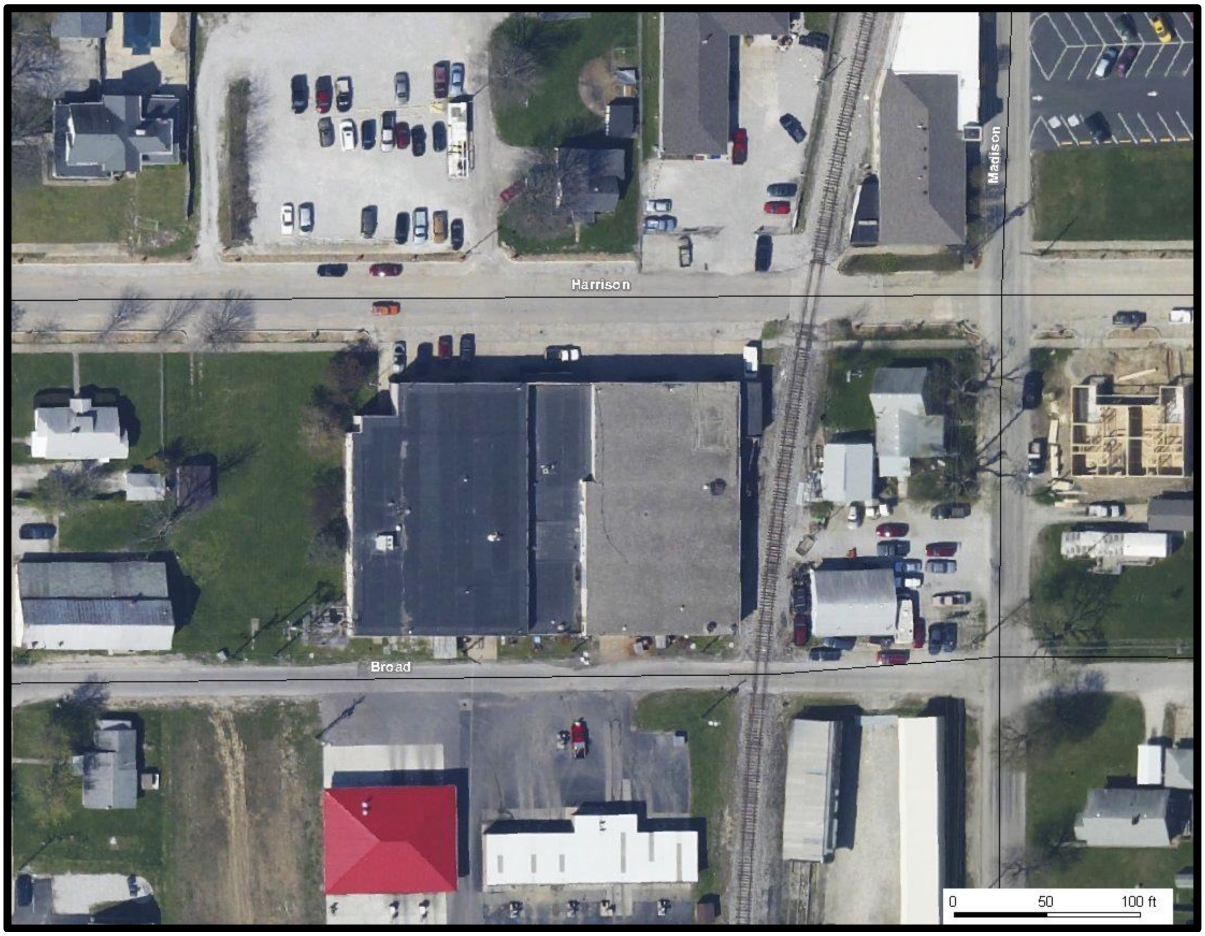
REMEDIATION WORK PLAN ADDENDUM

Indiana Machine Works
135 East Harrison Street
Mooresville, Indiana
VRP Site #6051201



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VRP Site #6051201

February 23, 2015

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EXECUTIVE SUMMARY

Indiana Technology Development (ITD, aka Indiana Machine Works (IMW)) and Labeco Properties, LLC entered into a Voluntary Remediation Agreement (VRA) with the Indiana Department of Environmental Management (IDEM) on July 28, 2006, pursuant to Indiana Code (IC) 13-25-5-8 for the purpose of addressing subsurface contamination at the IMW facility located at 135 East Harrison Street, Mooresville, Brown Township of Morgan County, Indiana (Site, **Figure 1**). The Voluntary Remediation Program (VRP) number for the Site is #6051201. The objective of the project is to obtain a Certificate of Completion from IDEM and a Covenant Not to Sue from the State of Indiana Governor's Office. The purpose of this Remediation Work Plan (RWP) Addendum is to propose a Site-specific closure strategy consistent with IC 13-25-5-8.5 (as amended by House Enrolled Act (H.E.A.) 1162 (2009)) and the IDEM Remediation Closure Guide (RCG) in order to protect human health and the environment.

This RWP is designed to:

- Reduce on-Site contaminants in soil, groundwater and indoor air to Site-specific closure levels, "remediation goals";
- Reduce off-Site impacted groundwater by treating source areas and dissolved plume chlorinated volatile organic compounds (CVOC) ; and
- Manage potential exposure pathways to residual potential contaminants through recording Environmental Restrictive Covenant(s) (ERC).

This document is being submitted as an addendum to the following RWPs previously submitted for the Site:

1) *Additional Site Investigation and Remediation Work Plan*, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated August 18, 2008;
2) *Further Site Investigation and Remediation Work Plan*, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated January 31, 2013; and

3) *Interim Remediation Work Plan*, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated September 23, 2013.

The previous 2008 RWP received IDEM approval and successful public noticing, but was never implemented. The 2013 RWPs did not receive IDEM approval, were not submitted for public comment, and were also not implemented.

<u>Constituents of Concern</u>

Analytical results from soil and groundwater sampling indicate the main Site constituents of concern (COC) are as follows:

- Tetrachloroethylene (PCE) and its daughter breakdown products trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), and vinyl chloride (VC).
- 1,1,1-Trichloroethane (1,1,1-TCA) and its daughter breakdown product 1,1-dichloroethane (1,1-DCA).

<u>Site Hydrogeology</u>

The Site hydrogeology is comprised of the following three hydrostratigraphic units (a low-permeable surficial unit is not included):

- Hydrostratigraphic Unit #1 (Shallow Groundwater)
  - Saturated alluvial deposits consisting of sands interbedded with discontinuous loams.
  - Approximate depth interval is 6 to 16 feet below ground surface (ft bgs).
  - Depth to groundwater is 3.5 and 8 ft bgs.
  - Groundwater flows to the east-southeast.

- Hydrostratigraphic Unit #2
  - Dry to moist, dense silty clay loam and clay loam.
  - Approximate depth interval is 16 to 26 ft bgs.
  - Inhibits vertical migration of COC to Hydrostratigraphic Unit #3.

- Hydrostratigraphic Unit #3 (Deep Groundwater)
  - Saturated, fine to medium, dark brown to gray sand.
  - Approximate depth interval is 22 ft bgs to at least 40 ft bgs.
  - Depth to groundwater is 21 and 27 ft bgs.
  - Groundwater flow to the southwest.

COC Source and Distribution

Two source areas along the southern perimeter of the Site's main building have resulted in a groundwater plume (Plume #1) located below the southeasten corner of the Site's main building. A second, independent plume (Plume #2) is located northeast of the Site, and is believed to have originated in the floor drains and/or the basement sump located in northern portion of the Site and conveyed to soil and groundwater from spills that were captured by the drain system and then leaked from the combined sewer line under E. Harrison Street.

Exposure Pathway Analysis and Site Cleanup Goals

An ERC will be recorded for the Site that restricts land use to commercial/industrial and prohibits the potable use of groundwater. Therefore, residential exposure pathways and the ingestion of groundwater at the Site are considered incomplete, and the only complete exposure pathway for potential on-Site receptors is vapor intrusion (VI) for industrial land use. Consequently, Roux proposes Site-specific cleanup goals for on-Site locations based on the Vapor Intrusion Groundwater Screening Levels (VIGWSL) for industrial land use.

Troy Risk, Inc. (TRI) conducted a potable well survey and determined that there are no potable wells installed on off-Site properties impacted by COC originating from the Site (TRI, 2013); therefore, ingestion of groundwater is currently incomplete for off-Site receptors. ERCs for off-Site locations may be evaluated to prohibit potable use of groundwater in the future; however, at this time, Roux proposes the Tap Water Screening Levels as the cleanup goals for off-Site locations.

Proposed Remedial Action

Based on the results of a successful In-Situ Chemical Reduction (ISCR) pilot test conducted at the Site, Roux proposes enhanced reductive dechlorination (ERD) via ISCR to treat both groundwater plumes, similar to the successful pilot test approach.

If post-remedy performance groundwater monitoring demonstrates that clean-up goals have been obtained and residual concentrations are stable or declining, Roux will prepare a Remedial Action Construction Completion Report (RCR) documenting the work has been implemented as presented in this RWP and request a Certificate of Completion from IDEM and a Covenant Not to Sue from the State of Indiana Governor's Office.

1.0 INTRODUCTION AND BACKGROUND

1.1 Site Location and History

VRP Site #6051201, referred to Indiana Machine Works, is located 135 East Harrison Street, Mooresville, Indiana in Brown Township of Morgan County (**Figure 1**). The Site consists of approximately 1.1 acres improved with three buildings: one approximately 28,500 square foot (ft^2) main building constructed of mason block construction on a concrete slab (**Figure 2**) and two wooded utility sheds (approximately 160 ft^2 combined). The buildings encompass approximately 70 percent of the total footprint of the Site, and the remainder of the Site is covered with concrete pavement in areas to the north and south of the main building (approximately13 percent of the total footprint), and grass-covered or gravel areas along the eastern, southern and western perimeters of the main building (approximately 17 percent of the total footprint). The Site is bounded on the west by residential properties; on the south by a car wash and lumber yard (across Broad Alley); on the east by an automobile repair shop and residential property (across the Conrail Railroad line); and on the north by a residential property, automobile repair shop, and parking lot (across Harrison Street).

Historically, the Site was part of several lots owned and operated by Laboratory Equipment Corporation. The aggregate property included three main buildings: the Administrative Building/Machine Shop located at 156 East Harrison Street, the Storage Building located at 142 East Harrison Street, and the Engineering/Fabrication/Assembly building (the current Site main building), located at 135 East Harrison Street. Additionally, the aggregate property consisted of outdoor storage areas, two parking lots, a trash incinerator, and various access driveways.

The lots were vacant land or housed residences until the 1960's. From 1962 to 1966, Laboratory Equipment Corporation purchased the lots and developed the land for metal fabrication operations. In 1983, Labeco Properties, Ltd purchased the property and leased it to Indiana Machine Works, Inc. (now Indiana Technology Development, Inc.) until 2005 as a metal fabrication and machining shop. Currently, the main Site building is leased to Advance Aero for aircraft repair and machining.

The general topography of the Site is relatively flat with an approximate surface elevation of 690 feet above mean sea level. There are no surface water bodies located on-Site. The East Fork of White Lick Creek is the nearest surface water body, which is located approximately ¾ miles east of the Site (A&W, December 2001).

The property is serviced by public utilities including municipal potable water, sanitary sewer, and storm sewer. Natural gas, sanitary sewer, storm sewer, and communications cable are all located within a utility corridor in Broad Alley, along the southern boundary of the Site (**Figure 2**). Additionally, water, sanitary sewer, and storm sewer are located on Harrison Street, along the northern boundary of the Site, and a mega-fiber optic cable is located along the eastern edge of the Conrail Railroad line, east of the Site.

1.2 Regional Geology and Hydrogeology

Regional soils consist primarily of Wisconsinan-age glacial till, glacial outwash and loess. A thin layer of outwash was deposited over the till in some areas. The texture of the till is predominantly loam, but in some areas it is sandy loam or clay loam. Layers of sand, loamy sand, and gravel are also common. Generally, the till is firm and compact due to compaction by glacial ice that covered it. These till deposits are predominantly calcareous, and generally extend approximately 50 ft bgs to bedrock. Bedrock consists primarily of the Borden Group, which is composed of gray argillaceous siltstone and shale. Fine-grained sandstone and discontinuous lenses of limestone are also common.

Regional groundwater occurs in the more permeable sediments within the drift aquifer and within the fractures of the underlying bedrock aquifer. According to the Morgan County Soil Survey, the seasonal high water table may be as shallow as one to three ft bgs in winter and early spring. Regional surface drainage is mostly through ditches that discharge into either the east or west forks of White Lick Creek, or through the City's storm water drainage network.

1.3 Previous Investigations

In 2001, Alt & Witzig Engineering, Inc. (Alt & Witzig) performed a Phase I Environmental Assessment of the six lots that comprised the original Laboratory Equipment property and recorded the following for the main building of Site:

- Engineering offices in the western portion of the building, a sandblasting room along the eastern portion of the building, and assembly, fabrication, painting, and testing in the central portion of the building;
- The building was serviced with floor drains that connect to the sanitary sewer;
- There was stained concrete flooring in the building; and
- There was stained soil east of the building.

Alt & Witzig reported that overflow oil and previous use of parts washing solvent may have accumulated in floor drains.

From 2001 to 2005, Alt & Witzig conducted Phase II soil and groundwater subsurface investigations to evaluate the areas of concern identified in the Phase I ESA. Alt & Witzig detected CVOC in soil and groundwater in the southeast corner of the Site building. From 2005 to the present, TRI conducted additional subsurface investigations to delineate the vertical and horizontal extent of the CVOC groundwater plume. TRI also conducted slug testing and a VI assessment to characterize the Site. Key findings from Site investigations conducted to date are summarized in the sections below.

1.3.1 Site Geology

The Site geology is comprised of a surface layer of brown silty clay loam to a depth of approximately 6 ft bgs, which is underlain by sands with interbedded, discontinuous loams and silt loams to a depth of approximately 16 ft bgs. A continuous layer of dense, silty clay loam is present at approximately 16 to 22 ft bgs, underlain by a fine to medium sand to a depth of at least 40 ft bgs (termination of the deepest boring). A generalized geologic stratigraphic column and hydrogeologic cross-sections of the Site are provided as **Figures 3 through 6.**

1.3.2 Site Hydrogeology

Site hydrogeology is described by the following three hydrostratigraphic units. The low-permeable surficial unit is not included, as it is not a unit that transmits water other than through infiltration into the uppermost hydrostratigraphic unit.

Hydrostratigraphic Unit #1 (Shallow Groundwater)

- Saturated alluvial deposits consisting of sands interbedded with discontinuous loams.
- Approximate depth interval is 6 to 16 ft bgs.
- Depth to groundwater is 3.5 and 8 ft bgs.
- Groundwater flows to the east-southeast.
- Hydraulic gradient ranges from 0.032 ft/ft to 0.049 ft/ft.
- Hydraulic conductivity (K) values range from 2.19 x 10^{-5} centimeters per second (cm/sec) to 4.23 x 10^{-4} cm/sec, with a geometric mean of 4.70 x 10^{-5} cm/sec.
- Groundwater velocity is estimated between 1.6 and 44 feet per year (ft/yr), with a geometric mean velocity of approximately 9 ft/yr.

Hydrostratigraphic Unit #2

- Dry to moist, dense silty clay loam and clay loam.
- Approximate depth interval is 16 to 22 ft bgs.
- Inhibits vertical migration of COC to Hydrostratigraphic Unit #3.

Hydrostratigraphic Unit #3 (Deep Groundwater)

- Saturated, fine to medium, dark brown to gray sand.
- Approximate depth interval is 22 ft bgs to at least 40 ft bgs.
- Depth to groundwater is 21 and 27 ft bgs
- Groundwater flow to the southwest.

- K values range from 3.84 x 10^{-5} cm/sec to 9.04 x 10^{-5} cm/sec, with a geometric mean of 5.89 x 10^{-5} cm/sec.

Groundwater elevation maps for shallow and deep groundwater are provided as **Figures 7** and **8**, respectively, for the most recent sampling event conducted in August 2014.

1.3.3 Contaminants of Concern

Analytical results from soil and groundwater sampling indicate the Site COC are as follows:

- PCE and its daughter breakdown products TCE, cis-1,2-DCE, and VC.
- 1,1,1-TCA and its daughter breakdown product 1,1-DCA.

1.3.4 Source Areas

Soil and groundwater impacts appear to be sourced by two distinct areas along the southern perimeter of the Site's main building and one area in the northeastern corner of the building. Suspected Source Area 1, located in the southeastern corner of the building, was used for painting operations. Suspected Source Area 2 is reported to have historically been used as a staging area for drums of waste solvent awaiting off-site disposal. Suspected Source Area 3, in the northern portion of the Site building, was used as a receiving bay for production materials. A separate room in Suspected Source Area 3 was used as a sand-blasting area and is the only portion of the Site with a basement which had a sump that may have captured impacted groundwater from Source Areas 1 and 2. However, the pathway for COC to reach soil and groundwater from Source Area 3 is likely from spills that were captured by the drain system and then leaked from the combined sewer line under E. Harrison Street. Source Areas are outlined in **Figure 2**.

1.3.5 Groundwater Plumes

Two groundwater plumes (Plume #1 and Plume #2) have been identified at the Site (**Figures 9** and **10**). Plume #1, located below the southeasten corner of the Site's main building, is believed to have originated from suspected Source Areas 1 and 2. Plume #2, located northeast of the Site, is believed to have originated in the floor drains and/or the basement sump located in Suspected Source Area 3. The floor drains and sump in this area are connected to the municipal storm sewer system. It appears that COC entered into the storm sewer and traveled east due to gravity drainage. The resulting plume may be a result of a break or joint failure in the storm sewer pipe and migration through the utility corridor.

1.3.6 Vapor Intrusion Assessment

Troy Risk conducted an analysis of the VI exposure pathway by collecting soil gas samples at the residential and commercial buildings east (downgradient) of the Site. Analytical results indicate COC originating from the Site are below VI screening levels.

2.0 CONCEPTUAL SITE MODEL

2.1 Potential Contaminant Exposure Pathway Analysis

An ERC will be recorded with Morgan County Deed Recorder's office for the Site to ensure that the property is restricted to commercial/industrial use in the future and the potable use of groundwater is prohibited. Consequently, residential exposure pathways and the ingestion of groundwater at the Site are incomplete. Therefore, the only complete exposure pathway for potential on-Site receptors is VI for industrial land use.

TRI conducted a potable well survey and determined that there are no potable wells installed on off-Site properties impacted by COC originating from the Site (TRI, 2013); therefore, ingestion of groundwater is currently incomplete for off-Site receptors. ERCs for off-Site locations may be evaluated to prohibit potable use of groundwater in the future; however, at this time, residential exposure pathways, including VI and future ingestion of groundwater are potentially complete for off-Site receptors.

2.2 Site-Specific Cleanup Goals

Based on the potentially complete exposure pathways discussed in **Section 2.1**, Roux proposes the following Site-specific cleanup goals in accordance with IDEM's Remediation Closure Guide (2014 Tables):

- <u>On-Site</u>: Industrial Vapor Intrusion Groundwater Screening Levels (VIGWSL)*
  - PCE: 0.47 milligrams per liter (mg/L)
  - TCE: 0.038 mg/L
  - 1,2-DCE: Not Established (NE)
  - VC: 0.035 mg/L
  - 1,1,1-TCA: 54 mg/L
  - 1,1-DCA: 0.55 mg/L

*Note: Vapor Intrusion may be evaluated via soil gas and/or indoor air analytical results as an alternative to groundwater results.

- Off-Site: Tap Water Screening Levels*
  - PCE: 0.005 mg/L
  - TCE: 0.005 mg/L
  - 1,2-DCE: 0.07 mg/L
  - VC: 0.002 mg/L
  - 1,1,1-TCA: 0.2 mg/L
  - 1,1-DCA: 0.024 mg/L

*Note: If ingestion of groundwater is prohibited via off-Site ERC's the residential VIGWSL will be the proposed Site-specific cleanup goals for off-Site locations.

2.3 Proposed Areas of Remediation

In order to delineate the areas for remedial action, Roux compared the most recent groundwater analytical results to the proposed Site-specific cleanup goals listed in **Section 2.2**. On-Site groundwater concentrations are compared to the Industrial VIGWSL and off-Site groundwater concentrations are compared to the Tap Water Screening Levels and the Residential VIGWSL on **Table 1, Table 2, Figure 9,** and **Figure 10**. The proposed remediation areas are depicted on **Figure 11**.

