Preservative Requirements	Additional Comments
3. Polychlorinated Biphenyls (PCBs)	8080	1 - 1 liter, amber glass	None	Ice to 4°C
4. Metals (Various)	Various	Various	HNO_3	Filter vs. non-filter? See PM
5. Herbicides/ Pesticides	8081/8150	1 - 1 liter, amber glass	None	Ice to 4°C

- When collecting a water sample from an open soil boring, perched water may drain into the soil boring from above the water table and mix with the actual aquifer water. In cases where multiple water-bearing units are present, it may be necessary to collect a depth discrete water sample. There are several techniques available for the collection of depth discrete water samples. When necessary, these techniques should be discussed with a Project Manager.
- Make sure that VOC samples collected in 40-mL vials do not contain air bubbles. Extra headspace in the container will allow dissolved-phase constituents to volatilize into the headspace causing questionable results.
- Slightly overfill each 40 ml VOA vial with groundwater so that a positive meniscus forms above the bottle neck. Examine vials as they are filled for air bubbles. Gently tap vials to dislodge bubbles before filling completely. Take care not to overflow the bottle and lose preservative. If overflowing occurs, discard vial and collect sample in a new vial with preservative.
- Place cap with Teflon septum on each vial as filled. Turn the VOA vial upside down and check for air bubbles. Tap the bottom of the VOA vials to dislodge any bubbles that may have formed around the cap or sides. If bubbles are present, discard vial and collect a fresh sample in a new vial with preservative.
- If a VOA sample appears to effervesce or contains entrained gas bubbles, discard sample and collect a fresh sample in an unpreserved container. Note in fieldbook and chain of custody that the hold time will be reduced from 14 days to seven days. Notify laboratory that unpreserved samples were collected and that the permissable hold time is reduced.
- Collect samples from each well (use a new pair of gloves for each sample) in the order that the wells were purged. Record the sample collection times in the field book.
- If necessary, collect duplicate samples, equipment blanks, trips blanks, field blanks, matrix spikes/matrix spike duplicates as directed by the Project Manager.
- Upon collection of the sample, follow the SOP entitled "Sampling Handling Procedures."

Based on the instruction provided by the Project Manager, collect the appropriate water samples. In soils of low permeability, it may be necessary to leave the soil boring open for several hours or more in order to allow sufficient volume to enter the soil boring for sample collection. The water samples should be properly labeled and stored in a secure, iced cooler as described in the SOP entitled “Sample Handling.”

Do not allow a driller to talk you out of collecting a water sample. A driller will often tell you there is insufficient water for the collection of a water sample. This is often not the case. If necessary, leave the soil boring open for a period of time and periodically check the water recovery in the boring. At a minimum, attempt to collect the water sample and if the water volume is insufficient, record this in the field book.

8.0 Equipment Decontamination

During the completion of the soil boring, the driller should decontaminate the push tubes between each sample. This is typically done using two buckets next to the drill rig. One bucket will contain a water/soap solution and the other bucket will be used for rinse water.

Personnel should wear the appropriate gloves at all times during soil boring description and sampling. Gloves should be changed between the collection of each sample.

9.0 Other Manual Soil Boring Techniques

There are several alternatives for the completion of soil borings. These alternatives include the following:

- Hand Auger
- Post-Hole Digger
- Auger Drill
- Hammer Ram or Slide Hammer

Any of these may be appropriate for the completion of soil boring in certain scenarios. These tools should only be used under instructions from the Project Manager. Many of the procedures described in the SOP are still applicable when using these alternative-boring tools.

Any of the tools listed above should be properly decontaminated between samples and/or borings.

10.0 Use of Soil Borings for Installation of Piezometers and/or Monitoring Wells

There are scenarios that require the installation of a piezometer or monitoring well using a push probe boring.

A piezometer typically consists of one-inch diameter PVC screened across the water table. A piezometer is used for the measurement of water levels only. The installation of a piezometer simply entails inserting the one-inch PVC screen and riser into the open boring hole. Sand pack and a bentonite seal will be completed in a manner similar to the monitoring well installation procedures described in the SOP entitled “Monitoring Well Installation.”

A monitoring well is typically not installed in a push probe boring. However, there are certain scenarios where this may be appropriate. The installation of a monitoring well within a soil boring should be discussed with a Project Manager.

Standard Operating Procedures
Monitoring Well Sampling

Rev. March 2013

1.0 Purpose

1.1 The purpose of this document is to describe the standard operating procedures (SOPs) for collecting groundwater samples from monitoring wells.

2.0 What is monitoring well sampling and why is it important?

2.1 Groundwater samples are collected from monitoring wells to determine water quality at a given site at a particular time. The water quality is determined based on laboratory analysis, and then compared to the appropriate regulatory cleanup objective.

2.2 More specifically, the collection and analysis of groundwater samples allow the environmental professional to evaluate one or more of the following:

2.2.1 The presence/absence of impacts to groundwater at a site;

2.2.2 The chemicals of concern associated with impacts at the site;

2.2.3 The extent of impacts to groundwater at a site and/or adjacent sites; and

2.2.4 The performance of natural attenuation or groundwater remediation efforts.

3.0 Monitoring Well Sampling Equipment

3.1 The following equipment is required to complete monitoring well sampling:

3.1.1 Site-specific field book with site map, pen

3.1.2 Safety cones

3.1.3 Water Level Meter/Oil-Water Interface Probe

3.1.4 Decontamination Equipment

3.1.5 Nitrile gloves (worn at all times during gauging activities)

3.1.6 Socket or adjustable wrench (most wells require 9/16" socket)

3.1.7 Metal Detector and shovel (during snow conditions)

3.1.8 Monitoring well keys (where applicable)

3.1.9 Site Health and Safety Plan

3.1.10 Sampling device (i.e., disposable bailer, peristaltic pump, Teflon bailer)

3.1.11 Sample containers (including pre-cleaned laboratory preserved containers)

3.1.12 Sample labels, chain-of-custody, tape, etc.

3.1.13 Cooler (including ice)

3.1.14 Sample filter (if necessary)

3.1.15 Conductivity/pH/temperature meter (if necessary)

3.1.16 Dissolved Oxygen Meter or Kit (if necessary)

4.0 Overview of Monitoring Well Sampling Procedures

4.1 State and federal regulations (e.g., RCRA, CERCLA, VRP) require owner/operators of facilities to prepare and implement a written groundwater sampling and analysis plan (SAP). Everyone must read and understand the SAP prior to sampling. The project manager must indicate a SAP exists and train the employee prior to any sampling.