3.0 REMEDIAL ACTION FEASIBILITY ANALYSIS

TRI completed a remediation feasibility study (FS) analysis as part of the two previous RWP submittals:

1) *Additional Site Investigation and Remediation Work Plan*, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated August 18, 2008; and

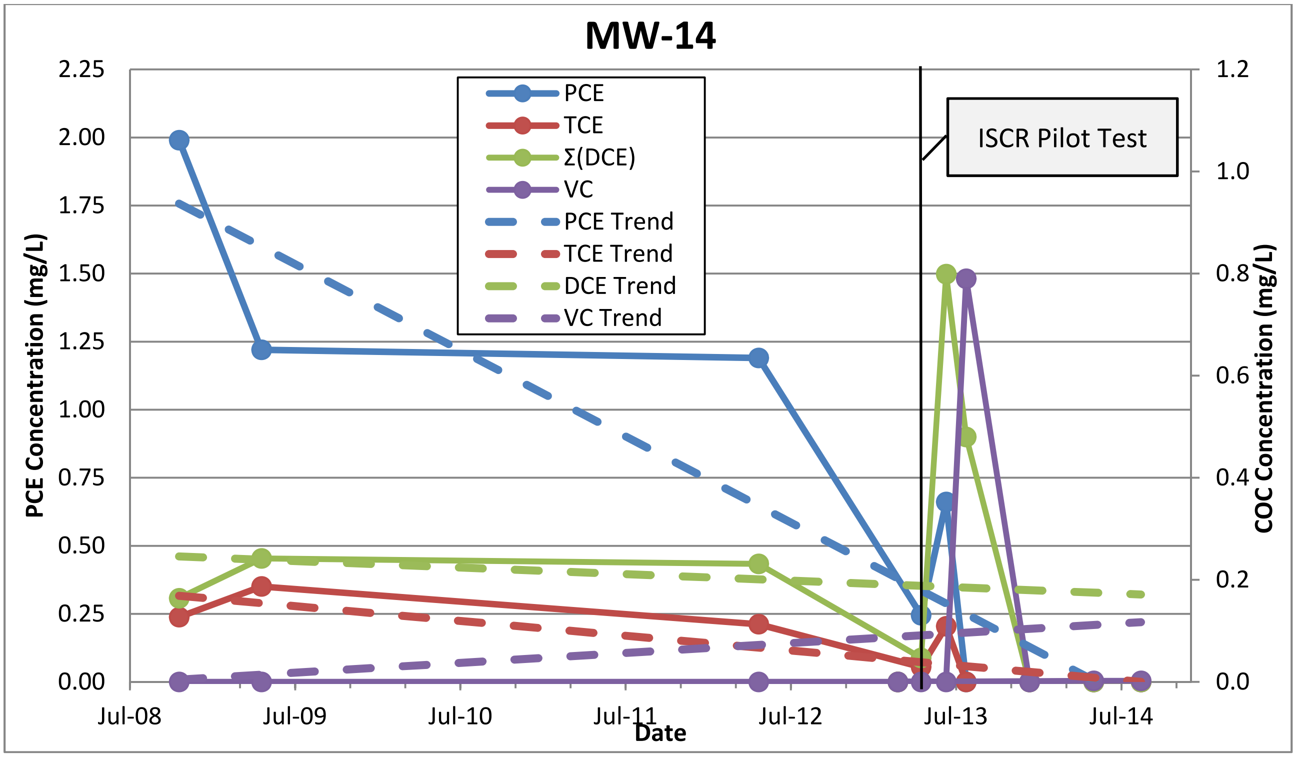
2) *Further Site Investigation and Remediation Work Plan*, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated January 31, 2013;

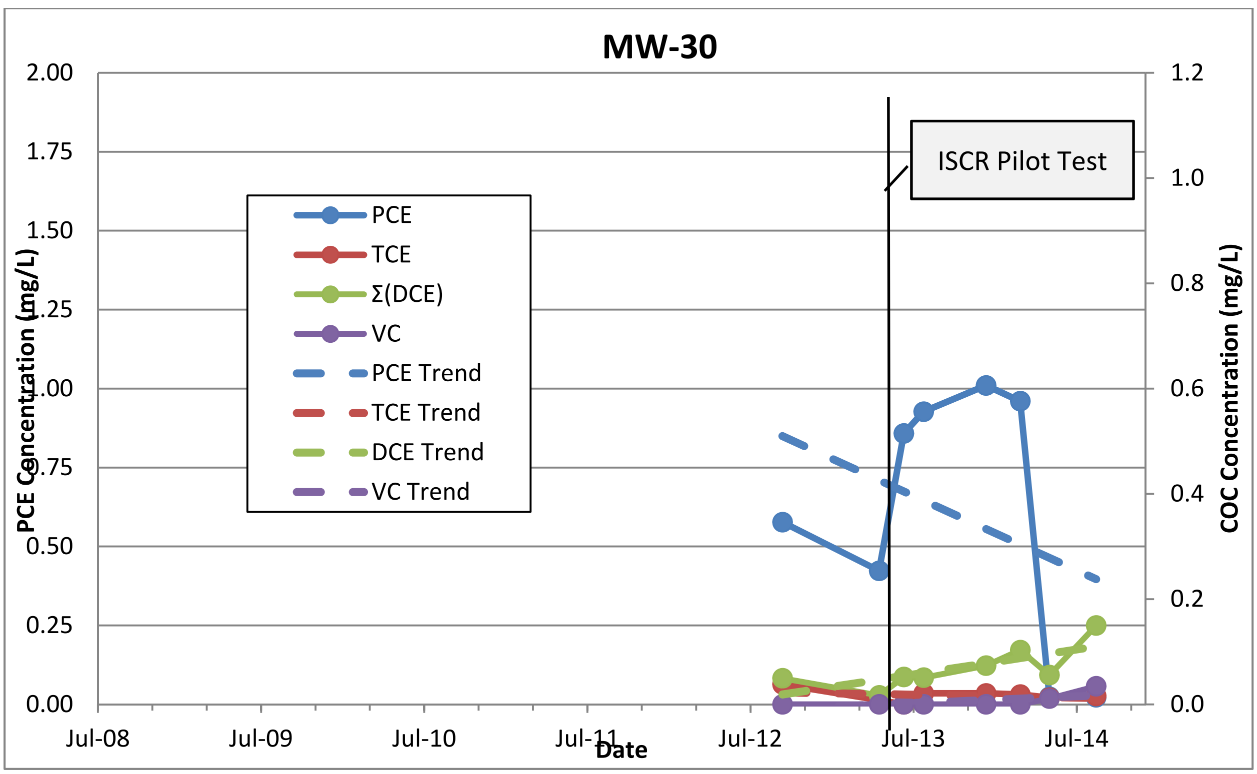
Based on the results of the FS, TRI implemented pilot testing for a multi-phase extraction (MPE) approach for Plume #1 and an In-Situ Chlorination Reduction (ISCR) approach for Plume #2. The MPE pilot test was focused on determining extraction well design criteria (i.e. vacuum radius and well spacing) and did not evaluate contaminant reduction goals. Results from the ISCR pilot test indicated that ISCR can effectively meet the clean-up goals. More specifically, the groundwater analytical results at monitoring wells within the ISCR pilot test area (MW-14 and MW-30) are as follows:

- At MW-14 (located directly within the ISCR pilot test area) concentrations of PCE and TCE were reduced to below laboratory detection limits (less than 0.005 ug/L). Concentrations of daughter breakdown products cis-1,2-DCE and VC initially increased as the parent compounds were reduced; however, within 6 months, concentrations of all COC were below laboratory detection limits.

- At MW-30 (located approximately 30 feet downgradient of the ISCR pilot test area), PCE and TCE were reduced 96 percent and 58 percent to 0.022 ug/L and 0.016 ug/L, respectively. Concentrations of daughter breakdown products cis-1,2-DCE and VC have increased as the parent compounds were reduced; however, Roux anticipates that with additional time and full-scale ISCR treatment with adequate amendment to treat the entire plume, COC will be effectively reduced to clean-up goals.

The following figures illustrate the temporal trends at MW-14 and MW-30:


MW-14
PCE Concentration (mg/L)
COC Concentration (mg/L)
Date
ISCR Pilot Test
PCE
TCE
Σ(DCE)
VC
PCE Trend
TCE Trend
DCE Trend
VC Trend
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Jul-08
Jul-09
Jul-10
Jul-11
Jul-12
Jul-13
Jul-14


MW-30
PCE Concentration (mg/L)
COC Concentration (mg/L)
Date
ISCR Pilot Test
PCE
TCE
Σ(DCE)
VC
PCE Trend
TCE Trend
DCE Trend
VC Trend
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Jul-08
Jul-09
Jul-10
Jul-11
Jul-12
Jul-13
Jul-14

Additional information pertaining to the ISCR pilot test is included in the following reports previously submitted to IDEM:

1) *In-Situ Chemical Reduction Implementation Plan – Plume 2,* Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated December 28, 2012;

2) *Response to IDEM Comments*, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated April 23, 2013

3) *ISCR Pilot Test Results,* Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated October 21, 2013

4) *Updated ISCR Pilot Test Results*, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated January 31, 2014; and

5) *ISCR 307-Day Post-Injection Pilot Test Results,* Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated March 28, 2014.

4.0 REMEDIATION PLAN

4.1 Institutional and Environmental Controls

The specific activities and land use restrictions proposed for IDEM's review pursuant to IC 13-14-2-8(b) (2009), are the following:

1) The Site should not be used for any residential purpose, including, but not limited to, residences, daily care or educational facilities for children (e.g., daycare centers for children or K-12 schools; and

2) Groundwater at the Site shall not be extracted and/or used for any purpose, including, but not limited to, human consumption, gardening, industrial purposes, or agriculture, except that groundwater may be extracted as part of an environmental investigation or remediation project.

An example ERC including these restrictions is included as **Appendix A**.

4.2 Enhanced Reductive Dechlorination via ISCR

Roux proposes to use ERD via ISCR to treat groundwater at the Site (Plumes #1 and #2). Roux proposes to contract with Redox Tech, LLC in order to mix and inject Provect-IR™ to promote ERD in Plume #1 and #2 areas. Provect-IR™ is a mixture of Zero-Valent Iron (ZVI), hydrophilic organic carbon sources, natural anti-methanogenic compounds, chemical oxygen scavengers, as well as vitamin and mineral sources. The corrosion of the ZVI yields ferrous iron and hydrogen, both of which are reducing agents. The hydrogen gas produced is also an excellent energy source for a wide range of bacteria. This product is designed to promote reductive dechlorination of CVOCs present in soil and groundwater. Data sheets for Provect-IR™ are presented in **Appendix B**.

Provect-IR™ promotes ISCR conditions for fast and effective destruction of targeted CVOC and is the only ISCR amendment reagent to simultaneously inhibit the production of methane during the requisite carbon fermentation processes (US Patent Office Scalzi *et al*, 2013, 2014). This promotes more efficient use of the hydrogen donor while avoiding negative issues associated with elevated methane (CH_4) in groundwater, soil gas, and indoor air.

The hydrophilic organic components of Provect-IR™ can be viewed as cellulose and hemicellulose which undergoes hydrolysis to yield glucose. Hydrogen gas (H_2) is produced during glucose fermentation via several enzymatic pathways, depending on site conditions and microbial populations.

Glucose + $6H_2O \rightarrow 6CO_2 + 12H_2$
Glucose + $2H_2O \rightarrow$ 2Acetate + $2CO_2 + 4H_2 + 2H^+$

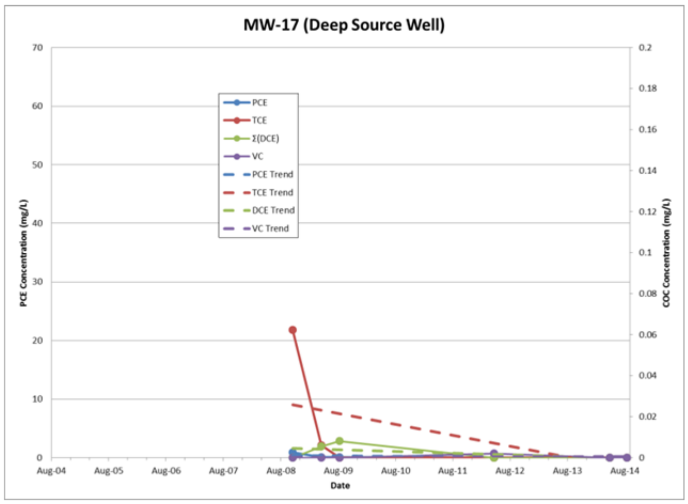
The maximum amount of H_2 that can be generated from a carbon source is about 0.18 moles H_2/ gram (g) substrate or 0.36 g H_2/g substrate. Provect-IR™ also contains ZVI which corrodes in water and produces hydrogen and hydroxide (OH^-) resulting in an increase in pH and decline in redox potential (Eh):

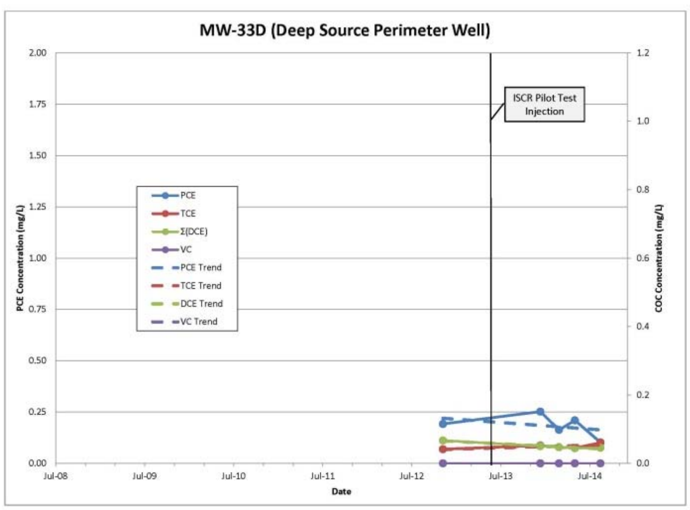
$$Fe^0 + 2H_2O \rightarrow Fe^{2+} + H_{2(aq)} + 2OH^-$$

Hydrogen gas evolution from ZVI will occur independently of the presence of organic compounds in the site water. Approximately 0.036 g H_2 will be released from ZVI itself. Provect-IR™ quickly helps promote anaerobic reducing geochemical conditions. Biodegraded calcium propionate provides a fast release rate and will liberate high amounts of total organic carbon (TOC) (greater than 1,000 mg/L) for an estimated 100 to 200 days. Next, the relatively more biodegradable components of the kelp and organic plant materials will liberate moderate levels of TOC (greater than 200 mg/L) for approximately 1 year. Subsequently, the more slowly degraded carbon moieties will liberate lower levels of TOC (e.g. >50 ppm) over approximately 2 years (depending on aquifer flow and geochemical conditions).

Roux proposes to deliver the Provect-IR™ via direct push injections (Geoprobe®) on a 12 to 15-foot horizontal injection point spacing. Amendment will be injected at a vertical increment of approximately 1 to 2 feet at each injection location from the top of the water table to the top of Hydrostratigraphic Unit #2 (approximately 4 to 16 ft bgs) in order to provide full treatment of Hydrostratigraphic Unit #1. Roux recommends terminating the ERD injections at the top of

Hydrostratigraphic Unit #2 in order to avoid compromising the integrity of the aquitard (which is inhibiting the vertical migration of CVOC into the underlying Hydrostratigraphic Unit #3). Treatment of Hydrostratigraphic Unit #3 will be achieved by treating Hydrostratigraphic Unit #1. As a contingency, Roux will continue to evaluate the CVOC trends in the shallow and deep wells in order to consider supplemental ISCR treatment in Hydrostratigraphic Unit #3 in plume areas #1 and #2. As illustrated in the following figures, in Plume Area #1, the PCE concentration trend in well MW-17D, indicates greater than 98 percent decrease from 0.870 mg/L (11/2008) to 0.00966 mg/L (08/2014). In Plume #2, PCE concentrations well MW-33D have remained stable.





The exact location and number of ERD injections will be dependent on building accessibility and field conditions; however, Roux estimates the following (**Figure 11**):

Plume #1 (South Plume)

- 41 injection points
- 15,700 pounds (lbs) of Provect-IR^{TM} mixed with potable water to form a slurry volume of 5,700 gallons.

Plume #2 (North Plume)

- 18 injection points
- 1,200 lbs of Provect-IR^{TM} mixed with potable water to form a slurry volume of 450 gallons.

Roux estimates the work will be completed in approximately 2 to 3 weeks. Previously executed access agreements for proposed off-site remedial work areas are presented in **Appendix C**. Roux will contact the off-site property owners and establish revised access agreements as necessary. Following amendment injections, each injection boring will be backfilled with bentonite pellets/chips and grade will be restored with like materials (i.e. asphalt/concrete or soil patch). Additionally, the ERD injections will be focused along the underground utility corridors that may be providing preferential contaminant flow paths. To facilitate this objective, Roux intends to contract with a private utility locating company to help field check/map the underground utilities prior to ERD remediation using electromagnetic and ground-penetrating radar techniques and visual assessment.

4.3 Methane Monitoring

Although Provect-IR^{TM} includes natural anti-methanogenic compounds and monitoring conducted by TRI following the ISCR pilot test indicated methane concentrations did not pose a potential explosion risk, Roux proposes to conduct additional methane monitoring after full-scale implementation as an extra safety precaution. Roux will monitor groundwater and soil gas concentrations in accordance with IDEM's Guidance, *Addressing Methane at Anaerobic Bioremediation Sites* (February 2014) to ensure that methane groundwater concentrations remain below 10 milligrams per liter (mg/l) and soil gas concentrations remain below 10% of the lower explosive limit (LEL) of 5% methane.

On a quarterly schedule for one year following full-scale implementation, Roux will conduct the following methane monitoring:

- Groundwater samples collected from at least one source well and one sentinel well from each plume for methane analysis via RSK 175 Modified.
- Soil gas samples collected adjacent to the building slabs at the Site, 205 E Harrison, and 207 E Harrison via a methane detector.
- Soil gas samples collected from the backfill of adjacent sewer lines via a methane detector.

4.4 Post-Remediation Groundwater Performance Monitoring

After completion of the ISCR amendment injections as described above, an approximate 6-month equilibration period will be considered, and then post-remediation performance monitoring will be implemented. Roux proposes Site-wide groundwater monitoring and sampling on a quarterly basis for one year followed by a semi-annual basis for two years (8 total sampling events). Sampling procedures will be performed in accordance with the existing Sampling and Analysis Plan (SAP) (**Appendix D**) for the Site consistent with previous sampling events. Groundwater sampling will be performed in accordance with USEPA's *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, EPA/540/S-95/504,* April 1996 guidelines and the IDEM's *Micro-purge Sampling for Monitoring Wells* technical memorandum, dated January 8, 2003. The wells will be purged until field parameters (pH, temperature, specific conductivity, oxidation-reduction potential [ORP] and dissolved oxygen [DO]) have stabilized. Field parameters will be measured using a multi-parameter meter equipped with a flow-through cell.

Groundwater samples will be analyzed for VOCs using US EPA Method 8260B. Roux also proposes to submit groundwater samples from select monitoring wells for supplemental geochemical parameter analysis (e.g. sulfate, sulfide, alkalinity, total organic carbon (TOC), and dissolved gases (ethane, ethane, and methane)) to help evaluate aquifer geochemical conditions following ISCR treatment. We estimate supplemental geochemical sampling at up to two (2) wells in each plume area.

The VOC sample results will be compared to remediation goals proposed for the Site as discussed in Section 2.2. Plume behavior and stability will be evaluated using multiple lines of evidence including, but not limited to: plume trend analysis (mass, flux, plume stability), time of travel, flow direction and elevation variability, and age of plume. The following monitoring well network is proposed for the first year, and modifications may be proposed for future years based on analytical results and ongoing trend evaluations:

<u>Plume #1:</u>
Background Well: MW-1
Source Wells: MW-4, MW-12, MW-17, MW-31
Sentinel Wells: MW-16, MW-19, MW-22, MW-32

<u>Plume #2:</u>
Background Well: MW-23
Source Wells: MW-13, MW-14, MW-29, MW-30, MW-33D
Sentinel Wells: MW-8, MW-25, MW-26R

The results of the groundwater sampling and plume stability monitoring program will be summarized in Annual Groundwater Monitoring Reports submitted to IDEM. The pilot test results indicated that the ISCR amendment successfully reduced both parent and daughter products in the vicinity of the injections without a buildup of vinyl chloride in the aquifer. Based on the success of the pilot test, Roux does not anticipate residual vinyl chloride to be problematic following full-scale remedy implementation; however, if the groundwater data indicates that vinyl chloride is not being reduced to ethene, then Roux will consider supplemental remedial activities (i.e. a second phase of ISCR injections in the affected area of the plume) and/or additional institutional controls such as off-site ERCs.

4.5 Vapor Intrusion Monitoring

Although paired soil gas/indoor air monitoring previously conducted by TRI indicated vapor intrusion is not a risk, Roux plans to conduct additional monitoring as an extra safety measure. The supplemental paired sampling will be conducted at off-site commercial and residential home properties where the VIGWSL are exceeded.

4.6 Quality Assurance Project Plan (QAPP)

A Site-specific Quality Assurance Project Plan (QAPP) is included as **Appendix E**. The QAPP has been developed to incorporate relevant RCG guidance for characterization of the nature and extent of Site contamination and quality assurance/quality control program in accordance with RISC Technical Guidance Table 3-3.

4.7 Health and Safety Plan (HASP)

A Site-specific Health and Safety Plan (HASP), as required by the Occupational Safety and Health Administration (OSHA) under Hazardous Waste Operations & Emergency Response, 29 CFR 1910.120, has been developed to guide proposed remedial activities that will be implemented at the Site. The HASP identifies potential work hazards, information on safe working practices when working in potentially hazardous situations, and appropriate safety equipment.

The HASP incorporates Site information, emergency contact names and phone numbers, emergency hospital location, a map illustrating the route to the hospital, Site specific hazards, and Material Safety Data Sheets (MSDS) for Site-specific COC. The plan establishes a specific chain of command and responsibilities, and will be on Site whenever work described in this RWP is being performed. All personnel working at the Site will be required to read and sign the HASP. A copy of the Site-specific HASP is included as **Appendix F.**

4.8 Community Relations Plan

Roux has prepared a Community Relations Plan for the Site, which follows the guidelines described in the IDEM Nonrule Policy Document, WASTE-0049-NPD, dated March 8, 2001. This plan identifies the property owners, registered neighborhood organizations, and sensitive community institutions (i.e. schools, health care facilities, child care centers, etc.) within 2 miles of the Site. A copy of the Site-specific Community Relations Plan is included in **Appendix G**.

4.9 Proposed Implementation Schedule

Roux has selected preferred remediation contractors and will procure the necessary permits to complete the proposed ISCR remediation activities at Plume #1 and #2 areas.

In preparation to implement the proposed RWP activities, Roux will execute necessary subcontracts with our preferred remedial construction contractor, remediation vendor, off-Site fixed laboratories, and surveyor. Once these contracts are established, the following activities and estimated durations will include:

1) ERD via ISCR – 2 to 3 weeks
2) Post-Remedy Performance Groundwater Monitoring (minimum 6 months following groundwater remediation) – 3 years

4.10 Remediation Completion Report

Following implementation of the post-remedy performance groundwater monitoring, Roux will prepare a Remedial Action Construction Completion Report (RCR) documenting the work has been implemented as presented in this RWP. The RCR will include:

- Description of RWP implementation methods and procedures;
- Photographic log of work activities;
- ISCR injection documentation and boring locations;
- Groundwater performance monitoring and analytical results; and
- Plume stability demonstration.

4.11 Remedial Cost Estimate

Roux has prepared an itemized cost estimate to implement ISCR treatment at Plumes #1 and #2 areas and perform post-remedy groundwater monitoring and reporting based on the tasks presented in this RWP Addendum (**Table 3**).

5.0 REFERENCES

Indiana Department of Environmental Management, Remediation Closure Guide with 2014 Screening Level Tables, 2014.

Indiana Department of Environmental Management, *Addressing Methane at Anaerobic Bioremediation Sites, February 2014.*

US EPA, Integrated Risk Information System (IRIS) for Tetrachloroethylene (PCE), February 10, 2012.

Additional Site Investigation and Remediation Work Plan, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated August 18, 2008.

Further Site Investigation and Remediation Work Plan, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated January 31, 2013.

In-Situ Chemical Reduction Implementation Plan – Plume 2, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated December 28, 2012.

ISCR Pilot Test Results, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated October 21, 2013.

Updated ISCR Pilot Test Results, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated January 31, 2014.

ISCR 307-Day Post-Injection Pilot Test Results, Indiana Machine Works, 135 East Harrison Street, Mooresville, Indiana, Troy Risk Inc., dated March 28, 2014.

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TABLES

Table 1. On-Site Monitoring Wells
Groundwater Analytical Data for Contaminants of Concern
Indiana Machine Works
135 East Harrison Street, Mooresville, IN

Sample ID	Screen Interval (feet)	Date	PCE and Daughter Products (mg/L)				TCA and Daughter Products (mg/L)	
			PCE	TCE	cis-1,2 DCE	VC	1,1,1-TCA	1,1-DCA
Industrial VIGWSL [1]			**0.47**	**0.038**	**NE**	**0.035**	**54**	**0.55**
On-Site Shallow Monitoring Wells								
MW-1	10-20	10/13/2004	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		1/25/2005	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		7/1/2005	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		7/19/2007	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		11/6/2008	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/2/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/7/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-2	10-20	10/13/2004	**1.1**	**0.083**	**0.400**	<0.002	**0.032**	**0.013**
		1/25/2005	**0.770**	**0.057**	**0.270**	<0.002	**0.028**	**0.016**
		7/1/2005	**0.680**	**0.048**	**0.200**	<0.002	**0.034**	**0.018**
		7/19/2007	**2.27**	**0.191**	<0.005	<0.002	**0.200**	**0.0402**
		11/6/2008	**1.17**	**0.0909**	**0.117**	<0.002	<0.005	**0.0221**
		5/2/2012	**0.301**	**0.0278**	**0.0638**	<0.002	**0.0428**	**0.013**
		5/7/2014	**0.308**	**0.0272**	**0.0555**	<0.002	**0.083**	**0.0225**
		8/20/2014	**0.239**	**0.0203**	**0.0527**	<0.002	**0.0582**	**0.0185**
MW-3	10-20	10/13/2004	**0.200**	**0.018**	**0.180**	**0.035**	**0.180**	**0.089**
		10/13/2004 DUP	**0.230**	**0.026**	**0.130**	**0.026**	**0.200**	**0.07**
		1/25/2005	**0.480**	**0.026**	**0.170**	**0.027**	**0.300**	**0.13**
		1/25/2005 DUP	**0.450**	**0.028**	**0.180**	**0.028**	**0.310**	**0.13**
		7/1/2005	**1.10**	**0.11**	**0.180**	**0.03**	**0.410**	**0.1**
		7/1/2005 DUP	**1.20**	**0.12**	**0.096**	**0.13**	**0.160**	**0.052**
		7/19/2007	**0.504**	**0.102**	**0.363**	**0.0622**	**0.418**	**0.349**
		11/6/2008	**1.34**	**0.29**	**0.222**	**0.0486**	**0.436**	**0.23**
		11/6/2008 DUP	**0.994**	**0.381**	**0.231**	**0.0173**	**0.417**	**0.222**
		5/2/2012	**1.20**	**0.222**	**0.0981**	**0.00909**	**0.258**	**0.0888**
		5/7/2014	**1.22**	**0.139**	**0.0353**	**0.00230**	**0.145**	**0.015**
		8/20/2014	**1.35**	**0.180**	**0.0997**	**0.0121**	**0.226**	**0.101**
MW-4	10-20	10/13/2004	**68.0**	**0.026**	**0.028**	**0.014**	**6.800**	**3.9**
		1/25/2005	**31.0**	<0.25	<0.25	<0.1	**1.600**	**0.85**
		7/1/2005	**30.0**	<1.0	<1.0	<0.4	**2.100**	<1.0
		7/19/2007	**19.5**	**0.0864**	<0.005	**0.00894**	**1.630**	**0.466**
		11/6/2008	**21.7**	<0.25	<0.25	<0.1	**0.925**	**0.555**
		5/2/2012	**21.6**	**0.167**	**0.0126**	<0.002	**0.461**	**0.208**
		5/6/2014	**29.6**	**0.0529**	<0.005	<0.002	<0.005	**0.201**
		5/6/2014 DUP	**30.6**	**0.0527**	<0.005	<0.002	**0.312**	**0.194**
		8/20/2014	**30.8**	**0.104**	**0.0895**	**0.0211**	**0.734**	**0.766**
		8/20/2014 DUP1	**30.7**	**0.099**	**0.0900**	**0.0214**	**0.742**	**0.800**
MW-13	6-16	7/19/2007	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		11/6/2008	**0.0114**	<0.005	<0.005	<0.002	<0.005	<0.005
		5/6/2009	**0.0265**	<0.005	<0.005	<0.002	<0.005	<0.005
		5/2/2012	**0.0304**	<0.005	<0.005	<0.002	<0.005	<0.005
		5/6/2014	**0.0151**	<0.005	<0.005	<0.002	<0.005	<0.005
		8/20/2014	**0.0138**	<0.005	<0.005	<0.002	<0.005	<0.005
MW-18	5-15	11/6/2008	**43.5**	**0.093**	**0.0102**	<0.002	**2.570**	**0.544**
		5/2/2012	**0.768**	<0.005	<0.005	<0.002	**0.00976**	<0.005
		5/7/2014	**5.21**	<0.005	<0.005	<0.002	<0.005	<0.005
		8/20/2014	**0.798**	**0.00622**	<0.005	<0.002	**0.0299**	**0.00762**
MW-20	5-15	11/6/2008	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/2/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/6/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-21	5-15	11/6/2008	**0.0886**	<0.005	**0.0397**	<0.002	**0.0127**	**0.00817**
		5/1/2012	**0.161**	<0.005	**0.0346**	<0.002	**0.0134**	**0.00675**
		5/6/2014	**0.139**	<0.005	**0.0315**	<0.002	**0.0133**	**0.00560**
		8/19/2014	**0.125**	<0.005	**0.0333**	<0.002	**0.0119**	<0.005
MW-23	5-15	8/27/2009	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/1/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/6/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005

Bold exceeds method detection limit
Yellow highlighting indicates value exceeds the Industrial VIGWSL
mg/L = Milligrams per Liter
(1) Industrial VIGWSL = Vapor Intrusion Groundwater Screening Level for Industrial Land Use (IDEM RCG, 2014)

Table 1. On-Site Monitoring Wells
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Indiana Machine Works
135 East Harrison Street, Mooresville, IN

Sample ID	Screen Interval (feet)	Date	PCE and Daughter Products (mg/L)				TCA and Daughter Products (mg/L)	
			PCE	TCE	cis-1,2 DCE	VC	1,1,1-TCA	1,1-DCA
Industrial VIGWSL [1]			**0.47**	**0.038**	**NE**	**0.035**	**54**	**0.55**
On-Site Deep Monitoring Wells								
MW-5	20-30	10/13/2004	**0.0092**	<0.005	<0.005	<0.002	<0.005	<0.005
		1/25/2005	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		7/1/2005	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		7/19/2007	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		7/19/2007 DUP	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		11/6/2008	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/1/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/6/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-6	20-30	10/13/2004	**0.019**	<0.005	<0.005	<0.002	<0.005	<0.005
		1/25/2005	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		7/1/2005	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		7/19/2007	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		11/6/2008	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/2/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/6/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-7	35-40	12/14/2006	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		12/14/2006 DUP	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		7/19/2007	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		11/8/2008	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/2/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/6/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-17	27-32	11/6/2008	**0.870**	**0.0624**	<0.005	<0.002	<0.005	**0.102**
		5/6/2009	**0.0619**	**0.006**	**0.00554**	<0.002	<0.005	**0.298**
		8/27/2009	**0.076**	<0.005	**0.0081**	<0.002	<0.005	**0.546**
		5/2/2012	**0.0201**	<0.25	<0.25	**0.0021**	<0.005	**0.395**
		5/6/2014	**0.0073**	<0.005	<0.005	<0.002	<0.005	**0.105**
		8/20/2014	**0.00966**	<0.005	<0.005	<0.002	<0.005	**0.193**

Bold exceeds method detection limit
Yellow highlighting indicates value exceeds the Industrial VIGWSL
mg/L = Milligrams per Liter
(1) Industrial VIGWSL = Vapor Intrusion Groundwater Screening Level for Industrial Land Use (IDEM RCG, 2014)

Table 2. Off-Site Monitoring Wells
Groundwater Analytical Data for Contaminants of Concern
Indiana Machine Works
135 East Harrison Street, Mooresville, IN

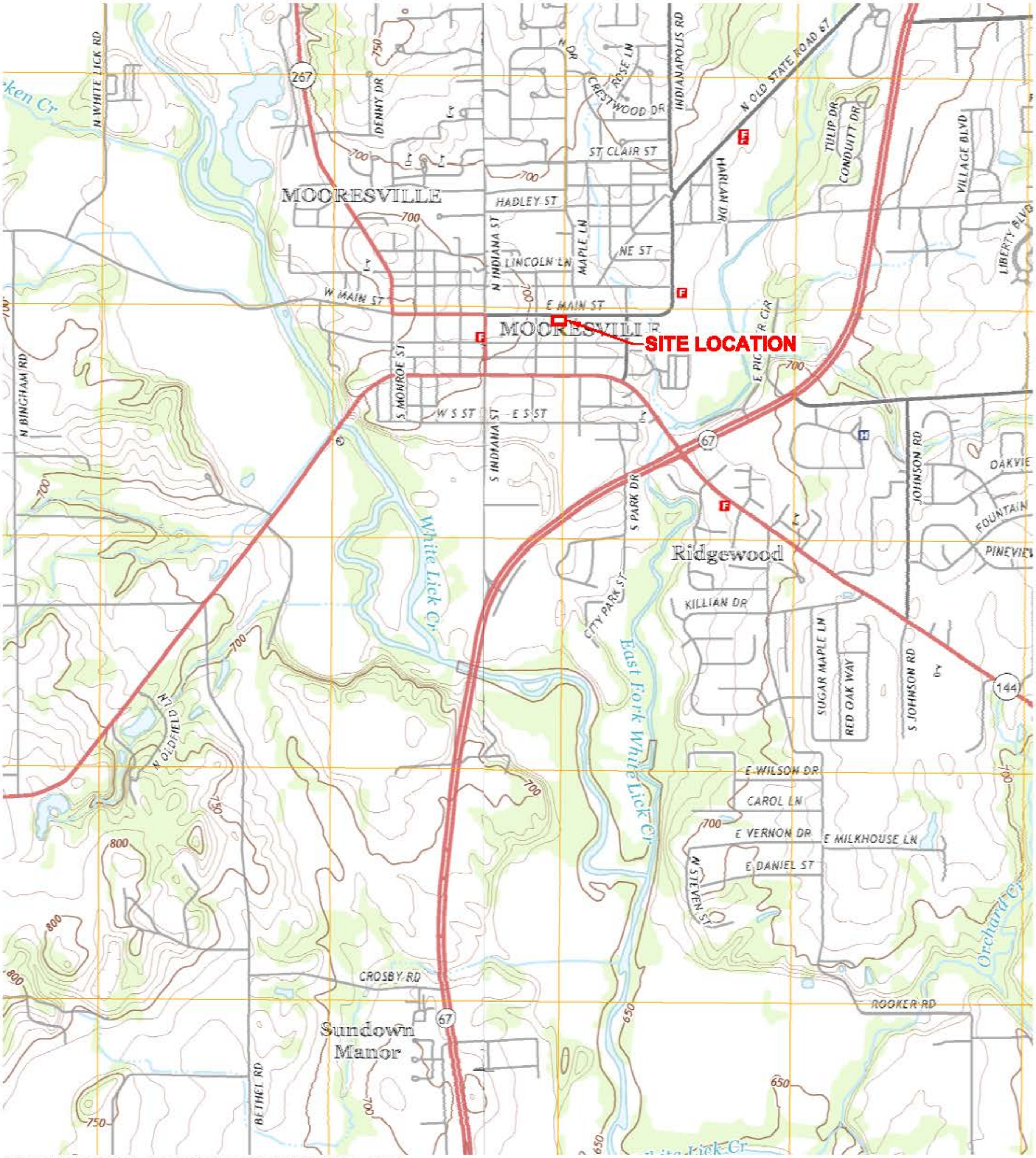
Sample ID	Screen Interval	Date	PCE and Daughter Products				TCA and Daughter Products	
			PCE	TCE	DCE	VC	TCA	DCA
Tap Water [1]			**0.005**	**0.005**	**0.07**	**0.002**	**0.2**	**0.024**
Residential VIGWSL [1]			**0.11**	**0.0091**	**NE**	**0.002**	**13**	**0.11**
Off-Site Shallow Monitoring Wells								
MW-8	6-16	7/19/2007	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		11/6/2008	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/2/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/8/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-9	6-16	7/19/2007	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		11/6/2008	**0.0081**	**0.0056**	<0.005	<0.002	<0.005	<0.005
		5/6/2009	**0.0106**	<0.005	<0.005	<0.002	<0.005	<0.005
		5/1/2012	**0.0160**	**0.0058**	**0.0095**	<0.002	<0.005	<0.005
		4/24/2013	**0.0158**	<0.005	**0.0056**	<0.002	<0.005	<0.005
		6/18/2013	**0.0214**	<0.005	<0.005	<0.002	<0.005	<0.005
		8/1/2013	**0.0356**	<0.005	<0.005	<0.002	<0.005	<0.005
		12/18/2013	**0.0425**	<0.005	<0.005	<0.002		
		3/4/2014	**0.0214**	<0.005	<0.005	<0.002		
		5/7/2014	**0.0240**	<0.005	<0.005	<0.002	<0.005	<0.005
		8/20/2014	**0.0192**	<0.005	<0.005	<0.002	<0.005	<0.005
MW-12	6-16	7/19/2007	**0.300**	**0.0499**	**0.413**	<0.002	**0.0102**	<0.005
		11/6/2008	**0.358**	**0.0632**	**0.142**	<0.002	**0.0118**	<0.005
		5/2/2012	**0.191**	**0.212**	**0.511**	<0.002	**0.0805**	**0.00693**
		5/7/2014	**0.224**	**0.300**	**0.247**	<0.002	**0.0482**	<0.005
		8/20/2014	**0.110**	**0.0904**	**0.0514**	<0.002	**0.0915**	<0.005
MW-14	5-15	11/6/2008	**1.99**	**0.127**	**0.164**	<0.002	**0.151**	**0.00685**
		5/6/2009	**1.22**	**0.187**	**0.236**	<0.002	**0.0796**	**0.00527**
		5/2/2012	**1.19**	**0.113**	**0.221**	<0.002	**0.141**	**0.00622**
		4/24/2013	**0.245**	**0.0294**	**0.047**	<0.002	<0.005	<0.005
		6/18/2013	**0.661**	**0.109**	**0.799**	<0.040	<0.100	<0.100
		8/1/2013	<0.100	<0.100	**0.480**	**0.790**	<0.100	<0.100
		12/18/2013	<0.005	<0.005	<0.005	<0.002	<0.005	
		3/4/2013	<0.005	<0.005	<0.005	<0.002	<0.005	
		5/8/2014	<0.005	<0.005	<0.005	**0.002**	<0.005	<0.005
		8/20/2014	<0.005	<0.005	<0.005	**0.00205**	<0.005	<0.005
MW-15	5-15	11/6/2008	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/1/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/8/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-16	5-15	11/6/2008	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/2/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/7/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-19	5-15	11/6/2008	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/2/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/7/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-22	5-15	11/6/2008	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/2/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/6/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-25	5-15	8/27/2009	**0.00763**	<0.005	<0.005	<0.002	<0.005	<0.005
		5/1/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/7/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/20/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-26	5-15	8/27/2009	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-26R	5-15	4/24/2013	N/A	N/A	N/A	N/A	N/A	N/A
		6/18/2013	<0.005	<0.005	<0.005	<0.002	<0.005	
		8/1/2013	<0.005	<0.005	<0.005	<0.002	<0.005	
		12/18/2013	<0.005	<0.005	<0.005	<0.002	<0.005	
		3/4/2014	<0.005	<0.005	<0.005	<0.002	<0.005	
		5/8/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/20/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-27	3-13	9/21/2012	**0.00809**	<0.005	<0.005	<0.002	<0.005	<0.005
		8/20/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-28	3-13	11/16/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/7/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/20/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
MW-29	3-13	9/21/2012	**0.617**	**0.0133**	**0.0263**	<0.002	**0.0271**	<0.005
		4/24/2013	**0.323**	**0.0219**	**0.0457**	<0.002	**0.00879**	
		6/18/2013	**0.520**	**0.0319**	**0.0538**	**0.00272**	**0.0117**	
		8/1/2013	**0.315**	**0.0343**	**1.02**	**0.00325**	**0.00995**	
		12/18/2013	<0.005	<0.005	**0.0708**	**0.179**	**0.0085**	
		3/4/2014	**0.0159**	**0.0107**	**0.0569**	**0.024**	<0.005	
		5/8/2014	**0.645**	**0.0221**	**0.111**	<0.002	**0.0189**	<0.005
		8/20/2014	**0.517**	**0.0203**	**0.114**	<0.002	**0.0190**	<0.005
MW-30	3-13	9/21/2012	**0.577**	**0.038**	**0.0495**	<0.002	**0.0195**	<0.005
		4/24/2013	**0.423**	**0.00818**	**0.017**		**0.00609**	
		6/18/2013	**0.858**	<0.050	**0.052**	<0.020	<0.050	
		8/1/2013	**0.927**	**0.0209**	**0.0508**	<0.002	**0.0295**	
		12/18/2013	**1.01**	**0.0209**	**0.0736**	<0.002	**0.0275**	
		3/4/2014	**0.96**	**0.0187**	**0.103**	<0.002	**0.0174**	
		5/8/2014	**0.0241**	**0.0128**	**0.0497**	**0.011**	<0.005	<0.005
		8/20/2014	**0.0223**	**0.0159**	**0.144**	**0.0343**	<0.005	<0.005
MW-31	3-13	9/21/2012	**4.99**	**0.0459**	<0.005	<0.002	**0.793**	<0.005
		5/7/2014	**3.08**	**0.0334**	**0.0173**	<0.002	**0.0541**	<0.005
		8/20/2014	**4.46**	**0.0497**	**0.00781**	<0.002	**0.0611**	<0.005
MW-32	3-13	9/21/2012	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		5/8/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
		8/19/2014	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005
Off-Site Shallow Monitoring Wells								
MW-33D	22-27	11/16/2012	**0.192**	**0.0414**	**0.0668**	<0.002	**0.0886**	0.00685
		12/18/2013	**0.252**	**0.0522**	**0.050**	<0.002	**0.0491**	
		3/4/2014	**0.163**	**0.0472**	**0.0476**	<0.002	**0.0322**	
		5/8/2014	**0.217**	**0.045**	**0.0445**	<0.002	**0.0373**	<0.005
		5/8/2014 DUP	**0.202**	**0.0439**	**0.0437**	<0.002	**0.0364**	<0.005
		8/20/2014	**0.107**	**0.0636**	**0.0459**	<0.002	**0.0324**	<0.005
		8/20/2014 DUP2	**0.0972**	**0.0572**	**0.0448**	<0.002	**0.0238**	<0.005

Bold exceeds method detection limit
Orange highlighting indicates value exceeds the Residential VIGWSL
Green highlighting indicates value exceeds the Tap Water Screening Level
mg/L = Milligrams per Liter
(1) Residential VIGWSL = Vapor Intrusion Groundwater Screening Level for Residential Land Use (IDEM RCG, 2014)

Table 3
Estimated Costs
Former Laboratory Equipment – Mooresville, Indiana

Remedial Component	Unit	Total
Task 1: Focused Source Area Remedial Action		
On-Site and Off-Site Institutional & Environmental Controls	Lump	$15,000
Focused Source Area ISCR Injections	Lump	$164,700
	Task 1 Total:	**$179,700**
Task 2: Post-Remedy Groundwater Monitoring and Plume Stability Analysis		
Groundwater Monitoring (8 events)	$11,687 /event	$93,500
Fate and Transport Modeling	Lump	$3,500
Plume Stability Analysis	Lump	$3,500
Indoor Air Sampling (2 events)	$5,000 /event	$10,000
Annual Reporting (3 years)	$10,000 /report	$30,000
	Task 2 Total:	**$140,500**
Total Without Contingency		**$320,200**
20% Contingency		**$64,040**
Total With Contingency		**$384,240**

FIGURES



SOURCE: USGS MAP MOORESVILLE EAST QUADRANGLE; 2013

QUADRANGLE LOCATION

2000' 0 2000'

Title:

SITE LOCATION AND TOPOGRAPHIC MAP

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

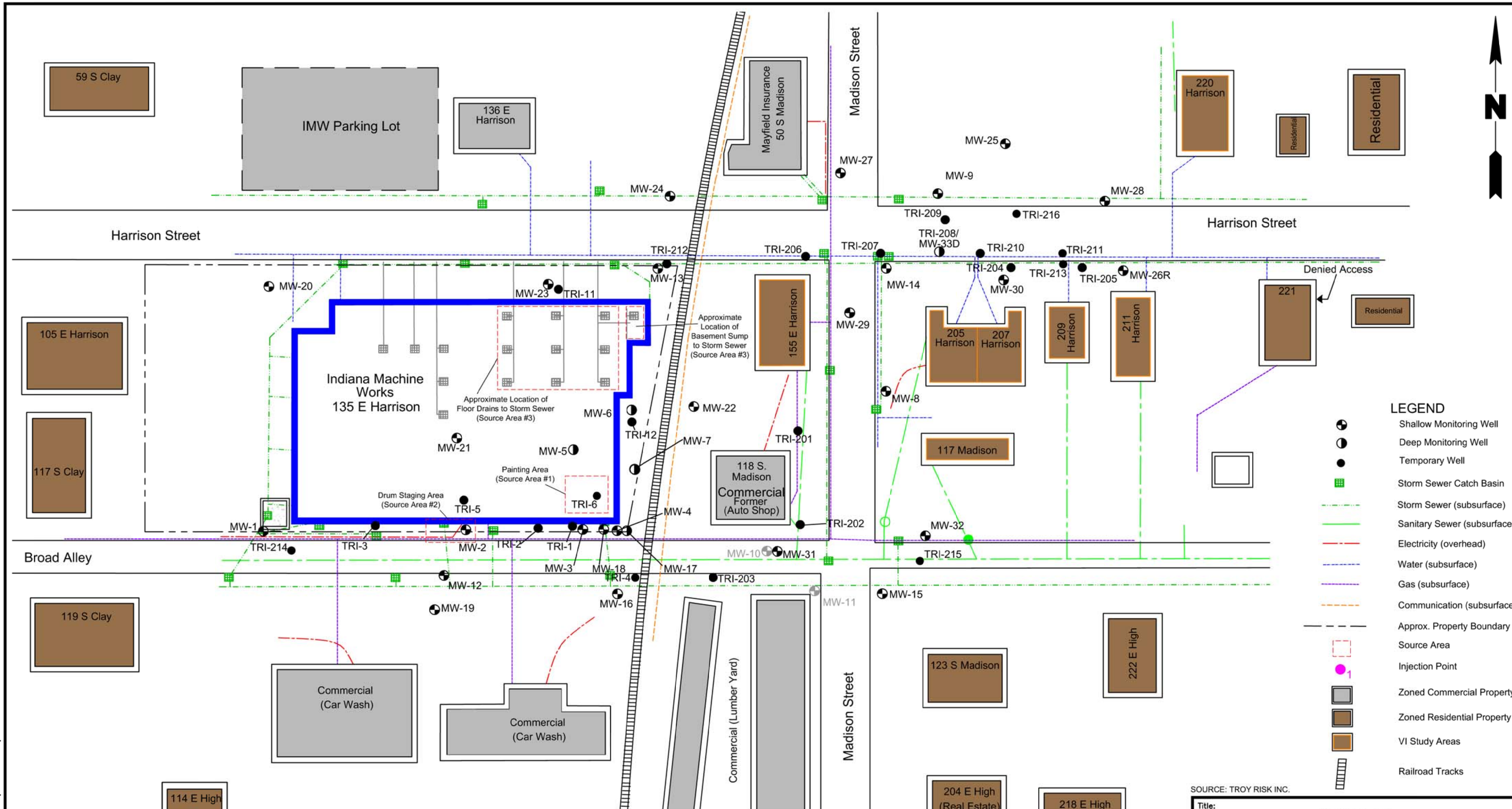
Prepared For:

INDIANA MACHINE WORKS

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/19/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	1
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_01-TOPOMAP.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_01-TOPOMAP.DWG



SOURCE: TROY RISK INC.