4.2 Typically, monitoring well sampling consists of the following components:

4.2.1 Groundwater Gauging

4.2.2 Monitoring Well Purging as described in Section 5.0.

4.2.3 Sample Collection as described in Section 6.0.

4.2.4 Sample Handling Procedures are described in Section 7.0.

4.3 An alternative method of monitoring well sampling using low-flow or micro-purge sampling equipment may be specified. Micro-purge sampling equipment and techniques are detailed in the Low-Flow Sampling SOP.

4.4 Groundwater gauging is almost always required prior to the completion of monitoring well sampling. **Always gauge all wells during every sampling event even if you are not sampling all wells, unless informed otherwise by your PM.** It is the Project Manager’s responsibility to inform you if any wells do not require sampling.

4.5 The Project Manager must provide instructions on what should be done when free product is detected.

4.6 Groundwater purging is also almost always required prior to the completion of monitoring well sampling. There are certain sandy sites that do not require purging if they meet certain conditions. It is the Project Manager’s responsibility to inform you if any wells do not require purging.

5.0 Monitoring Well Purging

5.1 Complete groundwater gauging activities at the site. Depth to water, depth to product, total well depth and instrument used information should be recorded in the field book.

5.2 Monitoring well purging consists of the removal of stagnant water present in the well prior to the collection of the sample. Purging is conducted in order to make sure a representative sample of the groundwater is collected. Stagnant water usually has different chemical characteristics from the natural formation groundwater surrounding the well.

5.3 For monitoring well purging purposes, it is recommended three well volumes of water are removed from the well. To determine the volume, calculate the height of the water column. The height of the water column is the difference between the depth to water in the well and the total well depth. Use the following rules-of-thumb to determine the three well volumes required for purging of a monitoring well. The rules-of-thumb below provide the user with the total purge volume in gallons.

5.3.1 **2-inch well purge volume =** (0.5) * Water Column Height

5.3.2 **4-inch well purge volume** = (2) * Water Column Height

5.3.3 **Example:**

5.3.3.1 **2-inch well; DTW** = 10.00 feet, Total Depth = 15.00 feet

5.3.3.2 **Water column height** = 15.00 - 10.00 = 5.00 feet

5.3.3.3 **Total Purge Volume (3 well volumes)** = (0.5) * 5.00 feet = **2.5 gallons**

5.3.4 Record the required and actual purge volume in the field book.

5.4 Typically, dedicated, disposable bailers are utilized for monitoring well purging. Other equipment options for monitoring well purging are briefly described at the end of this section. The appropriate gloves should be worn at all times during monitoring well purging.

5.5 Based on the total depth of the well, tie a string/rope to the bailer. **Be sure that this knot is tight so the bailer is not lost into the well.** If a bailer is lost in a well, it must be removed that day! The best way to remove a bailer from a monitoring well is to use fishing line and several weighted fish hooks (treble hooks work great) to hook the eye of the bailer.

5.6 Lower the bailer into the well and allow the bailer to fill with water. Remove the bailer from the well and pour the water from the bailer into a 5-gallon bucket. Use the 5-gallon bucket to estimate total purge volume.

5.7 If the site requires a dissolved oxygen measurement (DO) measurement, the DO measurement should be taken from the second bailer of water removed from the monitoring well. DO measurement procedures are included in the SOP entitled “Field Equipment Operations.” Record the DO measurement in the field book.

5.8 Continue the process of removing water from the well using the bailer. Make all efforts not to spill the groundwater onto the ground surface. Also, make sure the bailer or string does not touch the ground surface at any time in order to prevent any contamination of the well. Transfer all water from the bucket into labeled, 55-gallon drums (refer to the Investigation Derived Waste Management SOP).

5.9 If the total required purge volume can be removed, record this in the field book. If the monitoring well goes dry before removing the entire 3 well volumes, record this in the field book also. Typically, if the well goes dry, no additional purging is necessary. However, record this information in the field book and record the volume of water that was removed from the well. As soon as the well recovers sufficiently, the required samples should be collected.

5.10 Dispose of disposable bailers. (In some cases, disposable bailers may be dedicated for use in one well. If bailer is to be dedicated, place the disposable bailer inside the well and secure above the water level with the expandable cap). Use the bailer only for one well to avoid cross-contamination. Move to the next well with a new bailer and a new pair of gloves.

5.11 Optional purging equipment:

5.11.1 **Peristaltic pumps**—operates using mechanical peristalsis (creating vacuum); operates to depths up to 27 feet below ground surface.

5.11.2 **Whale pumps**—Operates to depths up to ~ 60 feet bgs

6.0 Sample Collection Procedures

6.1 Prior to leaving for the field, make sure the Project Manager provides you with the following information:

6.1.1 The monitoring wells to be sampled;

6.1.2 The constituents for which the samples will be analyzed;

6.1.3 The sample containers required for the sample analysis;

6.1.4 The Data Quality Objectives (DQOs) and turnaround time requested.

6.1.5 The laboratory to be used for the analysis;

6.1.6 The proper chain-of-custody to use; and

6.1.7 The proper parcel delivery service/airbill (e.g., Fed Ex, UPS, etc.) to use.

6.2 Developing all monitoring wells first should allow the monitoring wells to adequately recover prior to sampling. By recovering this means, the natural formation water should flow back into the well.

6.3 Each monitoring well should be sampled with new gloves.

6.4 If the site requires the measurement of natural attenuation parameters such as pH, temperature, conductivity, ORP, these parameters should be measured and recorded prior to sampling.

6.5 To collect the sample from the well, lower the dedicated bailer into the well and remove a bailer full of water. The following table includes a list of the parameters which water samples are typically analyzed for. This is not a comprehensive list as it includes those constituents commonly sampled. The table lists the constituents in the sampling order the sample method, container requirements, preservative requirements and additional comments. Generally, samples are collected in the order of the most volatile to least volatile constituents.

Sample Constituent (in order of collection)	**Sample Method (SW-846)***	**Sample Container Requirements**	**Sample Preservative Requirements**	**Additional Comments**
1. Volatile Organic Compounds (VOCs)	8260	3 - 40 mL vials	HCl - lab prepared	No air bubbles, ice to 4°C
2a. Semi-Volatile Organic Compounds (SVOCs)	8270	1 - 1 liter, amber glass or 2 - 100 mL vials	None	Ice to <6°C
2b. Polynuclear Aromatic Hydrocarbons (PNAs or PAHs)	8270 SIM	2 - 100 mL vials	None	Ice to 4°C
3. Polychlorinated Biphenyls (PCBs)	8080	1 - 1 liter, amber glass	None	Ice to 4°C
4. Metals (Various)	Various	Various	HNO_3	Filter vs. non-filter? See PM
5. Herbicides/ Pesticides	8081/8150	1 - 1 liter, amber glass	None	Ice to 4°C

6.6 Make sure that VOC samples collected in 40-mL vials do not contain air bubbles. Extra headspace in the container will allow dissolved-phase constituents to volatilize into the headspace causing questionable results.

6.6.1 Slightly overfill each 40 ml VOA vial with groundwater so that a positive meniscus forms above the bottle neck. Examine vials as they are filled for air bubbles. Gently tap vials to dislodge bubbles before filling completely. Take care not to overflow the bottle and lose preservative. If overflowing occurs, discard vial and collect sample in a new vial with preservative.

6.6.2 Place cap with Teflon septum on each vial as filled. Turn the VOA vial upside down and check for air bubbles. Tap the bottom of the VOA vials to dislodge any bubbles that may have formed around the cap or sides. If bubbles are present, discard vial and collect a fresh sample in a new vial with preservative.

6.6.3 If a VOA sample appears to effervesce or contains entrained gas bubbles, discard sample and collect a fresh sample in an unpreserved container. Note in fieldbook and chain of custody that the hold time will be reduced from 14 days to seven days. Notify laboratory that unpreserved samples were collected and that the permissable hold time is reduced.

6.7 Collect samples from each well (use a new pair of gloves for each sample) in the order that the wells were purged. Record the sample collection times in the field book.

6.8 If necessary, collect duplicate samples, equipment blanks, trips blanks, field blanks, matrix spikes/matrix spike duplicates as directed by the Project Manager.

6.9 Upon collection of the sample, follow the SOP entitled “Sampling Handling Procedures.” A brief overview of these procedures is included as Section 7.0.

6.10 Note in the field book and notify the Project Manager of any of the following:

6.10.1 Damage to monitoring well casing or protective casing

6.10.2 Missing or damaged expandable caps

6.10.3 Any unusual measurement or observation

6.10.4 Any unanticipated visitor to the site (clients/regulators)

6.10.5 Omission of scheduled well from sampling activities

6.10.6 Any accidents occurring on site during gauging activities

6.10.7 The detection of free product in wells not normally exhibiting free product

6.11 Close all monitoring wells and throw disposable bailers away. Close and label all drums. **Always record the number and type of drums left at the site.** Re-label if the labels become illegible.

6.12 Finally, during purging and sampling activities, people might inquire as to what you are doing. Please inform people that you are obtaining the measurement to groundwater. No additional information should be provided. If they persist, notify the Project Manager.

7.0 Sample Handling Procedures

7.1 This is a brief overview of sampling handling procedures as it pertains to the collection of monitoring well samples. See the SOP entitled “Sample Handling Procedures” for more detailed instructions.

7.2 Appropriately label each sample container immediately upon collection and place the sample container into a secured, iced cooler. If necessary, wrap the sample in bubble wrap for shipping to the laboratory.

7.3 Once sampling is complete, complete the chain-of-custody. Deliver the sample to the laboratory if local or prepare cooler for overnight shipment.

Heartland Environmental Associates, Inc.

Standard Operating Procedure
Low Flow Sampling

Peristaltic Pump
QED MP-20 Multi-parameter sonde, meter and flow-cell

Rev. March 2013

In accordance with IDEM recommendations, groundwater samples will be collected from the monitoring wells using a modified low-flow, micro-purge sampling method based on USEPA and IDEM guidance (USEPA document EPA/540/S-95/504, Low-Flow [Minimal Drawdown] Groundwater-Water Sampling Procedures, April 1996; IDEM Office of Land Quality [OLQ] Geological Service, Technical Memorandum, Short Review of the Micro-Purging Option for Monitoring Wells, June 3, 1998; and IDEM OLQ Geological Service, Technical Memorandum, The Micro-Purge Sampling Option, June 6, 2012).

A peristaltic pump is a type of positive displacement pump used for pumping fluids. The fluid is contained within a flexible tube fitted inside a circular pump casing fitted with a rotor with a number of rollers attached to the rotor. As the rotor turns, the rollers compress the tubing thus forcing the fluid to move through the tube. This process is called peristalsis.

A peristaltic pump suitable for use in micro-purge sampling will be equipped with a rheostat to vary the rotational speed of the pump from 0.1 to 10 liters/minute.