Title:

SITE PLAN, ZONING, AND UTILITY LAYOUT MAP

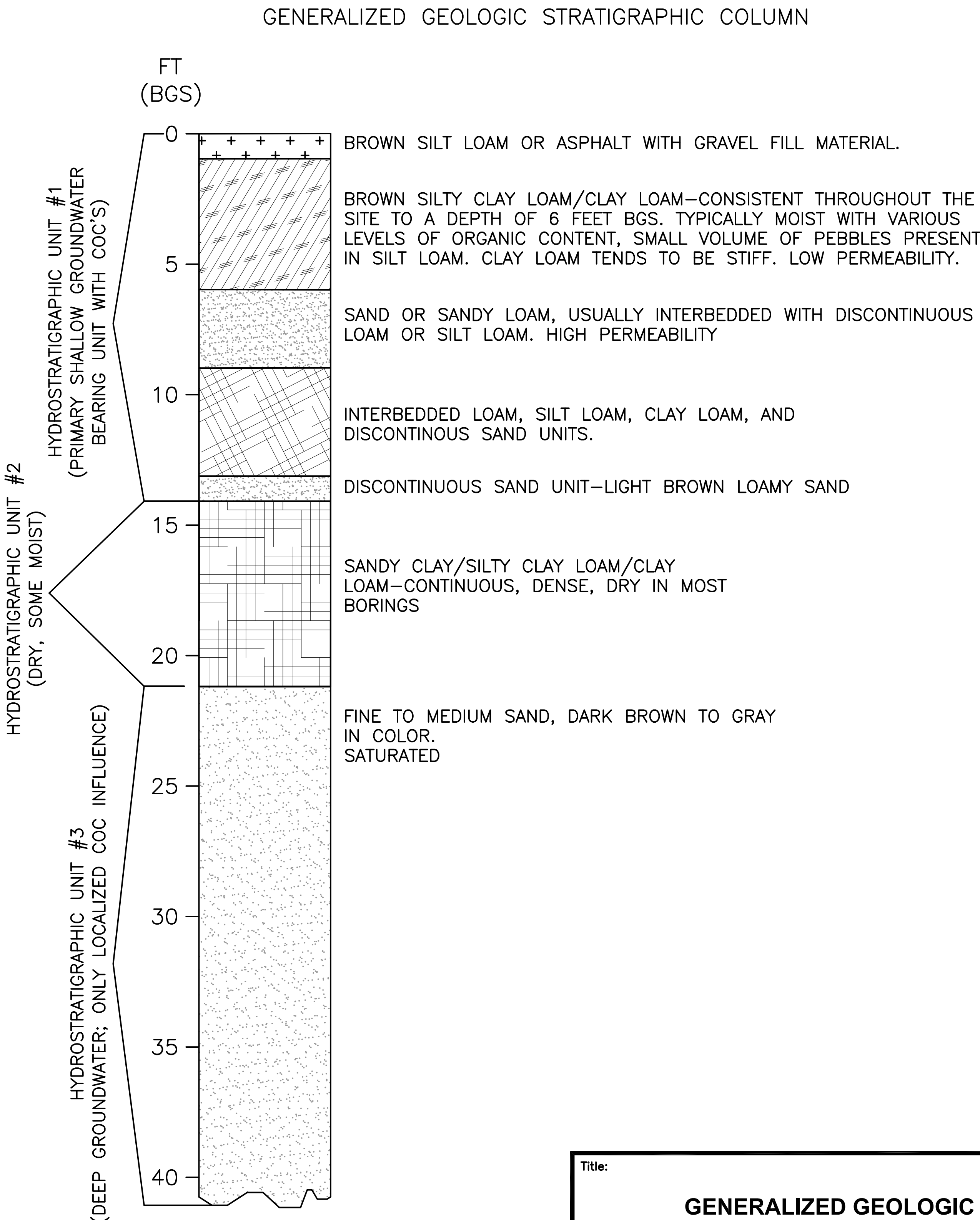
135 EAST HARRISON STREET
MOORESVILLE, INDIANA

Prepared For:

INDIANA MACHINE WORKS

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/19/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	2
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_02-SITE PLAN-ZONING.DWG		



T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_03-GEOLOIC STRAT.DWG

Title:

GENERALIZED GEOLOGIC STRATIGRAPHIC COLUMN

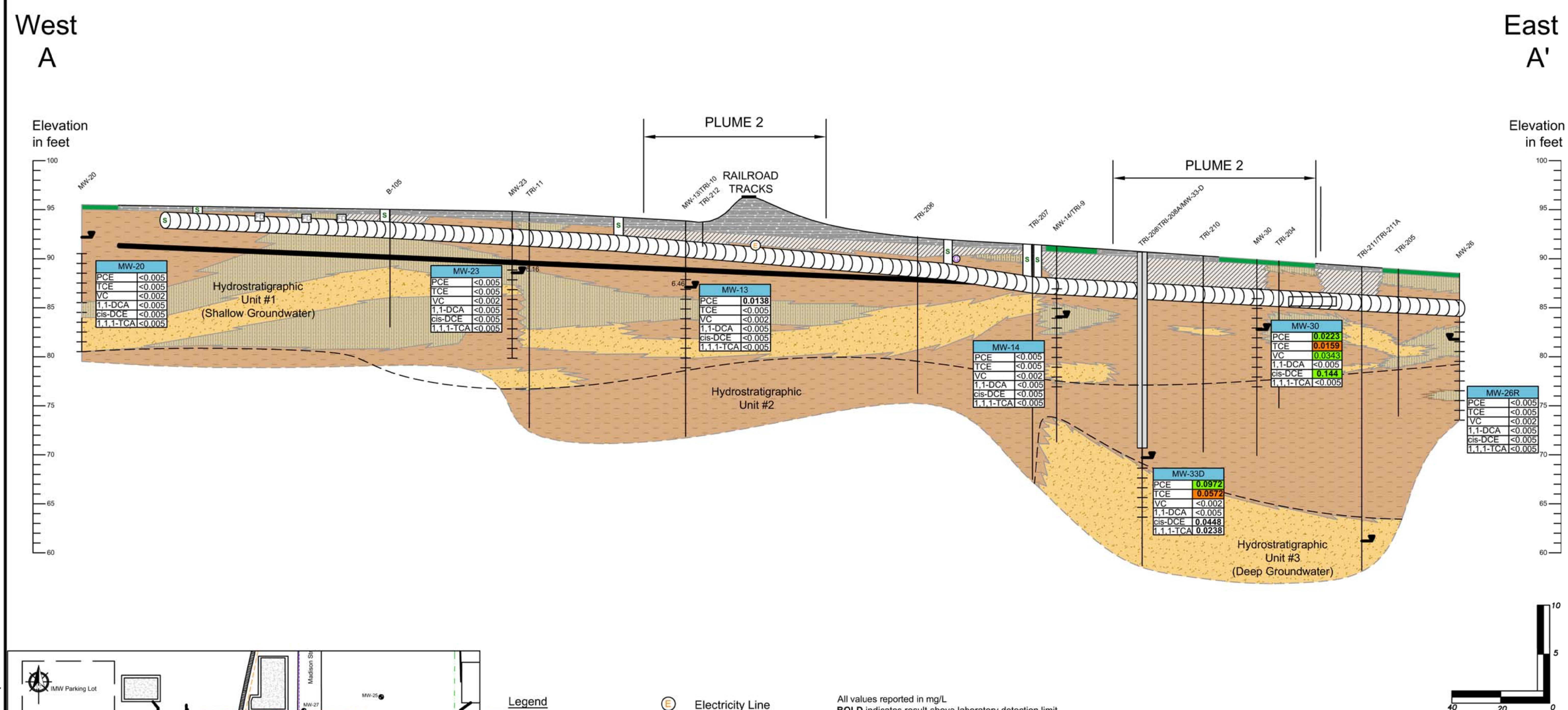
135 EAST HARRISON STREET
MOORESVILLE, INDIANA

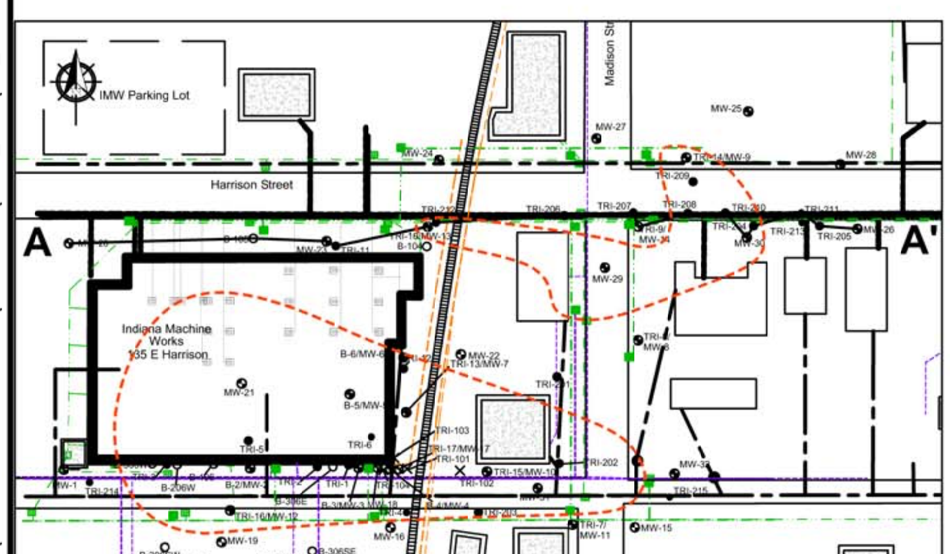
Prepared For:

INDIANA MACHINE WORKS

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/19/2015	FIGURE
Prepared by: JJS	Scale: N.T.S.	3
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_03-GEOLOIC STRAT.DWG		





Legend

- Grass/Topsoil
- Asphalt/Concrete
- Clays and Clay Loams
- Loams
- Sands
- Fill
- Electricity Line
- IMW Floor Drain
- Gas Line
- Sewer Line
- Storm Sewer Drain
- Water Line
- Well Screen
- Groundwater Elevation Gauged on 08/19/2014

Note: Elevations are approximate and were surveyed relative to an arbitrary on site datum of 100'

All values reported in mg/L
BOLD indicates result above laboratory detection limit
ORANGE highlighting value exceeds the Tap Water screening value.
GREEN highlighting indicates value exceeds the Residential VIGWSL.
YELLOW highlighting indicates value exceeds the Industrial VIGWSL.

VIGWSL: Vapor intrusion Groundwater Screening level for land use.

	TAPWATER	RES. VIGWSL	IND. VIGWSL
PCE	0.005	0.11	0.47
TCE	0.005	0.0091	0.038
VC	0.002	0.002	0.035
1,1-DCA	0.024	0.11	0.55
cis-DCE	0.07	NE	NE
1,1,1-TCA	0.2	13	54

PCE: Tetrachloroethene
TCE: Trichloroethene
VC: Vinyl Chloride
1,1 DCA: 1,1 Dichloroethane
cis-DCE: cis-1,2 -Dichloroethene
1,1,1-TCA: 1,1,1 Trichloroethane

SCALE: 1" = 40'
Vertical Exaggeration 4:1

SOURCE: TROY RISK INC.

Title:

GEOLOGIC CROSS-SECTION A-A'

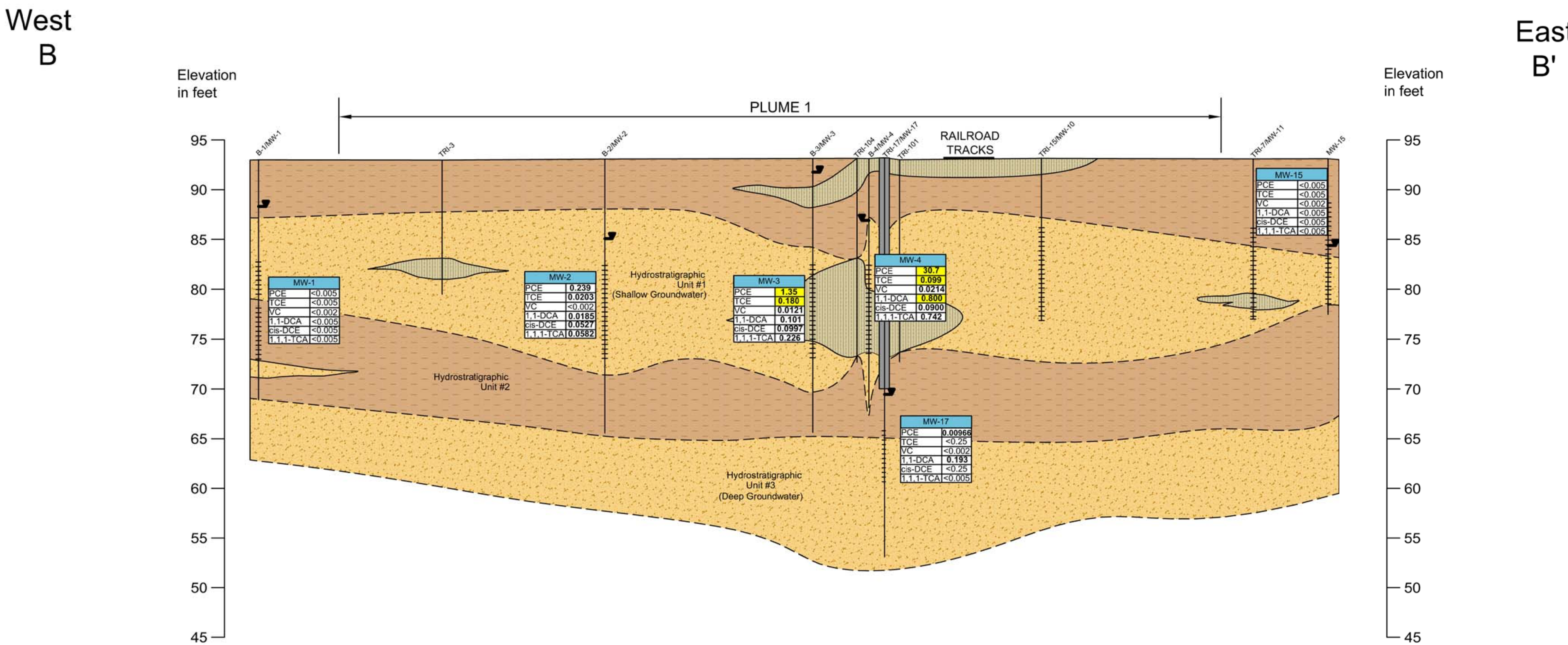
135 EAST HARRISON STREET
MOORESVILLE, INDIANA

Prepared For:
INDIANA MACHINE WORKS

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/12/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	4
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_04-06-CROSS SECTION.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_04-06-CROSS SECTION.DWG



Legend

- Clays and Clay Loams
- Loams
- Sands
- Fill
- Well Screen
- Groundwater Elevation Gauged on 8/19/2014

All values reported in mg/L
BOLD indicates result above laboratory detection limit
ORANGE highlighting value exceeds the Tap Water screening value.
GREEN highlighting indicates value exceeds the Residential VIGWSL.
YELLOW highlighting indicates value exceeds the Industrial VIGWSL.

VIGWSL: Vapor intrusion Groundwater Screening level for land use.

	TAPWATER	RES. VIGWSL	IND. VIGWSL
PCE	0.005	0.11	0.47
TCE	0.005	0.0091	0.038
VC	0.002	0.002	0.035
1,1-DCA	0.024	0.11	0.55
cis-DCE	0.07	NE	NE
1,1,1-TCA	0.2	13	54

PCE: Tetrachloroethene
TCE: Trichloroethene
VC: Vinyl Chloride
1,1 DCA: 1,1 Dichloroethane
cis-DCE: cis-1,2 -Dichloroethene
1,1,1-TCA: 1,1,1 Trichloroethane

Note: Elevations are approximate and were surveyed relative to an arbitrary on site datum of 100'

40 20 0
10
5
0

SCALE: 1" = 40'
Vertical Exaggeration 4:1

SOURCE: TROY RISK INC.

Title:

GEOLOGIC CROSS-SECTION B-B'

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

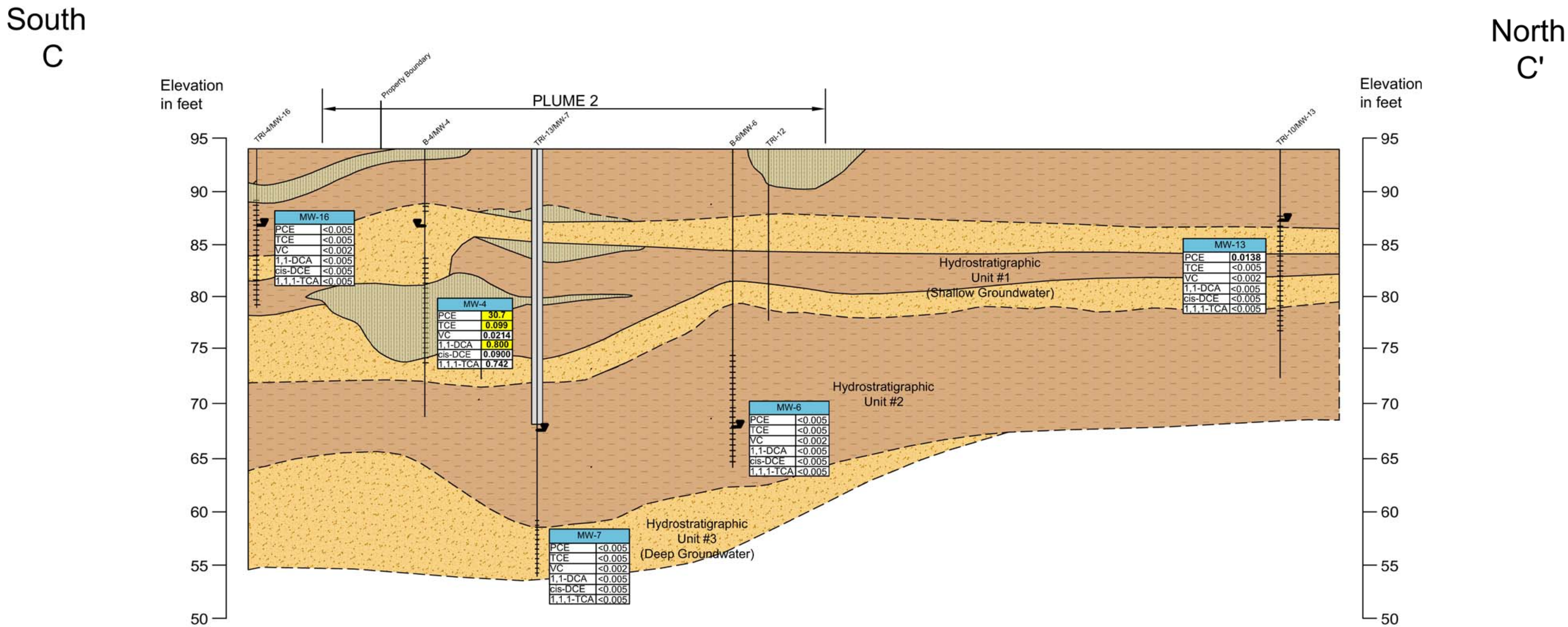
Prepared For:

INDIANA MACHINE WORKS

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/12/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	5
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_04-06-CROSS SECTION.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_04-06-CROSS SECTION.DWG



Legend

Clays and Clay Loams

Loams

Sands

Fill

Well Screen

Groundwater Elevation
Gauged on 8/19/2014

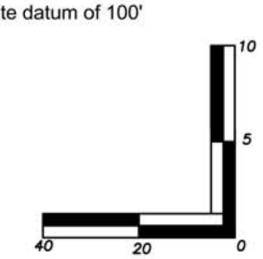
All values reported in mg/L
BOLD indicates result above laboratory detection limit
ORANGE highlighting value exceeds the Tap Water screening value.
GREEN highlighting indicates value exceeds the Residential VIGWSL.
YELLOW highlighting indicates value exceeds the Industrial VIGWSL.

VIGWSL: Vapor intrusion Groundwater Screening level for land use.

	TAPWATER	RES. VIGWSL	IND. VIGWSL
PCE	0.005	0.11	0.47
TCE	0.005	0.0091	0.038
VC	0.002	0.002	0.035
1,1-DCA	0.024	0.11	0.55
cis-DCE	0.07	NE	NE
1,1,1-TCA	0.2	13	54

PCE: Tetrachloroethene
TCE: Trichloroethene
VC: Vinyl Chloride
1,1 DCA: 1,1 Dichloroethane
cis-DCE: cis-1,2 -Dichloroethene
1,1,1-TCA: 1,1,1 Trichloroethane

Note: Elevations are approximate and were surveyed relative to an arbitrary on site datum of 100'



SCALE: 1" = 40'
Vertical Exaggeration 4:1

SOURCE: TROY RISK INC.

Title:

GEOLOGIC CROSS-SECTION C-C'

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

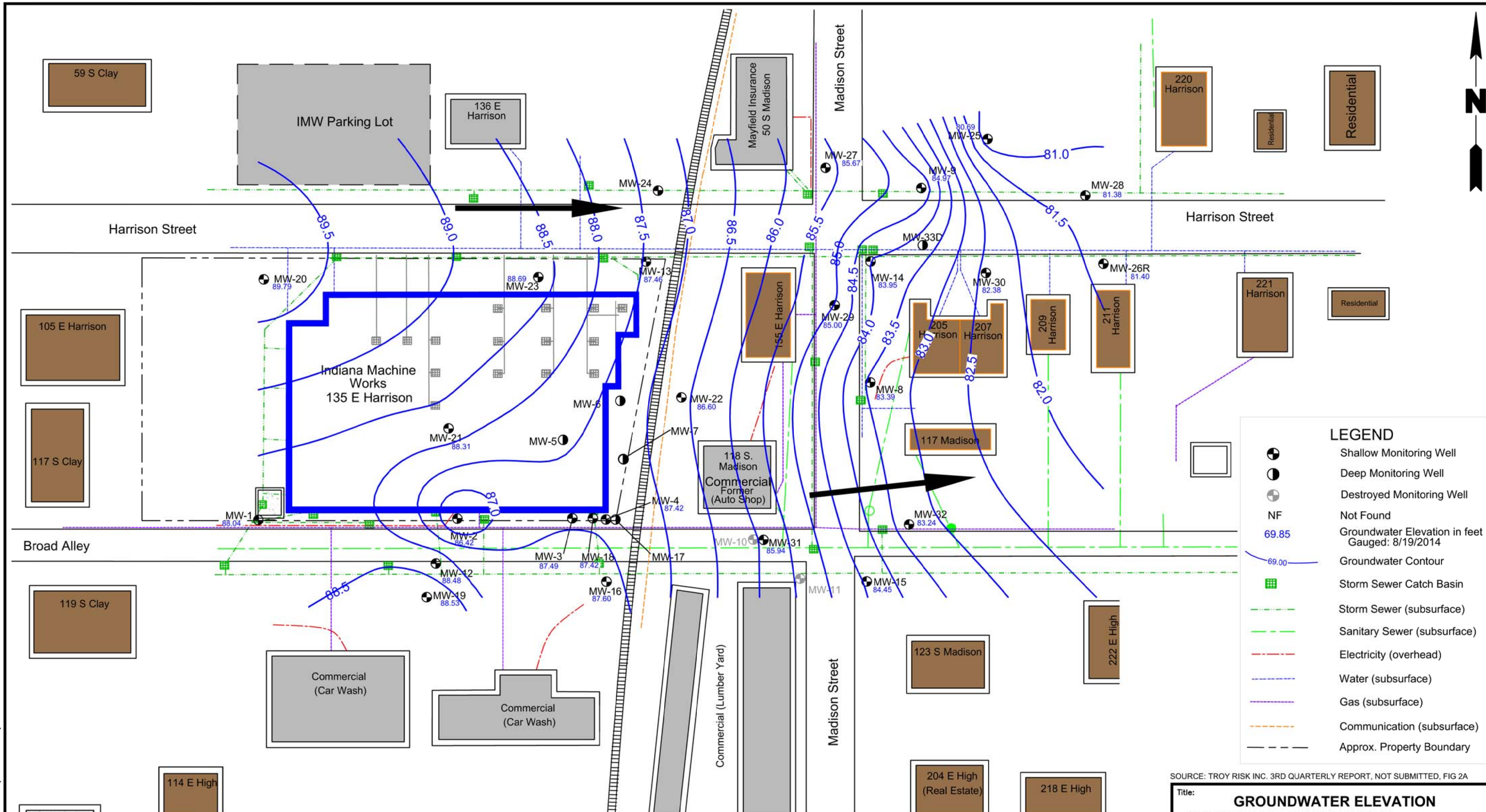
Prepared For:

INDIANA MACHINE WORKS

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/12/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	
Project Mgr: TA	Project: 1181.0060I000	6
File: FIG_04-06-CROSS SECTION.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_04-06-CROSS SECTION.DWG



SOURCE: TROY RISK INC. 3RD QUARTERLY REPORT, NOT SUBMITTED, FIG 2A

Title:

GROUNDWATER ELEVATION IN THE SHALLOW HYDROSTRATIGRAPHIC UNIT, AUGUST 2014

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

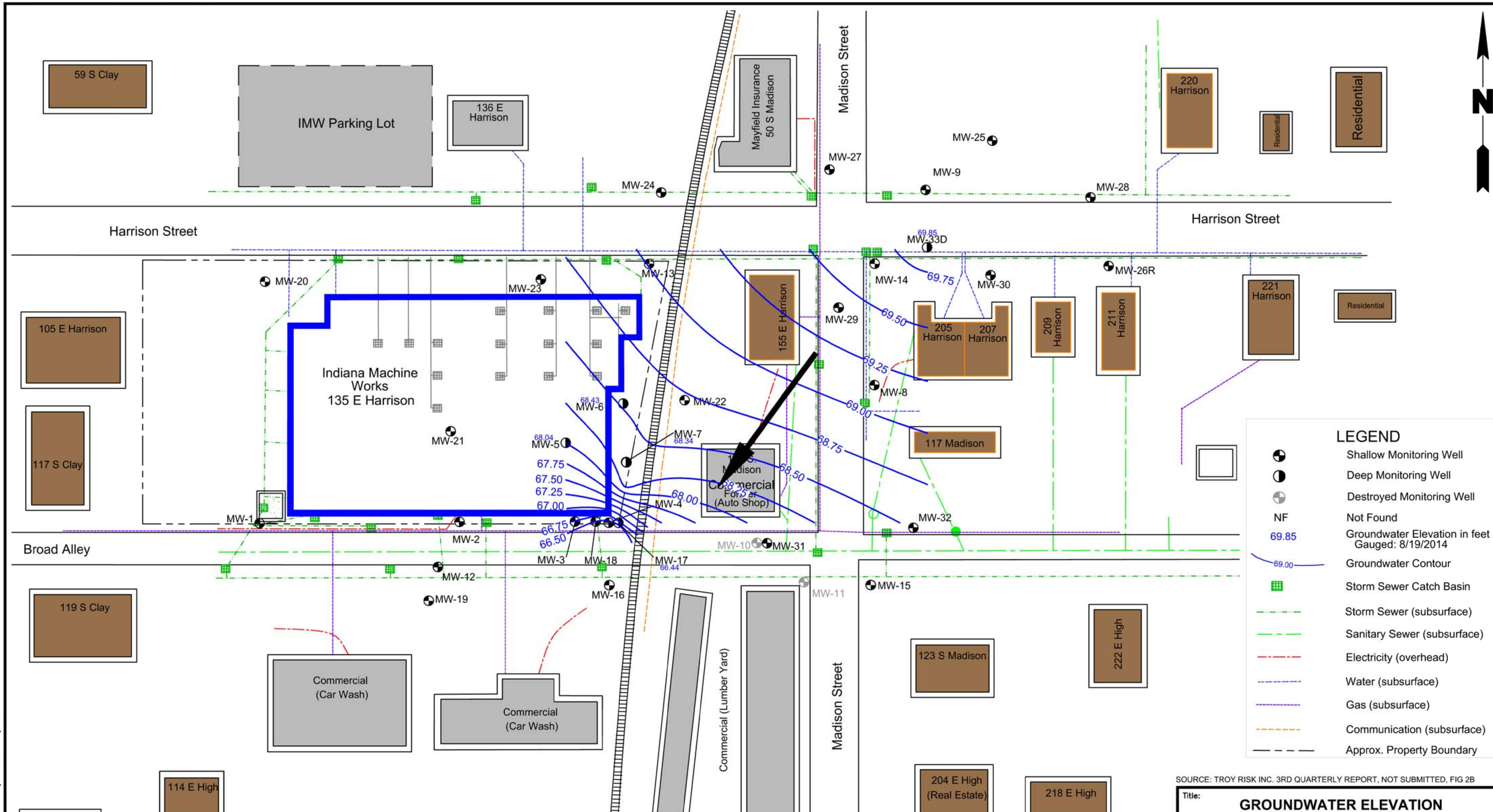
Prepared For:

INDIANA MACHINE WORKS

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/19/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	7
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_07-08-POTENTIOMETRIC SURFACE MAP.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_07-08-POTENTIOMETRIC SURFACE MAP.DWG



T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_07-08-POTENTIOMETRIC SURFACE MAP.DWG

SOURCE: TROY RISK INC. 3RD QUARTERLY REPORT, NOT SUBMITTED, FIG 2B

Title:

GROUNDWATER ELEVATION IN THE DEEP HYDROSTRATIGRAPHIC UNIT, AUGUST 2014

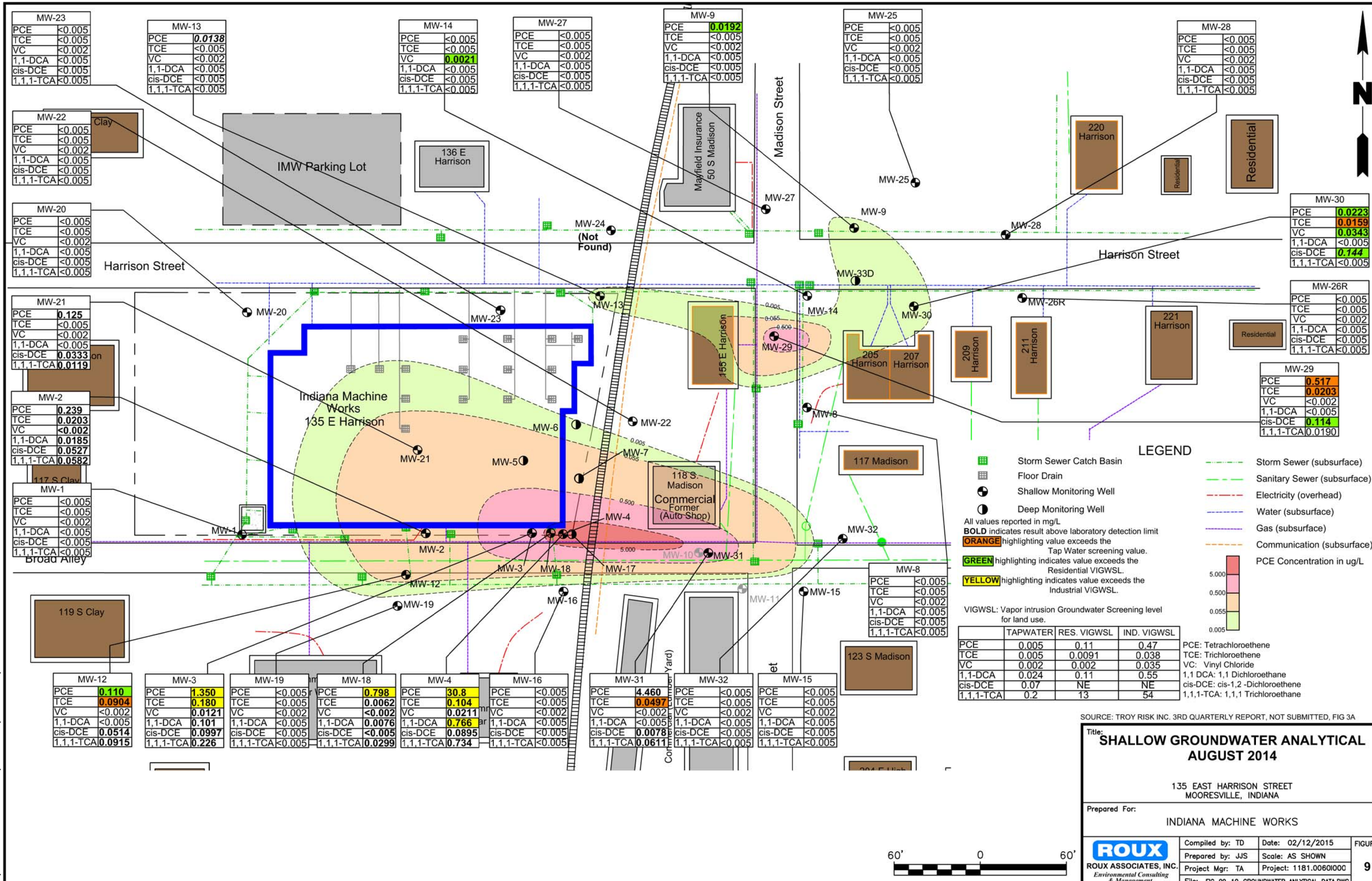
135 EAST HARRISON STREET
MOORESVILLE, INDIANA

Prepared For:

INDIANA MACHINE WORKS

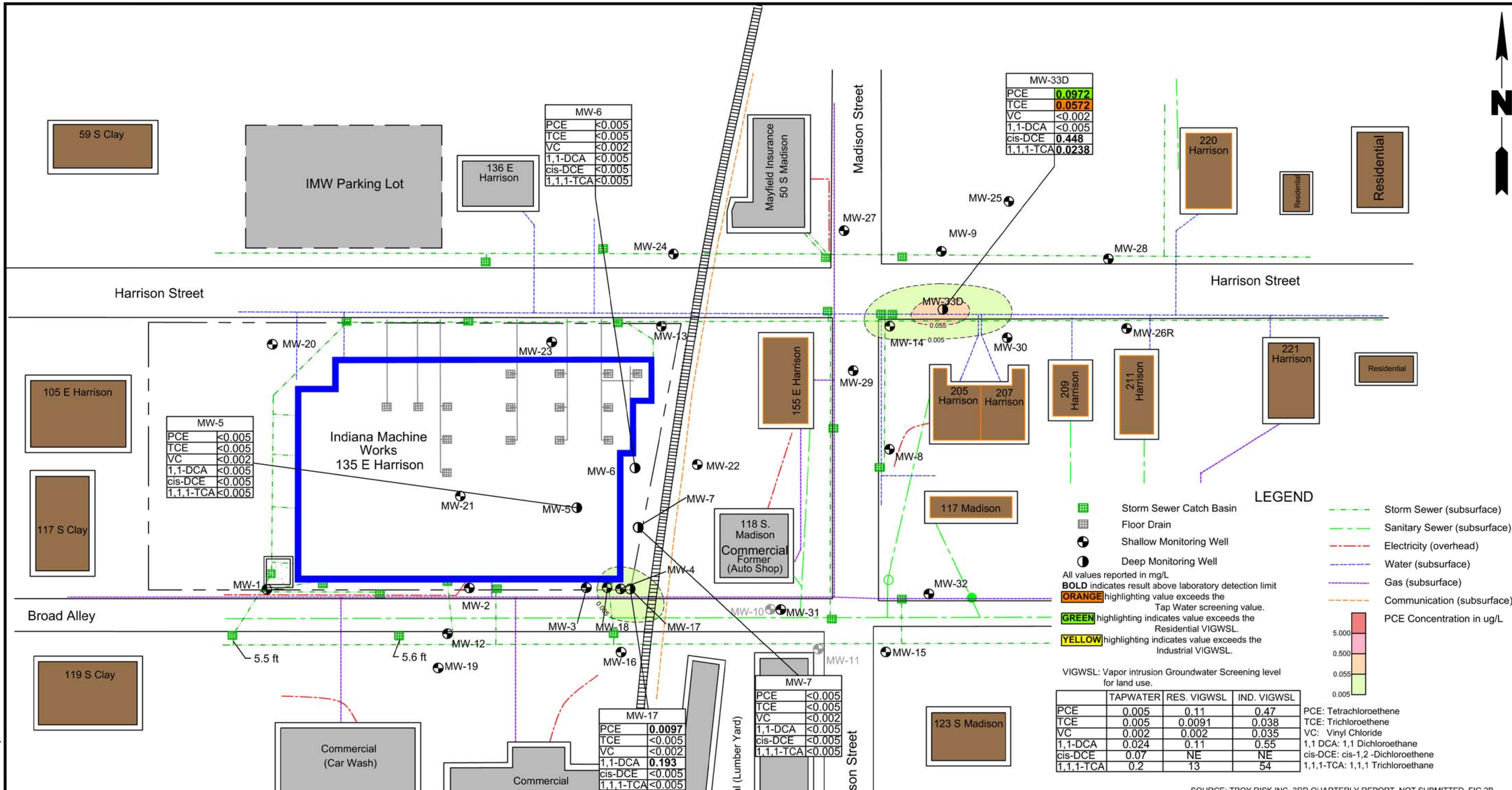
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/19/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	8
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_07-08-POTENTIOMETRIC SURFACE MAP.DWG		



	TAPWATER	RES. VIGWSL	IND. VIGWSL
PCE	0.005	0.11	0.47
TCE	0.005	0.0091	0.038
VC	0.002	0.002	0.035
1,1-DCA	0.024	0.11	0.55
cis-DCE	0.07	NE	NE
1,1,1-TCA	0.2	13	54

Well	PCE	TCE	VC	1,1-DCA	cis-DCE	1,1,1-TCA
MW-23	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-13	0.0138	<0.005	<0.002	<0.005	<0.005	<0.005
MW-14	<0.005	<0.005	0.0021	<0.005	<0.005	<0.005
MW-27	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-9	0.0192	<0.005	<0.002	<0.005	<0.005	<0.005
MW-25	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-28	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-22	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-20	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-30	0.0223	0.0159	0.0343	<0.005	0.144	<0.005
MW-26R	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-21	0.125	<0.005	<0.002	<0.005	0.0333	0.0119
MW-2	0.239	0.0203	<0.002	0.0185	0.0527	0.0582
MW-29	0.517	0.0203	<0.002	<0.005	0.114	0.0190
MW-1	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-8	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-12	0.110	0.0904	<0.002	<0.005	0.0514	0.0915
MW-3	1.350	0.180	0.0121	0.101	0.0997	0.226
MW-19	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-18	0.798	0.0062	<0.002	0.0076	<0.005	0.0299
MW-4	30.8	0.104	0.0211	0.766	0.0895	0.734
MW-16	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-31	4.460	0.0497	<0.002	<0.005	0.0078	0.0611
MW-32	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005
MW-15	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005



MW-6	
PCE	<0.005
TCE	<0.005
VC	<0.002
1,1-DCA	<0.005
cis-DCE	<0.005
1,1,1-TCA	<0.005

MW-5	
PCE	<0.005
TCE	<0.005
VC	<0.002
1,1-DCA	<0.005
cis-DCE	<0.005
1,1,1-TCA	<0.005

MW-33D	
PCE	**0.0972**
TCE	**0.0572**
VC	<0.002
1,1-DCA	<0.005
cis-DCE	**0.448**
1,1,1-TCA	**0.0238**

MW-17	
PCE	**0.0097**
TCE	<0.005
VC	<0.002
1,1-DCA	**0.193**
cis-DCE	<0.005
1,1,1-TCA	<0.005

MW-7	
PCE	<0.005
TCE	<0.005
VC	<0.002
1,1-DCA	<0.005
cis-DCE	<0.005
1,1,1-TCA	<0.005

	TAPWATER	RES. VIGWSL	IND. VIGWSL
PCE	0.005	0.11	0.47
TCE	0.005	0.0091	0.038
VC	0.002	0.002	0.035
1,1-DCA	0.024	0.11	0.55
cis-DCE	0.07	NE	NE
1,1,1-TCA	0.2	13	54

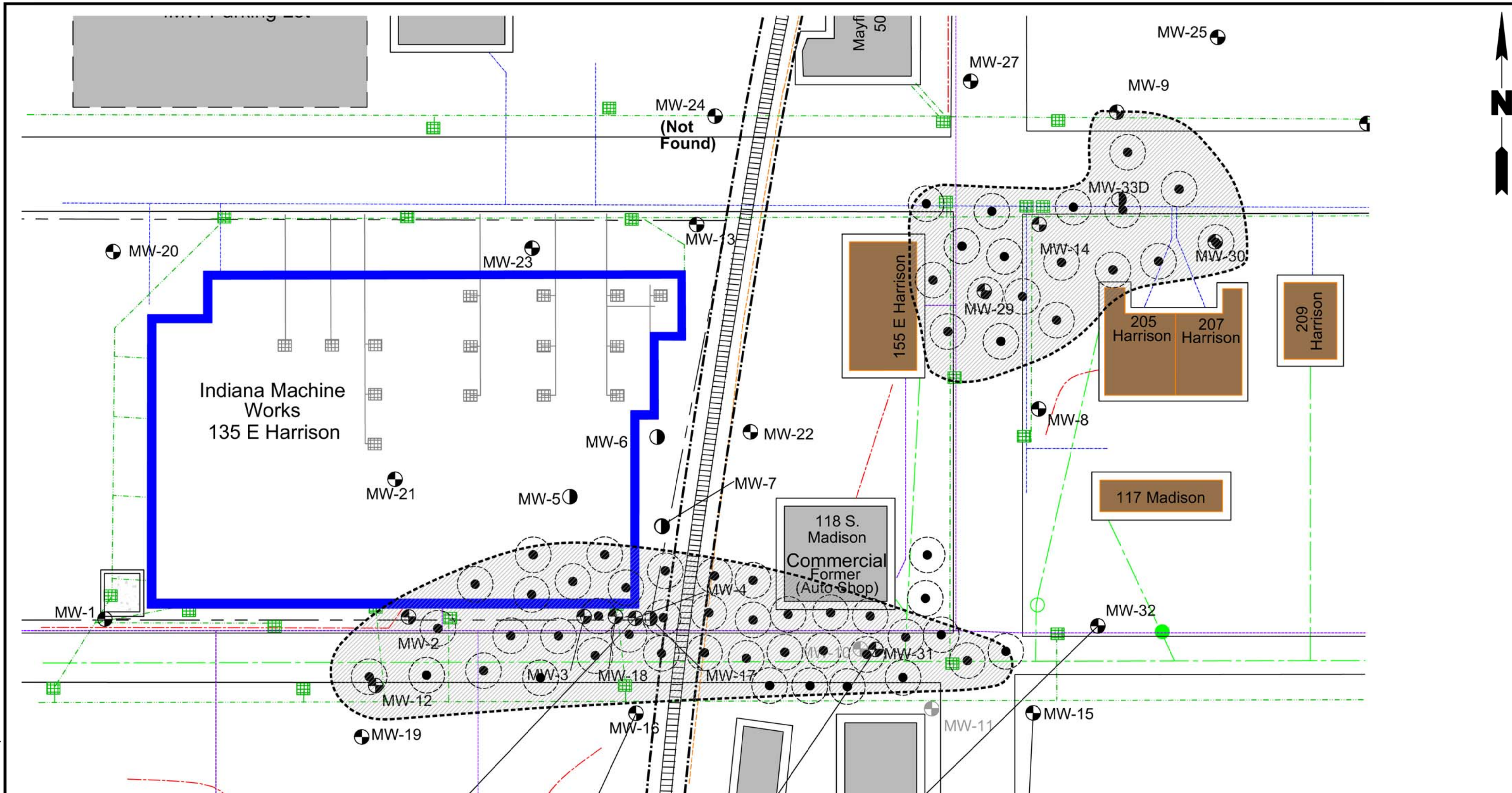
Title:
DEEP GROUNDWATER ANALYTICAL DATA AUGUST 2014

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

Prepared For:
INDIANA MACHINE WORKS

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/12/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	10
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_09-10-GROUNDWATER ANLYTICAL DATA.DWG		



T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_11-PROP_REMEDIATION_AREAS.DWG

LEGEND

- Storm Sewer Catch Basin
- Floor Drain
- Shallow Monitoring Well
- Deep Monitoring Well
- Proposed Injection Point with Approximate Radius of Influence (59)
- Storm Sewer (subsurface)
- Sanitary Sewer (subsurface)
- Electricity (overhead)
- Water (subsurface)
- Gas (subsurface)
- Communication (subsurface)
- Rail Road Tracks with Approximate ROW
- Proposed Remediation Treatment Area Exceeding Remediation Goals

All values reported in mg/L

REMEDIATION GOALS (mg/L)		
	ON-SITE	OFF- SITE
PCE	0.47	0.005
TCE	0.038	0.005
DCE	----	0.070
VC	0.035	0.002

40' 0 40'

Title:

PROPOSED REMEDIATION AREAS

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

Prepared For:

INDIANA MACHINE WORKS

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/12/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	11
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_11-PROP_REMEDIATION_AREAS.DWG		

APPENDICES

APPENDIX A

Example ERC

Environmental Restrictive Covenant

THIS ENVIRONMENTAL RESTRICTIVE COVENANT ("Covenant") is made this ______ day of _______, 20___, by____________________ located at ___________________________.