Intake tubing for the Peristltic Pump commonly consists of 0.19-inch (5 mm) ID / 0.25-inch (6 mm) OD Teflon® fluorinated ethylene propylene (FEP) tubing. Where allowed by project requirements, other materials (e.g. low-density polyethylene (LDPE) or high-density polyethylene (HDPE)) tubing) may be utilized in place of the Teflon® tubing. Peristaltic tubing commonly consists of silicone tubing with 0.25-inch (6 mm) inner diameter. Outer diameter depends on make and model of pump.

Note that the use of a peristaltic pump is not recommended for volatile organic sampling. Peristaltic pumps apply a suction on the water surface within the sample tubing that may cause degassing that results in loss of volatiles and a variation in pH. Changes in pH may cause changes in dissolved metals concentrations. The decision to use a peristaltic pump is dependent on the intended use of the data.

Prior to sampling event, ensure that equipment is operational, the power source is adaquate, and that metering equipment has been properly calibrated. Obtain monitoring well installation information to determine the well elevation, depth, and screened interval.

Procedures

1. Calibrate QED MP-20 multi-parameter sonde daily before commencing field activities. See MP-20 SOP for general procedures and calibration methods.

2. Maintain standard clean procedures. Use new nitrile gloves for each installation. Keep tubing bagged until needed. Do not let tubing contact ground. Do not re-use tubing (unless using tubing dedicated to that well). Decontaminate all equipment in contact with groundwater before installation.

2. Measure the depth to water in the monitoring well.

3. Calculate the length of tubing required to place the intake at the midpoint of the saturated portion of the well screen.

The pump intake should be at least two feet above the bottom of the screen and no less than 0.5-feet below the static water level. Record calculated tubing length on standard data sheet.

4. Cut pump intake and discharge tubing to length. Discharge tubing connects pump to flow-cell and is usually 2 to 4-feet long.

5. Replace pump peristltic tubing with clean new silicone tubing. Connect pump intake and discharge tubing to silicone peristaltic tubing. Attach with hose clamps, if necessary, to obtain firm airtight fit.

8. Gently feed tubing into well until intake submerged to proper depth. Do not agitate water. Straighten tubing before lowering to minimize scraping against well casing.

9. Insert water level probe and record water level and time on standard data sheet.

10. Connect pump to 12VDC power source (battery box or vehicle power socket).

12. Attach discharge tubing to pump and flow-cell. Attach discharge hose to flow-cell and drape in bucket. Use 3/8-inch tubing (or larger) for discharge hose. Using 1/4-inch tubing may cause a siphon effect that induces air leakage in the flow-cell that will cause false dissolved oxygen readings. Attach water quality sonde to flow-cell and meter. Meter will be started after filling flow-cell. If possible, shade flow-cell and tubing from direct sunlight to minimize heating of groundwater.

13. Start pump. Adjust flow rate. Flow rate must be one liter per minute or less. Fill flow-cell completely until water is discharging to bucket. Observe flow-cell to ensure that all air bubbles are evacuated from cell. After allowing three minutes to purge, measure flow rate using graduated cylinder and stopwatch. Record time, flow rate, and current water level in well.

14. Start multimeter. Record initial readings.

15. Record time, meter readings, water levels, and flow rates at three-minute intervals until stabilization occurs. Water level drawdown must not exceed 0.3 feet. Reduce the flow rate if drawdown is excessive.

The parameters measured for stability determination may be pH, temperature, specific conductivity, oxygen-reduction (redox) potential (ORP), dissolved oxygen (DO) or turbidity. Not all the parameters need be measured to determine stability; however, ORP, DO, or turbidity must be at least one of the parameters used to determine stability. Stability will be determined when three or more consecutive measurements do not vary more than the following:

pH	± 0.1 unit
Specific Conductance	± 3%
Temperature	± 3%
DO	± 10%
OPP	±10 millivolts
Turbidity	10 %

Once the specific parameter or parameters have been selected as stabilization parameters, the same stability parameter or parameters should be used to determine purge stability for all groundwater samples at the site, unless the selected stability parameter or parameters should prove to be impractical (i.e. if stability cannot be achieved after a reasonable time period of purging). If stability cannot be achieved within 1-hour of continuous low-flow purging, the purge may be considered complete, and the sample collection may proceed.

16. After achieving stabilization, proceed with sampling. Disconnect the pump discharge from the flow-cell to fill sampling containers. Do not fill sample containers from flow-cell discharge hose. The flow rate may be adjusted downward for sampling. Groundwater sample collection and sample handling should follow procedures detailed in Monitoring Well Sampling SOP and Quality Assurance/Quality Control, Sampling, Sample Handling & Chain of Custody Protocol SOP

17. Record total volume water purged on standard data sheets.

18. After sampling is complete, remove water level probe and tubing from the well. Disconnect pump intake and discharge tubing from pump. Remove silicone tubing from pump and dispose of tubing. If tubing is to be dedicated to the well, place tubing in a clean new plastic bag marked with the well ID for re-use.

20. Decontaminate the water level probe, multimeter sonde, DO Meter probe, and flow-cell with three rinses of deionized water only. Do not use Alconox on the sonde or flow-cell.

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Standard Operating Procedure
Instrument Calibration

QED MP-20 Multi-parameter Sonde and Meter

Rev. March 2013

The QED MP-20 Sonde is a multi-parameter water quality sensing device that may be used to determine stabilization of water chemistry during micro-purge groundwater sampling. Calibration of water quality detection equipment is necessary to ensure that water quality parameters are accurately measured, that stabilization of those parameters has actually occurred, and to verify the proper functioning of equipment.

The QED MP-20 Sonde is equipped with sensors to detect and measure pH, oxidation-reduction potential, specific conductance, dissolved oxygen, and temperature. It may also be optionally equipped with a turbidity sensor.

The Sonde is calibrated by attaching a calibration cup to the Sonde and then pouring a calibration standard into the cup then watching the meter readings for the parameter to be calibrated. When the readings stabilize, send the calibration information to the Sonde via the Meter. Then confirm the data calibration.