WHEREAS: Owner is the fee owner of certain real estate in the County of Morgan, Indiana, which is located at __________________ and more particularly described in the attached Exhibit "A" ("Real Estate"), which is hereby incorporated and made a part hereof. This Real Estate was acquired by deed on ________________, and recorded on ________________, as Deed Record ______________________, in the Office of the Recorder of Morgan County, Indiana. The Real Estate consists of approximately _______ acres and has also been identified by the county as parcel identification number(s) ____________________. The Real Estate, to which this Covenant applies, is depicted on a map attached hereto as Exhibit ____.

WHEREAS: ___________________ entered into Indiana's Voluntary Remediation Program ("VRP") to address releases of hazardous substances and/or petroleum ("contaminants of concern") relating to the Real Estate. The Indiana Department of Environmental Management ("IDEM" or the "Department") assigned the project number _________. A remediation work plan was prepared in accordance with IC 13-25-5, which was approved by the Department on ___________________.

WHEREAS: IDEM approved the remediation work plan, which allows certain contaminants of concern to remain in the ground water and soil, provided that certain land use restrictions are implemented and engineering controls maintained to protect human health. The remaining contaminants of concern are listed in Exhibit ____, which is attached hereto and incorporated herein.

WHEREAS: The remediation work plan and completion report are hereby incorporated by reference and may be examined at the offices of the Department, which is located in the Indiana Government Center North building at 100 N. Senate Avenue, Indianapolis, Indiana. The documents may also be viewed electronically in the Department's Virtual File Cabinet by accessing the Department's Web Site (currently www.in.gov/idem/).

NOW THEREFORE, _________________ subjects the Real Estate to the following restrictions and provisions, which shall be binding on the current Owner and all future Owners:

I. RESTRICTIONS

1. Restrictions. The Owner:

(a) Shall not use or allow the use of the Real Estate for residential purposes, including, but not limited to, daily child care facilities or educational facilities for children (e.g., daycare centers or K-12 schools).

(b) Shall not use or allow the use or extraction of ground water at the Real Estate for any purpose, including, but not limited to: human or animal consumption, gardening, industrial processes, or agriculture, except that ground water may be extracted in conjunction with environmental investigation and/or remediation activities.

(c) Shall not use the Real Estate for any agricultural use.

(d) Shall restore soil disturbed as a result of excavation and construction activities in such a manner that the remaining contaminant concentrations do not present a threat to human health or the environment. This determination shall be made using the Department's current risk based guidance. Upon the Department's request, the Owner shall provide the Department written evidence (including sampling data) showing the excavated and restored area, and any other area affected by the excavation, does not represent such a threat. Contaminated soils that are excavated must be managed in accordance with all applicable federal and state laws, and disposal of such soils must also be done in accordance with all applicable federal and state laws.

(e) Shall neither engage in nor allow excavation of soil [at depths greater than ____ feet] in the area identified via GPS coordinates as the "Construction Worker Restriction Area" on the attached Exhibit _____ (which is incorporated herein), unless the soil disturbance obligations listed in the preceding paragraph are followed. In addition, the Owner shall provide written notice to the Department in accordance with paragraph 14 below at least ____ days before the start of soil disturbance activities. The owner, upon the Department's request, shall provide the Department evidence showing the excavated and restored area does not represent a threat to human health or the environment.

(f) Shall not construct or allow occupancy of a dwelling or work space on the Real Estate unless a vapor mitigation system is installed, operated, and maintained within the dwelling or work space. IDEM may waive this restriction in writing if the Owner has provided data and analysis demonstrating to IDEM's satisfaction that there is no unacceptable risk to human health via the vapor intrusion exposure pathway.

(g) Shall operate and maintain the ______________ depicted in Exhibit ____ so as to protect its functional integrity in accordance with _____________________. Owner shall notify the Department in writing at least fifteen (15) days in advance of conducting any construction or excavation work that may impact an engineered control, unless an emergency exists. Owner shall ensure that the integrity of the ______________ is restored immediately after disturbance by any construction or excavation work. Upon IDEM's request, the Owner shall provide written evidence showing the engineered control has been restored to its complete integrity.

(h) Shall maintain the integrity of the existing asphalt pavement or building, which is depicted on Exhibit _____ via GPS coordinates; this asphalt area serves as an engineered barrier to prevent direct contact with the underlying soils and must not be excavated, removed, disturbed, demolished, or allowed to fall into disrepair.

(i) Shall prohibit any activity at the Real Estate that may interfere with the ground water monitoring or well network.

(j) [*Insert other site specific restriction(s) here.*]

II. GENERAL PROVISIONS

2. Restrictions to Run with the Land. The restrictions and other requirements described in this Covenant shall run with the land and be binding upon, and inure to the benefit of the Owner of the Real Estate and the Owner's successors, assignees, heirs and lessees and their authorized agents, employees, contractors, representatives, agents, lessees, licensees, invitees, guests, or persons acting under their direction or control (hereinafter "Related Parties") and shall continue as a servitude running in perpetuity with the Real Estate. No transfer, mortgage, lease, license, easement, or other conveyance of any interest in or right to occupancy in all or any part of the Real Estate by any person shall affect the restrictions set forth herein. This Covenant is imposed upon the entire Real Estate unless expressly stated as applicable only to a specific portion thereof.

3. Binding upon Future Owners. By taking title to an interest in or occupancy of the Real Estate, any subsequent Owner or Related Party agrees to comply with all of the restrictions set forth in paragraph 1 above and with all other terms of this Covenant.

4. Access for Department. The Owner shall grant to the Department and its designated representatives the right to enter upon the Real Estate at reasonable times for the purpose of monitoring compliance with this Covenant and ensuring its protectiveness; this right includes the right to take samples and inspect records.

5. Written Notice of the Presence of Contamination. Owner agrees to include in any instrument conveying any interest in any portion of the Real Estate, including but not limited to deeds, leases and subleases (excluding mortgages, liens, similar financing interests, and other non-possessory encumbrances), the following notice provision (with blanks to be filled in):

NOTICE: THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL RESTRICTIVE COVENANT, DATED____________ 20__, RECORDED IN THE OFFICE OF THE RECORDER OF MORGAN COUNTY ON _________________, 20__, INSTRUMENT NUMBER (or other identifying reference) ________________ IN FAVOR OF AND ENFORCEABLE BY THE INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT.

6. Notice to Department of the Conveyance of Property. Owner agrees to provide notice to the Department of any conveyance (voluntary or involuntary) of any ownership interest in the Real Estate (excluding mortgages, liens, similar financing interests, and other non-

possessory encumbrances). Owner must provide the Department with the notice within thirty (30) days of the conveyance and: (a) include a certified copy of the instrument conveying any interest in any portion of the Real Estate; (b) if it has been recorded, its recording reference; and (c) the name and business address of the transferee.

7. Indiana Law. This Covenant shall be governed by, and shall be construed and enforced according to, the laws of the State of Indiana.

III. ENFORCEMENT

8. Enforcement. Pursuant to IC 13-14-2-6 and other applicable law, the Department may proceed in court by appropriate action to enforce this Covenant. Damages alone are insufficient to compensate IDEM if any owner of the Real Estate or its Related Parties breach this Covenant or otherwise default hereunder. As a result, if any owner of the Real Estate, or any owner's Related Parties, breach this Covenant or otherwise default hereunder, IDEM shall have the right to request specific performance and/or immediate injunctive relief to enforce this Covenant in addition to any other remedies it may have at law or at equity. Owner agrees that the provisions of this Covenant are enforceable and agrees not to challenge the provisions or the appropriate court's jurisdiction.

IV. TERM, MODIFICATION AND TERMINATION

9. Term. The restrictions shall apply until the Department determines that the contaminants of concern no longer present an unacceptable risk to the public health, safety, or welfare, or to the environment.

10. Modification and Termination. This Covenant shall not be amended, modified, or terminated without the Department's prior written approval. Within thirty (30) days of executing an amendment, modification, or termination of the Covenant, Owner shall record such amendment, modification, or termination with the Office of the Recorder of ______________ County and within thirty (30) days after recording, provide a true copy of the recorded amendment, modification, or termination to the Department.

V. MISCELLANEOUS

11. Waiver. No failure on the part of the Department at any time to require performance by any person of any term of this Covenant shall be taken or held to be a waiver of such term or in any way affect the Department's right to enforce such term, and no waiver on the part of the Department of any term hereof shall be taken or held to be a waiver of any other term hereof or the breach thereof.

12. Conflict of and Compliance with Laws. If any provision of this Covenant is also the subject of any law or regulation established by any federal, state, or local government, the strictest standard or requirement shall apply. Compliance with this Covenant does not

relieve the Owner of its obligation to comply with any other applicable laws.

13. Change in Law, Policy or Regulation. In no event shall this Covenant be rendered unenforceable if Indiana's laws, regulations, guidance, or remediation policies (including those concerning environmental restrictive covenants, or institutional or engineering controls) change as to form or content. All statutory references include any successor provisions.

14. Notices. Any notice, demand, request, consent, approval or communication that either party desires or is required to give to the other pursuant to this Covenant shall be in writing and shall either be served personally or sent by first class mail, postage prepaid, addressed as follows:

To Owner:
____
____
____
____
____

To Department:

IDEM, Office of Land Quality
100 N. Senate Avenue
IGCN 1101
Indianapolis, IN 46204-2251
Attn: Section Chief, Voluntary Remediation Program

An Owner may change its address or the individual to whose attention a notice is to be sent by giving written notice via certified mail.

15. Severability. If any portion of this Covenant or other term set forth herein is determined by a court of competent jurisdiction to be invalid for any reason, the surviving portions or terms of this Covenant shall remain in full force and effect as if such portion found invalid had not been included herein.

16. Authority to Execute and Record. The undersigned person executing this Covenant represents that he or she is the current fee Owner of the Real Estate or is the authorized representative of the Owner, and further represents and certifies that he or she is duly authorized and fully empowered to execute and record, or have recorded, this Covenant.

Owner hereby attests to the accuracy of the statements in this document and all attachments.

IN WITNESS WHEREOF, ____________________, the said Owner of the Real Estate described above has caused this Environmental Restrictive Covenant to be executed on this _______ day of _________________________, 20____.

____
Owner

STATE OF _______________)
) SS:
COUNTY OF _____________)

Before me, the undersigned, a Notary Public in and for said County and State, personally appeared __________________, the __________________ of the Owner, __________________________, who acknowledged the execution of the foregoing instrument for and on behalf of said entity.

Witness my hand and Notarial Seal this ___ day of ____________, 20___.

____

______________________________, Notary Public

Residing in ________________ County, _________

My Commission Expires:

This instrument prepared by:

Roux Associates, Inc.
Timothy Adams, PG
2000 Spring Road, Ste. 420
Oak Brook, IL 60523

I affirm, under the penalties for perjury, that I have taken reasonable care to redact each Social Security number in this document, unless required by law:

Roux Associates, Inc.
Timothy Adams, PG
2000 Spring Road, Ste. 420
Oak Brook, IL 60523

EXHIBIT A

LEGAL DESCRIPTION OF REAL ESTATE

EXHIBIT B

MAP OF REAL ESTATE

EXHIBIT C

CONTAMINANTS OF CONCERN

EXHIBIT D

CONSTRUCTION WORKER RESTRICTION AREA MAP

EXHIBIT E

ENGINEERED BARRIERS MAP

APPENDIX B

Provect-IR™ Chemical Data Sheets

OVERVIEW

Provect-IR™ Antimethanogenic *In Situ* Chemical Reduction (ISCR) Reagent is designed to treat persistent organic and/or inorganic contaminants present in the subsurface environment. It is unique in its composition:

- Zero-Valent Iron 10% (weight basis), average particle size = 15 µm yields 25 ft ZVI surface area / lb product
- Integrated Vitamins, minerals and nutrients (yeast extract) specially selected for anaerobes
- Chemical oxygen scavenger to maintain reduced condition
- Multiple, Complex, Hydrophilic, Timed-Release organic carbon sources (plant materials, Kelp, Calcium Propionate) @ 390 g H donor / lb product
- METHANE INHIBITORS to increase safety and efficiency

MATERIAL PACKAGING, HANDLING AND STORAGE

Provect-IR can be specially formulated to meet site-specific needs. The standard formulation contains 10% ZVI and is packaged as a dry powder in 50-lb easy-open (NO SHARPS), polyethylene-lined, recycled paper bags or, upon request, in 2,000 lb Supersacks. Typical shipments entail multiple units of 4x4 wooden pallets containing 40 bags x 50 lbs/ bag = 2,000 lbs reagent per pallet. Each pallet is neatly wrapped in water-resistant plastic, but direct exposure to rain should be avoided.

GENERAL HEALTH AND SAFETY GUIDELINES

Provect-IR is non-hazardous and safe to handle. The use of standard personal protective equipment is always recommended, including safety glasses, steel-toe boots, gloves, hearing protection (in the proximity of loud machinery) and hard hat. Dust mask may be desired when working with the material under certain conditions. The SDS is posted on our web site at the following link: Click Here!

SLURRY PREPARATION

Provect-IR is mixed with clean water on site to yield an aqueous slurry (see **Table 1** for field mixing guidelines). Experienced injection contractors can easily manage (mix, transport/pump, and inject) slurry containing between 20% and 30% solids (defined as the mass of dry Provect-IR divided by the total mass of slurry, including the water). For situations where more volume is desired, slurry density can be decreased, *e.g.*, using a thinner slurry. Conversely, for situations where less volume is required (for example to minimize surfacing issues), thicker slurry with higher solids can be applied. A slurry containing *ca*. 29% solids will have the following general characteristics:

- Wet Density = 0.9 to 1.1 g/cm^3
- Dry Density = 0.3 to 0.4 g/cm^3
- Viscosity = 500 to 1,500 cP

TABLE 1. FIELD GUIDE FOR MAKING SLURRY			
per 50 pound bag		per 25 kg bag	
Target weight %	USG water required	Target weight %	Liters water required
15	34	15	142
20	24	20	100
22	21	22	89
24	19	24	79
26	17	26	71
28	15	28	64
30	14	30	58
32	13	32	53
34	12	34	49
36	11	36	44

APPLICATION TECHNIQUES

Provect-IR has been employed for source area treatment, plume treatment and/or plume management using permeable reactive barrier (PRBs). The choice of installation method will depend on the site-specific conditions, including treatment depth and geology. The most commonly practiced *in situ* application method has been direct injection of aqueous slurry.

Provect-IR slurry containing 10 to 35% solids has been added to numerous aquifers using a variety of injection methods, including hydraulic fracturing, pneumatic fracturing and direct injection. It can also be added via direct soil mixing using deep soil mixing equipment, or it can placed directly into an open excavation or trench. ABC-CH4 is a liquid formulation of our antimethanogenic ERD reagent which has been added to existing well screens.

GENERAL GUIDELINES FOR DIRECT PUSH INJECTION OF AQUEOUS SLURRY

Mixing Equipment. Reagent slurry has be prepared in various ways, ranging from in-line automated mixing systems, to manual mixing using a hand-held drill with a mixing attachment, to more creative processes. Particularly for larger projects, experienced drillers will have some form of mechanical mixing system on site that includes a tank with a paddle-type mixer at the bottom. The slurry is then transferred to a feed tank connected to an injection pump so that slurry can be prepared continuously while injections are being performed (see example, ChemGrout mixing system www.chemgrout.com/500hp.htm). Slurry mixes quickly in these systems (<1 minute), and injections can proceed without interruption.

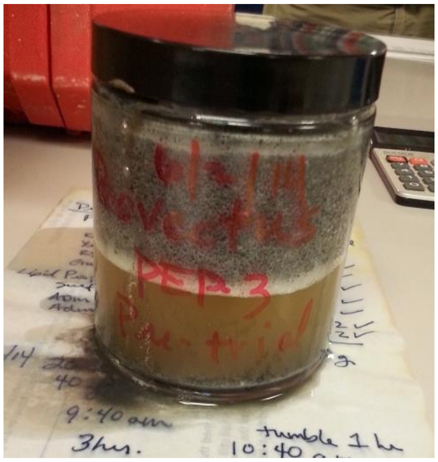
Pumps. Experienced drillers will have a variety of pumping equipment on site. For injecting slurries, an injection pump capable of generating at least 300 psi of pressure at a flow rate of >5 gpm is desired. Obviously, the pump needs to be able to handle solids, such as piston pumps, grout pumps, and progressing cavity pumps - with a preference towards the piston and grout pumps. Slurry is typically injected at pressures of 100 to 200 psi; however, higher pressures are sometimes required to initiate the injection. It is recommended to have a higher pressure pump available on site that can generate over 500 psi and ca. >10 gpm, as deeper installations often require higher injection pressures.

Tooling. Experienced drillers will have sufficient rod length on site to allow 3 to 5 injection points to be capped overnight to allow pressure to dissipate. This can help prevent backflow and surfacing of slurry as the injection rods are retracted. Likewise, experienced drillers will have on hand a variety of injection tips, some that direct the slurry horizontally (see for example GeoProbe's pressure activated tip at geoprobe.com).

In a "top-down" injection approach, the rods are initially advanced to the top of the targeted depth interval, and a specified volume of slurry is injected while recording flow rate, injection pressure, and slurry volume delivered. The injection rods are then further advanced a distance ranging 2 to 4 feet and the process is repeated to help ensure even distribution of slurry over the targeted depth interval. At the end of each injection point, a small volume of water (15 USG) is often used to clear the rods and the injection tip of any slurry.

Provect-IR™

Antimethanogenic ISCR Reagent



TECHNOLOGY DESCRIPTION

Provect-IR is a unique mixture of reagents combined into a single product that optimizes the *in situ* reductive dechlorination of chemicals present in soil, sediment, and groundwater. It acts by promoting synergistic interactions between:

- Natural antimethanogenic compounds
- Hydrophilic, nutrient rich organic carbon sources
- Zero-Valent Iron (ZVI)
- Chemical oxygen scavengers
- Vitamin and mineral sources

This distinctive, patented combination of natural and food-grade chemicals promotes ISCR conditions for fast and effective destruction of targeted constituents of interest (COIs) such as chlorinated solvents, organochlorine pesticides, and other halogenated compounds (Brown *et al.,* 2009; Dolfing *et al.,* 2008; US Patent Office Scalzi *et al* 2012). Notably, Provect-IR is the only ISCR reagent to simultaneously inhibit the production of methane during the requisite carbon fermentation processes (US Patent Office Scalzi *et al*, 2013, 2014). This promotes more efficient use of the hydrogen donor while avoiding negative issues associated with elevated methane (CH4) in groundwater, soil gas, and indoor air.

Current regulations for methane in groundwater vary from *ca*. 10 to 28 mg CH4/L (Indiana Department of Environmental Management, 2014). More State regulations are pending, with several ERD projects which intended to use liquid carbon (emulsified oils) sources failing to receive regulatory approval due to issues associated with excessive production of methane during previous technology applications (Personal Communication - State of California; State of Minnesota). Many remedial practitioners have subsequently been required to establish contingencies for conventional ERD/ISCR implementation in the event that methane exceeds a threshold level ranging from 1 ppm to 10 ppm groundwater. These contingencies often entail expensive and extensive systems for capturing and treating methane in soil gas/vapor captured via SVE systems.

MODE OF ACTION – HOW DOES IT WORK?

What is a Methanogen? In the 1970s, Dr. Carl Woese (1928 to 2012) and his colleagues at the University of Illinois-Urbana studied prokaryotic relationships using DNA sequences and they found that microbes that produce methane – or methanogens - are Archaea (Woese and Fox, 1977). The identification of this new Domain of microorganism was very important for many reasons, but from our limited perspective herein this vast difference in genetic composition means that methanogens are significantly different from typical heterotrophic bacteria and eukaryotes. In other words, *Dehalococcoides ethenogenes* are as different from methanogens as you are.

What is a Statin? A Statin can be defined as “a class of lipid-lowering drugs that reduce serum cholesterol levels by inhibiting a key enzyme involved in the biosynthesis of cholesterol”. Lovastatin is a widely known, potent statin used for decades to lower cholesterol in human blood by inhibiting 3-hydro-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, which is a key enzyme in the cholesterol biosynthesis pathway (Alberts *et al.,* 1980). It was the first statin approved by the United States Food and Drug Administration in 1987 as a hypercholesterolemic drug.

www.ProvectusEnvironmental.com • tel: (815) 650-2230 • fax: (815) 650-2232 • email: info@provectusenvironmental.com

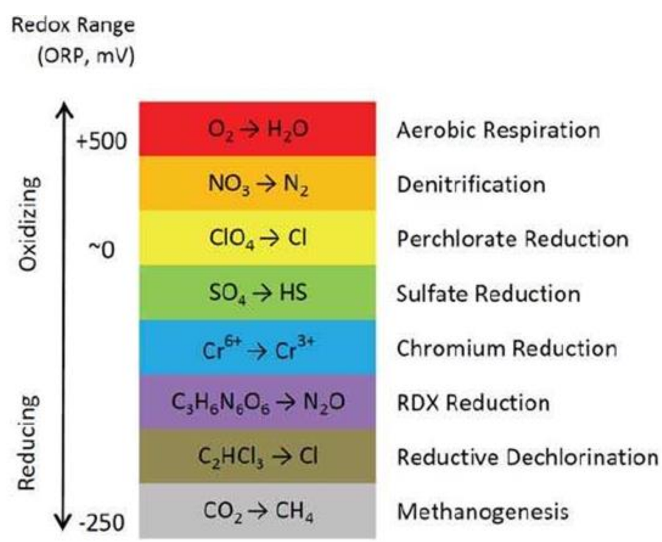
What is Red Yeast (Rice) Extract? The red yeast rice (RYR) extract that is component of Provect-IR is a substance extracted from rice that has been fermented with a type of yeast called *Monascus purpureus*. Red yeast extract is used as a food coloring, food additive/preservative, and is widely consumed by humans. The RYR extract contains a number of monacolins - most importantly, Monacolin K, otherwise known as Lovastatin or Mevinolin. Monacolin K is the only naturally occurring statin compound. In addition to Monacolin K, RYR extract also contains mono-unsaturated fatty acids and other vitamins that will effectively stimulate anaerobic bacteria in the subsurface.

So - How Does a Statin Inhibit a Methanogen? Interestingly, Monacolin K is a potent inhibitor of methanogenic archara because cell membrane production in archaea shares a similar pathway with cholesterol biosynthesis (Miller and Wolin, 2001). And since methanogens are so uniquely different than bacteria, the inhibitory effect is not observed in microbes that are typically associated with: i) catabolism of organic contaminants (such as pseudomonas species) and/or, ii) halo-respiration/biodegradation of chlorinated solvents (such as dehalococcoides species). RYR has been used in the cattle industry for decades in efforts to manage rumen microbiology and control methane production in cows.

ATTENUATION PROCESSES – SAFER, MORE EFFICIENT ISCR TREATMENT

In situ chemical reduction (ISCR) as defined by Dolfing *et al* (2008) describes the combined effect of stimulated biological oxygen consumption (via fermentation of an organic carbon source), direct chemical reduction with zero-valent iron (ZVI) or other reduced metals. The corresponding enhanced thermodynamic decomposition reactions that are realized at the lowered redox (Eh) conditions allow for more effective mineralization of many COIs.

A number of enhanced reductive dehalogenation (ERD) substrates and other accelerated anaerobic bioremediation technologies exist (*e.g.*, emulsified oils, non-emulsified oils, carbon-based hydrogen release compounds, vegetable matter + ZVI amendments) that purportedly offer similar responses. However, the Provect-IR antimethanogenic ISCR substrate is unique in its ability to yield Eh values most conducive to reductive dechlorination while simultaneously preventing methane production - which is a waste of the H being generated and potentially a safety issue under field conditions.



Provect-IR uniquely combines RYR extract with of a variety of specially selected reagents in order to induce genuine ISCR conditions and faciliate the destruction of targeted COIs in a safer, more efficacious manner. As outlined below, it can be used to manage environments impacted by chlorinated solvents, pesticides, heavy metals and other COIs.

Specially Selected Organic Hydrogen Donors: A variety of hydrophilic, nutrient rich organic carbon sources are incorporated in Provect-IR that assist in promoting the ISCR process. The Provect-IR bioremediation amendments consist of slow, medium and long-term release carbon sources. Such a formulation is desirable because it provides both a rapidly utilized electron donor (calcium propionate), slow-release long-term electron donors (kelp meal and yeast extract) and long-term release carbon sources (other cellulose and hemi-cellulose carbon such as soy meal). More specifically,

- Calcium propionate and other readily biodegradable carbon sources: Following the addition of simple carbon sources such as lactate, formate, ethanol or glucose to an aquifer setting these compounds are often converted rapidly to hydrogen and acetate. Although this is the desired response, the process is sometimes too rapid, and this can result in aquifer acidification (due to rapid VFA production) and the liberation of too much hydrogen (which allows methanogens and sulfate reducers to compete effectively with dehalogenators, which tend to grow more slowly). Hence, calcium propionate is used as a readily biodegradable carbon source.
- Yeast extract: This supplement provides a variety of organic hydrogen donors that have slower release profiles (*i.e*., they are not fermented as rapidly as proprionate). Yeast extract also contains biological components that are very useful to anaerobes, but are not available through other carbon-only media. In particular, yeast extract provides an abundant source of priming ATPase along with trace nutrients and vitamin B complexes.
- Kelp meal/Cellulose based carbon: These hydrogen sources are composed of a hydrophilic, solid and complex carbon that ferment more slowly and inherently generate less methane. The hydrophilic organic component of the kelp meal, for example, is composed of cellulose and hemicellulose and it may be treated during the manufacturing process so that some of the components more easily undergo hydrolysis to glucose while maintaining an overall longevity of 3 to 5+ years.

Chemical Oxygen Scavengers: The presence of chemical oxygen scavengers such as sodium sulfite helps minimize performance lag phases that are often observed following the injection of remedial amendments. This is due, in part, to the presence of oxygen that is introduced as a result of the field mixing and blending operations. It takes a cerain amount of time and reagent consumption to remove that introduced oxygen and allow the ISCR reactions to proceed. Provect-IR is unique it that manages this impact chemically, which is a more effective, reliable manner thus allowing the ISCR process to be more effective.

Zero-Valent Iron: The presence of ZVI in Provect-IR is critical to ISCR reactions. The ZVI is added as a reduced material that is oxidized during the reductive dechlorination reactions which use ZVI as the reducing agent. The *beta*-elimination reaction mainly produces (chloro)acetylene, ethane/ethane and chloride ions, without the accumulation of potentially problematic catabolites typical of microbiologically mediated sequential reductive dehalogenation processes (*e.g.,* DCE "stall"). As the ZVI reacts, hydroxyl ions are released and pH increases which is useful in neutralizing the acidity generated during the fermentation of carbon, where acids are generated. Oxidized iron species are also prodcued, where are useful in *alpha*-elimination reactions and iron cycling. One limitation to ZVI reactions is that they are surface mediated which means that direct contact is required for direct COI destruction.

RYR Extract: Provect-IR is the only ISCR amendment that will rapidly induce ISCR conditions while simultaneously preventing or significantly minimizing the production of methane. The benefits are notable:

- Safer: Methane is explosive with an LEL of 5% and an UEL of 15%. Production of methane will result from the addition of any conventional ERD or ISCR amendment: excessive and extended production of methane can result in elevated in groundwater concentrations (as high as 1,000 ppm have been reported) which can lead to accumulation in soil gas subsequently impacting indoor air. State specific regulations for methane in groundwater have been promulgated, with others pending for soil gas and indoor air.

- More Efficient = More Cost Effective: Production of methane is a direct indication that the hydrogen generated from the organic carbon amendments was used by methanogens and the amendment has been wasted because it was not utilized by acetogens or dehalorespiration. By inhibiting the growth and proliferation of methane producing Archaea, chlororespiring bacteria can become the more dominant bacterial populations.

PRIMARY FEATURES:

- Effective: No accumulation of dead-end catabolic intermediates as a function of substrate addition (as is common with [emulsified] oils and sources of carbon only).
  - Does not rely on physical sorption/sequestration as a major "removal" mechanism (as is common with oils).
  - Inherently buffered for pH control – will not acidify an aquifer and liberate heavy metals as potential secondary COIs.
- Efficient: Significantly lower costs as a result more efficient amendment utilization and avoidance of contingencies for methane management. No need for additional buffers.
- Safe: Fewer health and safety concerns as compared with use of traditional ERD or ISCR reagents; Avoid issues associated with new and emerging methane regulations.
- Ease of Use: Green and sustainable. All components integrated in a single package. Logistics with no surprises.
- Longevity: Engineered profile of carbon sources for multi-year longevity estimated at 3 to 7 years based on site-specific hydrogeology. Reagent will stay in place and remain active which prevents rebound.
- Improved Performance: More efficient use of hydrogen donors (does not get wasted as methane).
- Adaptable Formulations for Heavy Metals: Will not mobilize arsenic or other heavy metals yielding secondary contaminants (as is common with [emulsified] oils and sources of carbon only). Can be formulated to manage environments that are co-impacted by various inorganic contaminants (*e.g.*, As, [Hg], Ni, Pb, Zn) while simultaneously mineralizing the organic compounds.
- Patented Technologies: Technology end users and their clients are fully protected from all Patent and other legal issues.

PHYSICAL PROPERTIES:

Particle Size: ranges from ca. <5 to 100 micron (can be manufactured to specifications).

Dry Density: ranges from 0.4 to 0.5 g/cm3

29% Aqueous Slurry Density: ranges from 0.9 to 1.0 g/cm3

29% Aqueous Slurry Viscosity: ranges from 500 to 1,500 cP

SLURRY PREPARATION GUIDELINES:

Percent Solids Content	Mass of Provect-IR	Volume of Water (US gallons)
10%	25 lb	27
20%	25 lb	12
30%	25 lb	7

LITERATURE CITED:

Alberts, A., J. Chen, G. Kuron, V. Hunt, J. Huff, C. Hoffman, J. Rothrock, M. Lopez, H. Joshua, an E. Harris; 1980. Mevinolin: a Highly Potent Competitive Inhibitor of Hydroxymethylglutaryl-coenzyme A Reductase and a Cholesterol-Lowering Agent. Proceedings of the National Acadaemy of Sciences of the United States of America 77:3957-3961.

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Dolfing, J., M. Van Eekert, A. Seech, J. Vogan and J. Mueller. 2008. *In Situ* Chemical Reduction (ISCR) Technologies – Significance of Low Eh Reactions. International Journal Soil & Sediment Contamination 17 (1) : 63-74.

Miller, T.L. and M.J. Wolin. 2001. Inhibition of growth of Methane-Producing Bacteria of the Rumen Forestomach by HydroxymethylglutarylSCoA Reductase Inhibitors. J. Dairy Sci. 84:1445-1448.

Scalzi, M. and McGill, J. 2012. Method for the Treatment of Groundwater and Soils using Mixtures of Seaweed Kelp. US PTO No. 8,147,694 B2 (April 3, 2012).

Scalzi, M. and A. Karachalios. 2013 and 2014. Inhibition of Methane Production during Anaerobic Reductive Dechlorination. US PTO 13/ 785,840 and CIP 14/268,637

Woese, C.R. and G.E. Fox (1977). "Phylogenetic structure of the prokaryotic domain: the primary kingdoms". *Proceedings of the National Academy of Sciences of the United States of America* **74** (11): 5088–5090.

CONTACT US FOR A COMPLIMENTARY SITE EVALUATION

PROVECTUS ENVIRONMENTAL PRODUCTS, INC.

2871 West Forest Road, Suite 2 | Freeport, IL 61032

Tel: (815) 650-2230 | Fax: (815) 650-2232 | Email: info@ProvectusEnv.com

Multiple remedial contracting options available via strategic providers

Turn-Key, Risk-Reward, Pay-for Performance, Remedial Guarantees/Warranties

Safety Data Sheet (SDS)

OSHA HazCom 2012 Standard 29 CFR 1910.1200. Prepared to GHS Rev03.

Printing date 05/30/2014 *Reviewed on 05/30/2014*

* 1 Identification

· ***Product identifier***

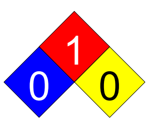
· ***Trade name: Provect-IR Antimethanogenic ISCR Reagent***
· ***Product description***
Remediation product for the treatment of soil, sediment and groundwater. Not for use in potable water sources.

· ***Details of the supplier of the safety data sheet***
· ***Manufacturer/Supplier:***
Provectus Environmental Products
2871 W. Forest Road
Suite 2
Freeport, IL 61032
Phone: 815-650-2230
Fax: 815-650-2232
www.provectusenvironmental.com
· ***Emergency telephone number:*** 815-650-2230

* 2 Hazard(s) identification

· ***Classification of the substance or mixture***
The product is not classified according to the Globally Harmonized System (GHS).

· ***Label elements***
· ***GHS label elements*** Non-Regulated Material
· ***Hazard pictograms*** Non-Regulated Material
· ***Signal word*** Non-Regulated Material
· ***Hazard statements*** Non-Regulated Material
· ***Hazard description:***
CONTAINMENT HAZARD: Any vessel that contains wetted reagent must be vented due to potential pressure build up from fermentation gases.
· ***Classification system:***
· ***NFPA ratings (scale 0 - 4)***



Health = 0
Fire = 1
Reactivity = 0

· ***HMIS-ratings (scale 0 - 4)***

HEALTH	0
FIRE	1
REACTIVITY	0

Health = 0
Fire = 1
Reactivity = 0

* 3 Composition/information on ingredients

7439-89-6	iron	5-40%
4075-81-4	calcium dipropionate	2 - 4%
	Proprietary Organic Carbon Sources	48-90%

· ***Chemical characterization: Mixtures***
· ***Description:*** Mixture of the substances listed below with nonhazardous additions.

· ***Dangerous components:***			
8013-01-2	Yeast extracts	STOT SE 3, H335	0.5 - 2%

(Contd. on page 2)

(Contd. of page 1)

9000-30-0	Guar gum	STOT SE 3, H335; Eye Irrit. 2B, H320; Combustible Dust	0.5 - 2%
7757-83-7	sodium sulphite	Acute Tox. 4, H302	1 - 2%

· ***Additional information:*** Product contains red yeast rice

4 First-aid measures

· ***Description of first aid measures***
· ***After inhalation:*** Remove person to fresh air. If signs/symptons continue, get medical attention.
· ***After skin contact:*** Wash off with soap and water. Get medical attention if irritation develops.
· ***After eye contact:*** Flush with water for 5 minutes
· ***After swallowing:***
Rinse mouth with water and afterwards drink plenty of milk or water. Call a poson control center or doctor immediately for treatment advice.
· ***Most important symptoms and effects, both acute and delayed*** No further relevant information available.
· ***Indication of any immediate medical attention and special treatment needed***
No further relevant information available.

5 Fire-fighting measures

· ***Extinguishing media***
· ***Suitable extinguishing agents:***
CO2, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
· ***Special hazards arising from the substance or mixture*** No further relevant information available.
· ***Advice for firefighters***
· ***Protective equipment:*** No special measures required.

* 6 Accidental release measures

· ***Personal precautions, protective equipment and emergency procedures*** Not required.
· ***Environmental precautions:*** Do not allow to enter sewers/ surface or ground water.
· ***Methods and material for containment and cleaning up:***
Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry. Sweep or vacuum up spillage and place in vented container.
· ***Reference to other sections***
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

* 7 Handling and storage

· ***Precautions for safe handling*** No special measures required.
· ***Information about protection against explosions and fires:*** Combustible material

· ***Conditions for safe storage, including any incompatibilities***
· ***Storage:***
· ***Requirements to be met by storerooms and receptacles:***
CONTAINMENT HAZARD: Any vessel that contains wetted reagent must be vented due to potential pressure build up from fermentation gases.
· ***Information about storage in one common storage facility:*** Not required.
· ***Further information about storage conditions:***
Keep tightly closed in a dry and cool place. Keep away from open flames, hot surfaces and sources of ignition. Any material that is wetted must be vented due to potential pressure build up from fermentation gases.

(Contd. on page 3)

Safety Data Sheet (SDS)

OSHA HazCom 2012 Standard 29 CFR 1910.1200. Prepared to GHS Rev03.

Printing date 05/30/2014 *Reviewed on 05/30/2014*

Trade name: Provect-IR Antimethanogenic ISCR Reagent

(Contd. of page 2)

· ***Specific end use(s)*** No further relevant information available.

* 8 Exposure controls/personal protection

· ***Additional information about design of technical systems:*** No further data; see section 7.

· ***Control parameters***
· ***Components with occupational exposure limits:***
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.
· ***Additional information:***
Dry or powdered ingredients are combustible. Dispersal of finely divided dust from products into air may form mixtues that are ignitable and explosive. Minimize airborne dust generation and eliminate sources of ignition.

· ***Exposure controls***
· ***Personal protective equipment:***
· ***General protective and hygienic measures:***
The usual precautionary measures for handling chemicals should be followed.
· ***Breathing equipment:*** Not required.
· ***Protection of hands:*** Not required.
· ***Eye protection:*** Not required.

* 9 Physical and chemical properties

· ***Information on basic physical and chemical properties***
· ***General Information***

· ***Appearance:***	
Form:	Solid
Color:	Brown to Green
· ***Odor:***	Pleasant
· ***Odor threshold:***	Not determined.
· ***pH-value:***	Not applicable.
· ***Change in condition***	
Melting point/Melting range:	Not determined.
Boiling point/Boiling range:	Undetermined.
· ***Flash point:***	Not applicable.
· ***Flammability (solid, gaseous):***	Not determined.
· ***Ignition temperature:***	
Decomposition temperature:	Not determined.
· ***Auto igniting:***	Product is not selfigniting.
· ***Danger of explosion:***	Dry or powdered ingredients are combustible. Dispersal of finely divided dust from products into air may form mixtures that are ingnitable and explosive. Minimize airborne dust generation and eliminate sources of ignition.
· ***Explosion limits:***	
Lower:	Not determined.
Upper:	Not determined.
· ***Vapor pressure:***	Not applicable.
· ***Density:***	Not determined.

(Contd. on page 4)

(Contd. of page 3)

· ***Relative density*** Not determined.
· ***Vapour density*** Not applicable.
· ***Evaporation rate*** Not applicable.

· ***Solubility in / Miscibility with***
Water: Soluble.

· ***Partition coefficient (n-octanol/water):*** Not determined.

· ***Viscosity:***
Dynamic: Not applicable.
Kinematic: Not applicable.

· ***Solvent content:***
Organic solvents: 0.0 %

Solids content: 100.0 %
· ***Other information*** No further relevant information available.

10 Stability and reactivity

· ***Reactivity*** No further relevant information available.
· ***Chemical stability*** Product is stable under normal conditions.
· ***Thermal decomposition / conditions to be avoided:*** No decomposition if used according to specifications.
· ***Possibility of hazardous reactions*** No dangerous reactions known.
· ***Conditions to avoid*** No further relevant information available.
· ***Incompatible materials:*** No further relevant information available.
· ***Hazardous decomposition products:*** No dangerous decomposition products known.

* 11 Toxicological information

· ***Information on toxicological effects***
· ***Acute toxicity:***
· ***Primary irritant effect:***
· ***on the skin:*** No irritant effect.
· ***on the eye:*** Product dust may cause eye irritation.
· ***Sensitization:*** No sensitizing effects known.
· ***Additional toxicological information:***
The product is not subject to classification according to internally approved calculation methods for preparations:
When used and handled according to specifications, the product does not have any harmful effects according to our experience and the information provided to us.

· ***Carcinogenic categories***

· ***IARC (International Agency for Research on Cancer)***
None of the ingredients is listed.

· ***NTP (National Toxicology Program)***
None of the ingredients is listed.

· ***OSHA-Ca (Occupational Safety & Health Administration)***
None of the ingredients is listed.

12 Ecological information

· ***Toxicity***
· ***Aquatic toxicity:*** No further relevant information available.

(Contd. on page 5)

(Contd. of page 4)

· ***Persistence and degradability*** No further relevant information available.
· ***Bioaccumulative potential*** No further relevant information available.
· ***Mobility in soil*** No further relevant information available.
· ***Additional ecological information:***
· ***General notes:*** Water hazard class 1 (Self-assessment): slightly hazardous for water
· ***Results of PBT and vPvB assessment***
· ***PBT:*** Not applicable.
· ***vPvB:*** Not applicable.
· ***Other adverse effects*** No further relevant information available.

13 Disposal considerations

· ***Waste treatment methods***
· ***Recommendation:*** Smaller quantities can be disposed of with household waste.

· ***Uncleaned packagings:***
· ***Recommendation:*** Disposal must be made according to official regulations.
· ***Recommended cleansing agent:*** Water, if necessary with cleansing agents.

* 14 Transport information

· ***UN-Number***	
· ***DOT, ADR, ADN, IMDG, IATA***	Non-Regulated Material
· ***UN proper shipping name***	
· ***DOT, ADR, ADN, IMDG, IATA***	Non-Regulated Material
· ***Transport hazard class(es)***	
· ***DOT, ADR, ADN, IMDG, IATA***	
· ***Class***	Non-Regulated Material
· ***Packing group***	
· ***DOT, ADR, IMDG, IATA***	Non-Regulated Material
· ***Environmental hazards:***	
· ***Marine pollutant:***	No
· ***Special precautions for user***	Not applicable.
· ***Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code***	Not applicable.
· ***UN "Model Regulation":***	-

15 Regulatory information

· ***Safety, health and environmental regulations/legislation specific for the substance or mixture***
· ***Sara***

· ***Section 355 (extremely hazardous substances):***

None of the ingredients is listed.

· ***Section 313 (Specific toxic chemical listings):***

None of the ingredients is listed.

· ***TSCA (Toxic Substances Control Act):***

7439-89-6	iron
4075-81-4	calcium dipropionate
8013-01-2	Yeast extracts
9000-30-0	Guar gum
7757-83-7	sodium sulphite

(Contd. on page 6)

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Printing date 05/30/2014 *Reviewed on 05/30/2014*

Trade name: Provect-IR Antimethanogenic ISCR Reagent

(Contd. of page 5)

· ***Proposition 65***

· ***Chemicals known to cause cancer:***
None of the ingredients is listed.

· ***Chemicals known to cause reproductive toxicity for females:***
None of the ingredients is listed.

· ***Chemicals known to cause reproductive toxicity for males:***
None of the ingredients is listed.

· ***Chemicals known to cause developmental toxicity:***
None of the ingredients is listed.

· ***Carcinogenic categories***

· ***EPA (Environmental Protection Agency)***
None of the ingredients is listed.

· ***TLV (Threshold Limit Value established by ACGIH)***
None of the ingredients is listed.

· ***NIOSH-Ca (National Institute for Occupational Safety and Health)***
None of the ingredients is listed.

· ***GHS label elements*** Non-Regulated Material
· ***Hazard pictograms*** Non-Regulated Material
· ***Signal word*** Non-Regulated Material
· ***Hazard statements*** Non-Regulated Material

· ***National regulations:***
The product is subject to be labeled according with the prevailing version of the regulations on hazardous substances.