The Sonde has built-in checks for calibration acceptance. If for any reason the calibration for any parameter cannot be completed, the Sonde will continue to use the calibration from the last time that particular parameter was calibrated successfully. However, the reason the Sonde failed to accept the new calibration should be determined (faulty sensor, bad standard, low battery, mistyped standard value, etc.)

The QED MP-20 Sonde must be calibrated daily before use to verify the proper functioning of the instrument and to ensure that collected data is accurate and repeatable.

Rental equipment may have been calibrated before shipment. Verify calibration documentation is present and run calibration checks to ensure that equipment is operating properly and readings are within acceptance ranges.

Refer to instrument manual for detailed calibration instructions.

General Calibration Outline

Select a calibration standard
Turn off Sonde circulator to prevent splashing
Clean and prepare the sensors
Attach calibration cup

Thoroughly rinse the sensors by half-filling the calibration cup with deionized water and shaking the sensor to make sure each sensor is free from contaminants
Rinse the sensors twice with a small portion of the calibration standard and discard the rinse
Fill the calibration cup with the standard
Complete the calibration
Discard the used calibration standard. Do not attempt to reuse calibration standards.

pH Calibration

pH calibration is accomplished using a two-point calibration. Refer to MP-20 manual for procedure details. Set the Zero Point with a pH 7.0 calibration standard, set the Span Point with a pH 4.0 calibration standard. Verify calibration with pH 10.0 calibration standard. Reading should be between 9.8 and 10.2. Do not reuse calibration standards.

Oxidation-Reduction Potential (ORP)

Check the MP20 temperature in the Main Screen. Fill calibration cup with Zobell Solution and allow 60 seconds for stabilization. Set calibration using temperature compensation chart for solution.

Specific Conductance

Specific conductance calibration is a single point procedure. There are three standards available. Select a conductivity standard with conductivity similar to the expected site conductivity.

73.9 uS/cm2 Conductivity
717.8 uS/cm2 Conductivity
6668 uS/cm2 Conductivity

Clean the oval measurement cell on the specific conductance sensor with a small, non-abrasive brush or cotton swab before calibrating. Fill calibration cup with conductivity standard. Make sure there are no bubbles present. Set calibration.

Dissolved Oxygen

Saturated-Air Method also calibrates DO mg/L
Fill the Calibration Cup with deionized or tap water (specific conductance less than 0.5 mS/cm) until the water is just level with the o-ring used to secure the sensor membrane. Remove any water any water droplets from the membrane with the corner of a tissue. Turn the black calibration cup cover upside down (concave upward) and lay it over the top of the calibration cup. Determine the barometric pressure for entry as the calibration standard.

Local barometric pressure, BP, in mmHg can be estimated using:

BP = 760- 2.5(A/100) where A is the local altitude above sea level in feet.

If using the local weather bureau BP, remember these numbers are corrected to sea level. To calculate the uncorrected atmospheric pressure BP', use the following function:

BP' = BP-2.5(A/l 00) where A is the local altitude above sea level in feet.

Temperature

Factory set. No calibration possible. Test by immersing probe in water of known temperature and check readings.

Turbidity

This calibration uses a two-point calibration.

This first calibration will set the low end. Fill calibration cup approximately ¾ full of deionized water, shake then empty. Refill cup ¾ full of deionized water and wait 60 seconds. Set calibration to 0.0 NTU

Set high end calibration with the 100 NTU solution. Rinse calibration cup thoroughly with deionized water and then rinse with 100 NTU solution. Refill cup with 100 NTU solution to top of sensor. Make sure all bubbles are dispersed. Set upper end calibration to 100 NTU.

Check calibration with 50 NTU solution. Reading should be + or -5% + 1 NTU. For 50 NTU solution the reading should be between 48.5 and 53.5 NTU.

Calibration Failures

All sensors should be calibrated within factory specified acceptance ranges. Failure to calibrate may be due to improper procedures, dirty sensor probes, damaged membrane, or equipment failure. In case of calibration failure, clean probes, review calibration procedures, or replace DO membrane if needed. Perform calibration again.

If second calibration fails, the equipment may be malfunctioning. Return equipment to manufacturer (or supplier if equipment is rented) for repair. Obtain replacement equipment.

Heartland Environmental Associates, Inc.

Standard Operating Procedures
Sampling Equipment and Site Personnel Decontamination

Rev. January 2013

1.0 Purpose

1.1 The purpose of this decontamination standard operating procedure (SOP) is to maintain reusable equipment, keep impacted material on site and to protect the health of the sampler.

1.2 For project specific decontamination guidelines, refer to the site specific health and safety plan (HASP) .

2.0 General Guidelines

2.1 Obtain necessary decontamination supplies, including brushes, bowls or buckets; decontamination solutions.

2.2 Prepare a decontamination area at the project site. This area should be in a non-impacted area of the site. Place plastic on ground at decontamination area to prevent spills during decontamination.

2.3 When preparing to decontaminate field equipment, don a new pair of nitrile gloves to protect hands during decontamination.

2.4 Remove dirt and gross impacts from the sampling tools and equipment using a clean, stiff-bristle brush. Remove dirt using a phosphate-free detergent and water solution. If necessary, additional decontamination utilizing an isopropyl alcohol rinse should be conducted. Use of isopropyl alcohol rinse should be stated in the site specific sampling and analysis plan.

2.5 Following removal of dirt, rinse all sampling equipment with distilled water.

2.6 If the sampling equipment will not be immediately used after decontamination, wrap in aluminum foil or plastic bags to so that equipment is ready for next use.

2.7 Wash and rinse personal protective equipment (PPE) in same manner. If PPE is disposable, collect the disposable materials for proper disposal.

2.8 Wash and rinse decontamination equipment. Properly dispose of rinse water and disposable decontamination equipment.

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Standard Operating Procedures
Quality Assurance/Quality Control
Sampling, Sample Handling & Chain of Custody Protocol

Rev. January 2013

1.0 Purpose

1.1 Define the various quality assurance/quality control (QA/QC) samples typically collected in the field.

1.2 Describe sample collection and handling procedures up to point of delivery to the laboratory, including sampling labeling and chain-of-custody procedures. These procedures are necessary in order to make sure the sample results achieve the project's QA/QC objectives.

2.0 Why is QA/QC important?

2.1 A QA/QC program is important in order to make sure that the precision, accuracy, completeness and representativeness of a site's data are known and documented.

2.2 Typically, sites in the IDEM, the USEPA or RCRA Programs require a Sample and Analysis Project Plan (SAPP) and/or Quality Assurance Project Plan (QAPP) describing the project-specific sampling and quality objectives and procedures.

3.0 Types of QA/QC samples

3.1 The project manager should notify field personnel of the necessary QA/QC samples required for any sampling event. The necessary QA/QC samples will also be included in the SAPP for the site, if one is prepared. The purpose of this SOP is to provide the field personnel with a general understanding of the various types of QA/QC samples.

3.2 **Duplicates (or replicates)—**A duplicate sample involves the collection of a split sample from one location, depth or well. The actual sample and the duplicate sample are both submitted for laboratory analysis in order to evaluate the consistency of the laboratory's analytical method in reproducing results for the same sample. The duplicate also serves as a check on sample collection technique. Theoretically, the two samples should have very similar analytical results.

3.2.1 **Example**—An actual and duplicate water sample are to be collected from a monitoring well. The sample collection method for both samples will be the same. Four, 40-ml vials will be collected instead of the usual two. One sample will be labeled as normal. The duplicate sample will typically be identified as DUP-1 with no sample collection time. We do not want the lab to know which sample has been duplicated.

3.2.2 Typically, one duplicate sample per 20 actual samples is collected for any sample media but this frequency is project specific and should be determined and discussed with the Project Manager.

3.2.3 The duplicate sample should be handled in an identical manner to the actual sample and should be analyzed for the same laboratory parameters as the actual sample.

3.2.4 When possible, duplicate samples should be collected from locations that are known or anticipated to have impacts. It is not as beneficial to have a duplicate sample from a location that is non-detect for all laboratory parameters.

3.2.5 For non-volatile constituents, the entire sample (both the actual and duplicate) should be collected in a common container and then divided into the two samples.

3.2.6 Field personnel should identify the location of the duplicate sample in the field book since this will only be identified as a DUP on the chain-of-custody.

3.3 **Trip Blank—**A trip blank evaluates sample handling procedures. A trip blank is a laboratory-prepared 40-ml vial filled with distilled water. Trip blanks are submitted along with other soil and/or groundwater samples to be analyzed for volatile organic compounds. The trip blank(s) should be ordered from the laboratory for shipment in the sample cooler(s) prior to the sampling event. It is taken into the field, not opened and returned to the lab. The trip blank will remain in the sample cooler throughout the sampling event and will be submitted for laboratory analysis of VOCs in order to detect contamination during field handling, shipment or in the laboratory. The trip blank is typically identified as *TB-1* on the chain-of-custody. Typically one trip blank is included with each sample cooler.

3.4 **Equipment or Field Blank—**A field blank is collected in the field in order to determine if samples are exposed to contaminants during the sampling process from sampling equipment. These samples essentially evaluate the effectiveness of decontamination procedures.

3.4.1 **Example**—Water samples are being collected for a constituent via a peristaltic pump. The collection of an equipment blank would involve the collection of a sample of distilled water using the same procedures. In this example, the peristaltic pump would be used to collect a sample from a one-gallon container of distilled water. The sample containers and preservatives should be the same as the other samples in the sampling event. The equipment blank would then be submitted for laboratory analysis of the same contaminants for which the other samples are being collected. Ideally, the equipment blank should be non-detect for all sample parameters.

3.4.2 Equipment blank samples are typically identified as EB-1, EB-2, etc.

3.4.3 The frequency, locations and procedures to be used in the collection of equipment blanks should be included in the SAPP and should also be specified by the Project Manager. The frequency, locations and procedures used in the collection of equipment blanks should be recorded in detail in the field book.

3.5 **Matrix Spike/Matrix Spike Duplicates (MS/MSD)—**MS/MSD samples are collected at a designated frequency in the field. The expected impacts in the field samples are not a concern in the collection of MS/MSD samples. MS/MSD samples require the same sample volume, containers and preservatives as the actual samples. These samples are identified as *MS/MSD-1*, *MS/MSD-2*, etc. The MS/MSD samples are "spiked" at the laboratory with a known concentration of the contaminant being analyzed for in order to evaluate the effect of the sample matrix (soil, groundwater, sludge, etc.) on the accuracy, precision and sensitivity of the laboratory equipment and procedures. Again, the frequency and locations of MS/MSD samples will be described in the SAPP and should be directed by the Project Manager.

4.0 Sample Handling Procedures

4.1 Upon collection of the sample, the sample should be labeled as described in Section 5.0.

4.2 The following sample information should be recorded in the field book: sample I.D. as appearing on chain-of-custody, sample time, sample volume and container, sample preservatives and analytical methods for which the sample will be submitted.

4.3 If the sample collection method varied from other samples, this should also be recorded in the field book.

4.4 If being hand-delivered to the laboratory, the sample should be immediately placed in an iced, secure cooler.

4.5 If being shipped to the laboratory, the sample should be wrapped in bubble wrap or equivalent in order to protect it during shipment. All containers for one individual sample should be wrapped together. The sample should then be placed in an iced, secure cooler.

4.6 Upon collection of all samples from a particular site, a chain-of-custody should be completed as described in Section 6.0.

4.7 Field personnel are personally responsible for the care and custody samples until they are transferred or properly dispatched. Samples should remain on ice or in the refrigerator in the warehouse until delivery or shipping. **Do not leave water samples in a car during below freezing temperatures, they can and will break.**

4.8 Samples should be delivered or shipped to the laboratory as soon as possible.

4.9 When hand-delivering samples to the laboratory, the chain-of-custody should be signed as described in Section 6.0.

4.10 The following should be completed when shipping samples to a laboratory via Federal Express or other carrier:

4.10.1 All individual samples should be wrapped in bubble wrap or equivalent to prevent breakage during shipment.

4.10.2 Ice should be double-bagged in ziplock bags to prevent water leakage in the cooler. If water were to leak in the cooler it has the potential to affect the sample quality. Place as much ice in the cooler as possible. If the samples arrive at the laboratory at a temperature exceeding 4°C, the sample analytical result will be compromised.

4.10.3 Fill any remaining space in the cooler with bubble wrap or equivalent to prevent movement or shifting of the samples during shipment.

4.10.4 The chain-of-custody should be placed in a Ziploc bag and taped to the inside of the lid of the cooler.

4.10.5 Tape the cooler lid shut and place a custody seal on the cooler.

4.10.6 Send all samples priority overnight. If sending from the office, sample pick-up should be requested late in the day to minimize ice meltage. Also make sure that someone is calling for the pick-up. Do not leave samples in reception area for a long time awaiting pickup during summer weather.

4.10.7 If shipping samples for Saturday delivery, make sure this is marked on the air bill. Also make sure the laboratory is open on Saturdays prior to shipping. Always check with the Project Manager before you have to send out samples on Friday for Saturday delivery.

4.10.8 Consider holidays prior to shipping samples. Make sure the laboratory will be open.

4.10.9 When sampling multiple sites, it is preferred that each site's samples are shipped in its own cooler when appropriate.

4.10.10 Include the internal job number on the airbill to allow for proper tracking.

5.0 Sample Labeling

5.1 Upon collection of a sample, the sample should be properly labeled as identified in the Project QAPP and SAP. Most laboratories will provide sample labels to fill out. Each sample label at a minimum should include the following:

5.1.1 Internal Project Number (with task if applicable)

5.1.2 Analytical parameters and method number

5.1.3 Sampler’s name or initials

5.1.4 Sample ID

5.1.5 Date and Time

5.1.6 Preservative

5.1.7 Sample Media or Matrix – i.e., water, soil, sediment, sludge, air, etc.

5.2 The label should be filled out using a waterproof marker and should be legible.

5.3 The label can be affixed to the sample container using clear packing tape when necessary. Most provided sample labels should be self-adhesive.

5.4 Upon applying the label to the sample, the sample should be placed into the secured, iced cooler.

6.0 Chain-of-Custody

6.1 A chain-of-custody (COC) form should be completed to record the custody of every sample collected during every sampling event. A COC should accompany every shipment of samples to the laboratory in order to establish the documentation necessary to trace sample possession from the time of sample collection through analysis.

6.2 Each laboratory also has its own COC; however other forms of COCs may be provided.

6.3 If sampling multiple sites, each site should have its own COC.

6.4 Each COC must include the following:

6.4.1 Project name

6.4.2 The laboratory to which the samples will be submitted

6.4.3 Internal job number and task code

6.4.4 Sampler name or initials

6.4.5 Preservative used, if appropriate

6.4.6 Project manager to whom the results should be sent

6.4.7 Sample Description—This is the sample ID. Several types of samples have been included in the sample COC included as Attachment B. When submitting soil boring samples the depths should also be included in parenthesis.

6.4.8 Sample date and time—The time should be recorded in military time.

6.4.9 Composite vs. Grab—Typically, grab samples are collected, which is a sample from a single location. A composite sample is the mixing of sample from several locations and/or depths to create one “composite” sample.

6.4.10 Sample Matrix—Enter water, soil, sludge, sediment or air.

6.4.11 Analyses Requested—Include one analysis per column. Check or X each sample for which this parameter should be analyzed. Check with the Project Manager or SAPP to determine the appropriate sample analytical method. Some parameters have multiple analytical methods. Make sure it is clear which samples should be analyzed and which should not for a particular analysis. The Project Manager should tell you what analyses should be run.

6.4.12 Dates Results Requested By—This is also commonly referred to as the turnaround time (TAT). The turnaround time is the time allowed for the laboratory to provide the sample results. The typical turnaround time is 2 weeks. This can be entered in this location as 2 weeks or normal. The Project Manager should direct you if a quicker turnaround time is required.

6.4.13 Remarks—In this area the sampler should inform the laboratory of any unusual requests or problems associated with the sample collection. For example, if you were only able to collect one 40-mL vial for the BTEX sample due to recovery, then it should be noted in the Remarks section. The following can also be included in the Remarks section:

- Delivery method and temperature when shipped or when delivered.
- Sample containers and preservatives for each type of sample.
- Any specific instructions to the laboratory such as holding waste oil parameters awaiting the TPH results.

6.4.14 Temperature When Shipped—enter 4°C or actual temperature

6.4.15 Total # of Containers—include the total number of each type of container

6.4.16 Temperature Upon Arrival at Lab—When hand-delivering, make sure the laboratory fills in this box. Should be 4°C or less.

6.5 If you make any changes to the COC, cross item out with one line and initial. Then make change above or to the side of the cross-out.

6.6 Include Page 1 of 2 (or appropriate) at the top of each COC page.

6.7 Any change in possession of the samples should be recorded by signing the COC at the bottom of the page. If one person collects the samples but someone else delivers the samples to the lab, this should be reflected in the signatures. There should not be gaps in the signature times unless the samples are shipped overnight.

6.8 A representative of the lab should sign the last box (Received For Lab By) upon receipt at the laboratory. If hand-delivered, the laboratory personnel should also fill out the Temperature Upon Arrival at Lab box. The laboratory personnel should then give the red copy of the COC to the field personnel prior to leaving the lab. This COC copy should be given to the Project Manager.

6.9 When shipping samples overnight, the COC is placed in a ziplock bag and taped to the inside of the lid of the cooler. The red copy of the COC should be removed prior to shipping and given to the Project Manager.

6.10 Remember all COCs are legal documents (same as the field notes) and should be treated as such. The COC should be filled out completely and accurately. The COC is often the first place lawyers look to discredit sampling results.

Heartland Environmental Associates, Inc.

Standard Operating Procedures
Investigation Derived Waste Management

Rev January 2013

1.0 PURPOSE

1.1 To promote proper and consistent handling, storage, and disposal of waste generated during field investigations, and to prevent or minimize the potential for the spread of project site impacts.

2.0 EQUIPMENT LIST

2.1 Site-specific Health and Safety Plan (HASP), including site map

2.2 Personal Protective Equipment (PPE) appropriate for the tasks to be performed, and material to which contact will occur (see HASP)

2.3 Project Field Book

2.4 New 55 gallon drums and waste labels (both hazardous and Non-hazardous)

2.5 Indelible ink pens

2.6 Heavy duty plastic bags

3.0 PROCEDURES

3.1 General

3.1.1 Waste material, both solid and liquid, generated during field investigations may include material from decontamination, purged groundwater, PPE, soil, disposable sampling equipment and/or other hazardous and non-hazardous wastes.

3.1.2 Generated waste, other than decontamination fluid and purge water, will be sorted by media type, investigation area, and/or investigation event, and contained within new DOT approved 55-gallon drums securely stored on site. A label, identifying the waste as hazardous or non-hazardous will be affixed to each drum.

3.2 Decontamination Water and Purge Water

3.2.1 Decontamination water and purge water generated during decontamination or sampling activities will be contained in 5-gallon buckets that are placed on a plastic liner and transferred to DOT approved 55-gallon drums and labeled appropriately pending analysis of the water.

3.3 Personal Protective Equipment

3.3.1 Disposable PPE (Tyvek® suits, Nitrile gloves, etc.) will be collected and stored securely on-site in heavy-duty, plastic bags. Following analysis of sampling and decontamination liquid waste material, the PPE will be transported to an off-site treatment in the same manner as the liquid material, in accordance to applicable state and federal laws.

3.4 Soil Cuttings and Split Spoon/Core Liners

3.4.1 Soil cuttings and associated disposable sampling equipment (e.g., core liners) generated during sampling activities will be packaged in DOT-approved 55 gallon drum, lined with plastic film bags. Drums containing soil cuttings and core liners will be properly labeled, stored securely onsite waiting laboratory analysis for proper disposal. Date of collection, point of generation and drum identification number will be recorded in the project field book.

3.5 NAPL and NAPL/Fluid Mixtures

3.5.1 NAPL and NAPL/water mixtures generated during field activities will be placed in a DOT 55-gallon drum. The quantity of NAPL and NAPL/water mixture placed in the drum will be recorded in the project field book. In the event a significant amout of NAPL is present, a certified hazardous waste hauler will be contracted to remove the material directly from the site at that time.

3.6 Disposable Sampling Equipment

3.6.1 Disposable sampling equipment (disposable bailers, plastic tubing, etc.) to which little or no soil is adhered, will be collected and placed in plastic bags, placed in DOT approved 55-gallon drums and stored securely stored on site. The quantity of disposable sampling equipment placed in the drums will be recorded in the project field book. Following waste characterization, the disposable sampling equipment will be transported to the appropriate disposal facility according to applicable state and federal laws.

3.7 Miscellaneous Solid Wastes

3.7.1 Non-hazardous/special wastes that may be generated during field activities include paper, food containers and wrapping, aluminum cans, bottles, plastic bags, and other miscellaneous debris. This material will be contained in heavy duty plastic sacks for daily disposal in approved sanitary waste receptacles.

3.8 Temporary Drum/Container Labeling

3.8.1 Immediately upon placement of waste in a drum, a temporary label with the language, “This container on hold pending analysis. Do not tamper with container. Authorized personnel only,” will be applied. Information that will be added to the temporary label will include:

1) The accumulation start date;
2) The event name;
3) Waste origin (i.e., boring or excavation location, investigation area, etc.);
4) Media type (e.g., PPE and debris, soil, etc.); and
5) Drum identification number.

3.9 Waste Characterization

3.9.1 Wastes will be characterized in accordance with the SAP and appropriate state and Federal requirements. Collection of additional samples for waste characterization is dependent the analytical results of the associated soil and ground water and specific requests for the final disposal facility. Waste sample collection activities, if needed, should occur before field investigation activities are completed.

3.10 Record-Keeping and Labeling

3.10.1 Upon containment of waste into a storage container (55-gallon drum), a 90-Day Investigation-Derived Waste Log will be completed. At the end of each day, for each drum receiving waste that day, a record that includes the area/location of waste, type of waste, amount of waste added, and the remaining capacity in each drum will be entered into the log. A label will be affixed to the container so that the label can be read without moving the container.

3.10.2 Once a waste is characterized as hazardous, then a hazardous waste label will be applied to the drum in which the waste is contained. Any previous label will be removed or covered.

3.10.3 Once a waste is characterized as non-hazardous, then the original label will remain and disposal arrangements will be made.

3.11 Waste Disposal

3.11.1 Within the 90 day temporary storage time frame, a waste disposal determination will be made so that waste can be transported for final disposal.

3.11.2 If the waste is determined to be a hazardous waste, the appropriate TSD facility will be contacted and arrangements made for disposal. This activity will be done in accordance to state and Federal requirements and laws. Associated manifest documenting transportation and disposal will be completed.

3.11.3 If the waste is classified as a Special Waste in the State of Indiana, again, disposal arrangements with the appropriate landfill will be made and manifests developed based on facility requirements.

3.11.4 Other wastes, such as general refuse, will be collected and disposed in the proper sanitary receptical.