· ***State Right to Know***

7439-89-6	iron	5-40%
4075-81-4	calcium dipropionate	2-4%
8013-01-2	Yeast extracts STOT SE 3, H335	0.5-2%
9000-30-0	Guar gum STOT SE 3, H335; Eye Irrit. 2B, H320; Combustible Dust	0.5-2%
7757-83-7	sodium sulphite Acute Tox. 4, H302	1-2%
	Proprietary Organic Carbon Sources	48-90%

All ingredients are listed.

· ***Chemical safety assessment:*** A Chemical Safety Assessment has not been carried out.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· ***Date of preparation / last revision*** 05/30/2014 / 6
· ***Abbreviations and acronyms:***
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association

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ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
Acute Tox. 4: Acute toxicity, Hazard Category 4
Eye Irrit. 2B: Serious eye damage/eye irritation, Hazard Category 2B
STOT SE 3: Specific target organ toxicity - Single exposure, Hazard Category 3

· **** Data compared to the previous version altered.***

SDS / MSDS Created by MSDS Authoring Services (www.MSDSAuthoring.com)

APPENDIX C

Access Agreements

LAW OFFICES OF
Harris & Currens
PROFESSIONAL CORPORATION

Steven L. Harris
sharris@harrisandcurrens.com

Timothy C. Currens
tcurrens@harrisandcurrens.com

9 West Main Street
Mooresville, IN 46158

Phone: (317) 831-4466
Fax: (317) 831-4709

September 19, 2012

Paul Troy, LPG
Principal Geologist
Troy Risk, Inc.
7466 Shadeland Station Way
Indianapolis, IN 46256

RE: Town of Mooresville
Your Client: Indiana Machine Works (IDEM VRP: 6051201)
Property Address:
135 E. Harrison St.

Gentlemen,

Enclosed please find the revised Release Agreement. Please execute the same and forward the original back to my office.

Best regards,

Timothy C. Currens

TCC/mdt
Encl.

RELEASE AGREEMENT

Comes now the Civil Town of Mooresville (hereinafter called "Town") and Troy Risk, Inc. (hereinafter called "Company") and the parties enter into the following Agreement:

WHEREAS, Company is an environmental consulting and engineering firm doing certain work in the Town of Mooresville at and around property located at 135 E. Harrison St., Mooresville, Indiana (the "Site"), under the direction of the Indiana Department of Environmental Management (hereinafter "IDEM");

WHEREAS, Company is requesting permission to make certain soil borings and install ground water monitoring wells in the Town's rights-of-way located specifically as shown in the attached Exhibit "A";

WHEREAS, Town is the owner of the rights-of-way and is in need of protecting these rights-of-way and the Town's citizens and employees;

NOW, THEREFORE, in exchange for the mutual consideration set out in this Agreement, the parties agree to the following:

1. Town allows Company, its employees, representatives, agents and contractors to enter on to the rights-of-way of Town in the areas shown in the attached Exhibit "A" for the purpose of installing monitoring wells and to make certain soil borings

to be compliant with IDEM.

2. Company will defend, indemnify and hold Town, Town's employees and agents harmless from all claims, demands, liabilities and damages which may be imposed on or incurred by Town, Town's employees and agents as a consequence of any act or omission on part of Company, or Company's employees, representatives, agents or contractors, in exercise of Company's occupancy or use of Town's rights-of-way pursuant to this Agreement. As a part of this indemnification, Company shall hold Town harmless from any litigation or claims against Town based upon the actions of Company or alleged actions of Company provided, however, that Company shall not be responsible in any way for environmental conditions that are the subject of this work.

3. Company shall remove all monitoring devices at the end of the testing period and shall close the wells according to the standards for well closure established by the State of Indiana and IDEM and for this purpose shall use the services of an Indiana certified well driller. Company shall hold Town harmless from any claims for damages in relation to Company's use of the wells.

4. This Agreement shall be binding upon the parties, their successors and assigns.

5. All notices with respect to this Agreement shall be deemed completed upon receipt by registered or certified mail, postage prepaid, return receipt requested, to the following:

Town: Town of Mooresville
4 E. Harrison St.
Mooresville, IN 46158

Company: Troy Risk, Inc.
]
7466 Shadeland Station Way
Indianapolis, IN 46256

6. This Agreement shall be in effect on the date of execution by both parties and shall continue in effect until Company determines it has completed the activities under this Agreement.

Signed and sealed this 18th day of September, 2012.

TOWN OF MOORESVILLE

By:
George Watkins, President
Mooresville Town Council

ATTEST:

by Debra Monts, Deputy
Sandy Perry
Clerk/Treasurer

TROY RISK, INC.

By: ______________________________
Printed: ___________________________
Title: _____________________________

This Instrument Was Prepared By: Timothy C. Currens, 3475-55, Harris & Currens, 9 W. Main St., Mooresville, IN 46158.

RELEASE AGREEMENT

Comes now the Civil Town of Mooresville (hereinafter called "Town") and Troy Risk, Inc. (hereinafter called "Company") and the parties enter into the following Agreement:

WHEREAS, Company is an environmental consulting and engineering firm doing certain work in the Town of Mooresville at and around property located at 135 E. Harrison St., Mooresville, Indiana (the "Site"), under the direction of the Indiana Department of Environmental Management (hereinafter "IDEM");

WHEREAS, Company is requesting permission to make certain soil borings and install ground water monitoring wells in the Town's rights-of-way located specifically as shown in the attached Exhibit "A";

WHEREAS, Town is the owner of the rights-of-way and is in need of protecting these rights-of-way and the Town's citizens and employees;

NOW, THEREFORE, in exchange for the mutual consideration set out in this Agreement, the parties agree to the following:

1. Town allows Company, its employees, representatives, agents and contractors to enter on to the rights-of-way of Town in the areas shown in the attached Exhibit "A" for the purpose of installing monitoring wells and to make certain soil borings

to be compliant with IDEM.

2. Company will defend, indemnify and hold Town, Town's employees and agents harmless from all claims, demands, liabilities and damages which may be imposed on or incurred by Town, Town's employees and agents as a consequence of any act or omission on part of Company, or Company's employees, representatives, agents or contractors, in exercise of Company's occupancy or use of Town's rights-of-way pursuant to this Agreement. As a part of this indemnification, Company shall hold Town harmless from any litigation or claims against Town based upon the actions of Company or alleged actions of Company.

3. Company shall remove all monitoring devices at the end of the testing period and shall close the wells according to the standards for well closure established by the State of Indiana and IDEM and for this purpose shall use the services of an Indiana certified well driller. Company shall hold Town harmless from any claims for damages in relation to Company's use of the wells.

4. This Agreement shall be binding upon the parties, their successors and assigns.

5. All notices with respect to this Agreement shall be deemed completed upon receipt by registered or certified mail, postage prepaid, return receipt requested, to the following:

Town: Town of Mooresville
4 E. Harrison St.
Mooresville, IN 46158

Company: Troy Risk, Inc.
7466 Shadeland Station Way
Indianapolis, IN 46256

6. This Agreement shall be in effect on the date of execution by both parties and shall continue in effect until Company determines it has completed the activities under this Agreement.

Signed and sealed this 4th day of September, 2012.

TOWN OF MOORESVILLE

By: ______________________
George Watkins, President
Mooresville Town Council

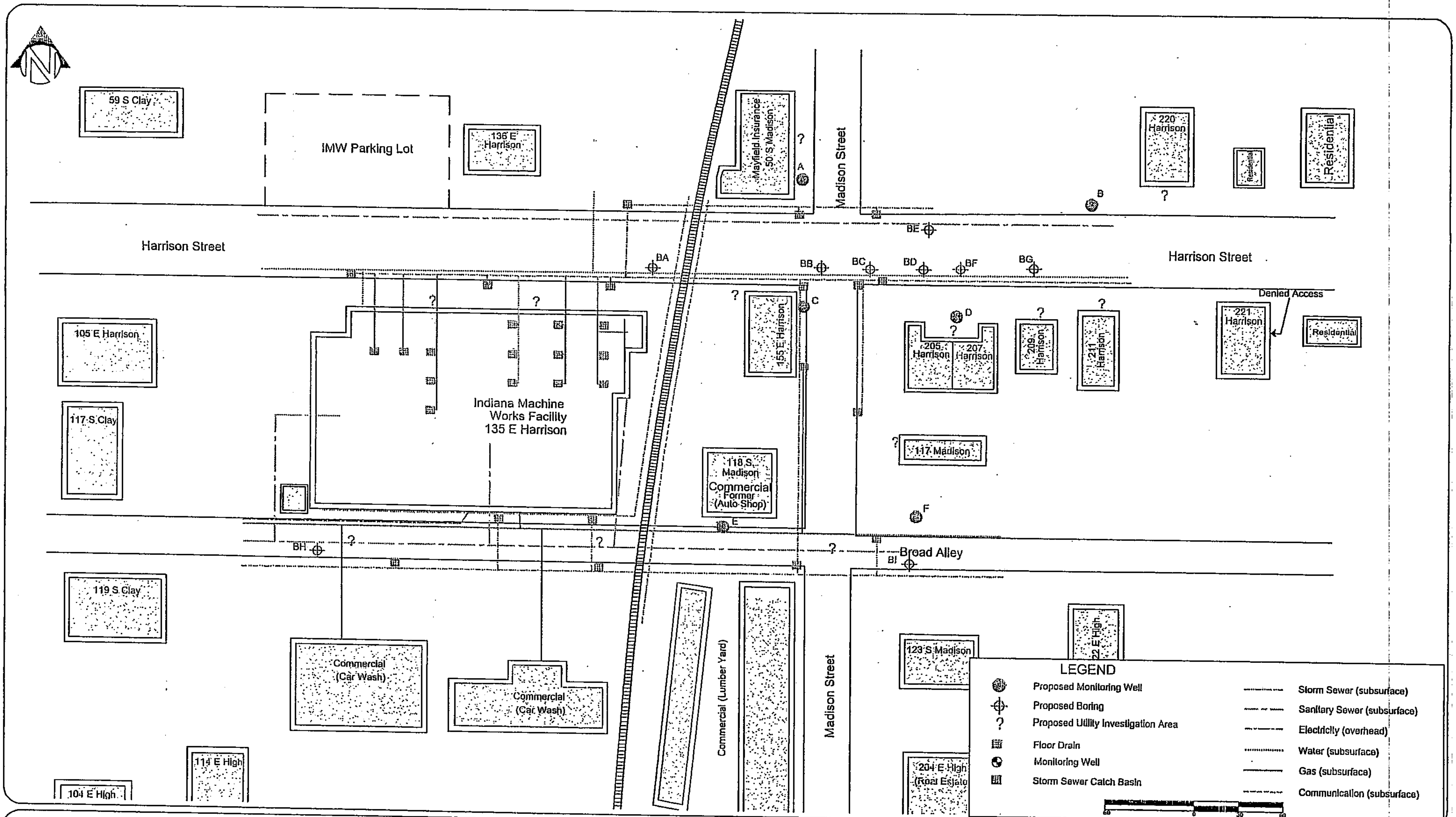
ATTEST:

____
Sandy Perry
Clerk/Treasurer

TROY RISK, INC.

By: ______________________
Printed: PAUL TROY
Title: President

This Instrument Was Prepared By: Timothy C. Currens, 3475-55, Harris & Currens, 9 W. Main St., Mooresville, IN 46158.

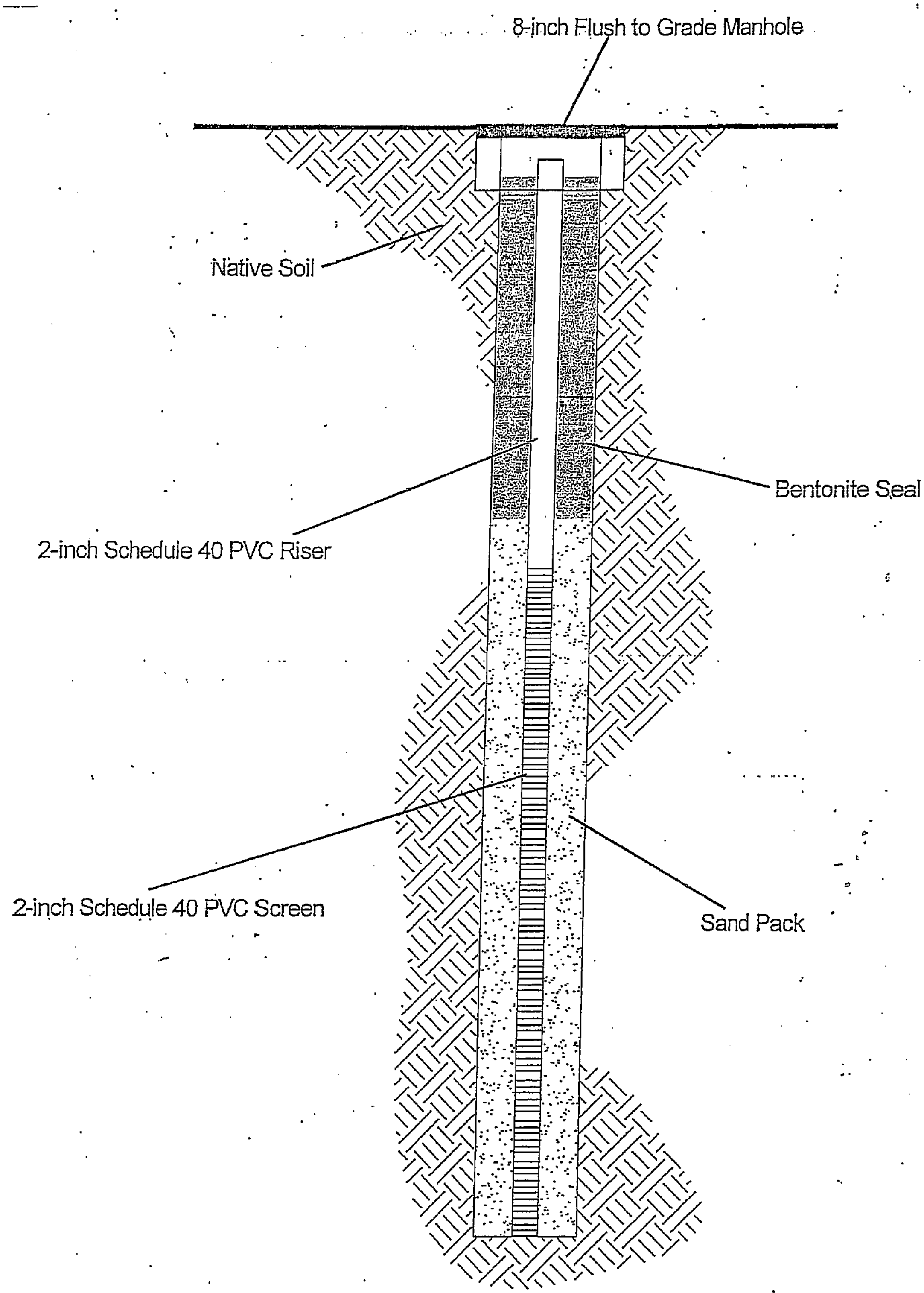


Proposed Boring and Monitoring Well Locations - Proposed ISCO Treatment Investigation

Indiana Machine Works
135 East Harrison Street
Mooresville, IN

Project Number:	95.05
Drawing File:	GW Analytical
Date:	July 5, 2012
Scale:	1"= 60'
Drawn By: AO Checked by: JAO	Figure: 1

Exhibit "A"



General Monitoring Well Construction Diagram	Project Number:	TROY RISK INC.
	Drawing File:	
	Date:	
	Scale:	
	Drawn By: JF	Figure: 2

Patricia Goss
340-9055 cell

CONSENT FOR LIMITED ACCESS

Sam Pugh (Property Owner), as owner of the property located at 205 East Harrison St. Mooresville, IN (referred to herein as "the Property"), hereby consents to allow Troy Risk, Inc. (Requesting Party) access to the Property for the limited purpose of performing environmental investigation and remediation work (Work) as described in and conditioned by the provisions set forth herein. Property Owner represents that it has the authority to enter into this agreement and no other consents are necessary.

Any communications to Property Owner required by or made pursuant to this Consent for Limited Access shall be made to: (Owner name) Sam Pugh
(Address) 4379 E Shady Lane Mooresville IN 46158 (Phone #) 317-831-0627
Any communications to Requesting Party required by or made pursuant to this Consent for Limited Access shall be made to: **Troy Risk, Inc. 7466 Shadeland Station Way, Indianapolis IN 46256 (317) 570-6730 ext 32**.

1. **Access**. Requesting Party shall have access to the Property at all reasonable times for undertaking and conducting the Work described in Section 2. Requesting Party shall coordinate with Property Owner regarding access to the Property, including reasonable notice to Property Owner in advance of visits to the Property. Requesting Party shall conduct activities on the Property in a manner that will minimize interference with the use of the Property by Property Owner.

2. **Scope of Work**. The Work to be performed may include the investigation of soil, groundwater, and indoor air contamination, including without limitation, tests, inspections, soil borings, surveys, installation of monitoring well(s), periodic monitoring of such wells, and

indoor air sampling. Any monitoring wells installed will be capped at grade level. Requesting Party will provide a copy of this Consent for Limited Access to its employees and contractors and require that they comply with the terms herein.

3. **<u>Condition of Property</u>.** Upon completion of the Work to be conducted at the Property, Requesting Party shall restore the Property to substantially the same condition as existed prior to the Work. The surface at all boring locations will be restored to its pre-investigation condition, ordinary wear and tear excepted.

4. **<u>Indemnification</u>.** Requesting Party agrees to indemnify Property Owner from any and all claims by third parties arising out of the Work performed on the Property by Requesting Party, its contractors, or any other agent of Requesting Party. Property Owner shall immediately notify Requesting Party of any such claim and shall cooperate with Requesting Party's investigation and defense (if any) of such claim, including continuing to provide Requesting Party access to the Property. Notwithstanding anything in this Consent for Limited Access to the contrary, Requesting Party is not responsible for indemnifying Property Owner from or against any claim or damage resulting from Property Owner's acts or omissions, including without limitation, its failure to permit Requesting Part to perform any of the Work on the Property.

5. **<u>Termination</u>.** The Requesting Party will notify Property Owner when the Work is completed, and this Consent for Limited Access will terminate at that time.

6. **<u>Successors and Assigns</u>.** This agreement is binding upon the parties, their agents, directors, shareholders, employees, parent affiliates, subsidiary companies, and successors in title or interest, assignees and heirs.

7. **Governing Law.** The laws of the State of Indiana shall apply to the interpretation of this agreement and to any disputes arising out of the matter set forth herein. If any portion of this agreement is found by a court of law to be void, the remaining terms and conditions shall remain in full force and effect.

IN WITNESS WHEREOF, the Parties have executed this Agreement on the dates set forth below.

TROY RISK, INC.

Printed Name: Jason B. Flagg, EIT
Title: Project Engineer, Troy Risk, Inc.

Date: 9/21/2009

Signed Name (Property Owner)
Printed Name: Sam Pugh
Title:

Date:

Janice Jacobs
home 831-2085
cell 363-9747
off M&T

CONSENT FOR LIMITED ACCESS

Sam Pugh (Property Owner), as owner of the property located at 207 East Harrison St. Mooresville, IN (referred to herein as "the Property"), hereby consents to allow Troy Risk, Inc. (Requesting Party) access to the Property for the limited purpose of performing environmental investigation and remediation work (Work) as described in and conditioned by the provisions set forth herein. Property Owner represents that it has the authority to enter into this agreement and no other consents are necessary.

Any communications to Property Owner required by or made pursuant to this Consent for Limited Access shall be made to: (Owner name) Sam Pugh
(Address) 4379 E. Shady Lane Mooresville IN 46158 (Phone #) 317-831-0677

Any communications to Requesting Party required by or made pursuant to this Consent for Limited Access shall be made to: **Troy Risk, Inc. 7466 Shadeland Station Way, Indianapolis IN 46256 (317) 570-6730 ext 32**.

1. **Access.** Requesting Party shall have access to the Property at all reasonable times for undertaking and conducting the Work described in Section 2. Requesting Party shall coordinate with Property Owner regarding access to the Property, including reasonable notice to Property Owner in advance of visits to the Property. Requesting Party shall conduct activities on the Property in a manner that will minimize interference with the use of the Property by Property Owner.

2. **Scope of Work.** The Work to be performed may include the investigation of soil, groundwater, and indoor air contamination, including without limitation, tests, inspections, soil borings, surveys, installation of monitoring well(s), periodic monitoring of such wells, and

indoor air sampling. Any monitoring wells installed will be capped at grade level. Requesting Party will provide a copy of this Consent for Limited Access to its employees and contractors and require that they comply with the terms herein.

3. **Condition of Property.** Upon completion of the Work to be conducted at the Property, Requesting Party shall restore the Property to substantially the same condition as existed prior to the Work. The surface at all boring locations will be restored to its pre-investigation condition, ordinary wear and tear excepted.

4. **Indemnification.** Requesting Party agrees to indemnify Property Owner from any and all claims by third parties arising out of the Work performed on the Property by Requesting Party, its contractors, or any other agent of Requesting Party. Property Owner shall immediately notify Requesting Party of any such claim and shall cooperate with Requesting Party's investigation and defense (if any) of such claim, including continuing to provide Requesting Party access to the Property. Notwithstanding anything in this Consent for Limited Access to the contrary, Requesting Party is not responsible for indemnifying Property Owner from or against any claim or damage resulting from Property Owner's acts or omissions, including without limitation, its failure to permit Requesting Part to perform any of the Work on the Property.

5. **Termination.** The Requesting Party will notify Property Owner when the Work is completed, and this Consent for Limited Access will terminate at that time.

6. **Successors and Assigns.** This agreement is binding upon the parties, their agents, directors, shareholders, employees, parent affiliates, subsidiary companies, and successors in title or interest, assignees and heirs.

7. **Governing Law.** The laws of the State of Indiana shall apply to the interpretation of this agreement and to any disputes arising out of the matter set forth herein. If any portion of this agreement is found by a court of law to be void, the remaining terms and conditions shall remain in full force and effect.

IN WITNESS WHEREOF, the Parties have executed this Agreement on the dates set forth below.

TROY RISK, INC.

Printed Name: Jason B. Flagg, EIT
Title: Project Engineer, Troy Risk, Inc.

Date: 9/21/2009

Signed Name (Property Owner)
Printed Name: Sam Pugh
Title:

Date:

TROY RISK INC.
7466 Shadeland Station Way ♦ Indianapolis, Indiana 46256-3925
Phone (317) 570-6730 ♦ Fax (317) 570-6731♦ **jokeefe@troyrisk.com**
Engineers Scientists and Geologists

April 23, 2012

Ms. Pat Clark
155 E Harrison Street
Mooresville, Indiana

Re: Access Agreement for Environmental Testing at 155 E Harrison Street, Mooresville, Indiana

Dear Ms. Clark:

Troy Risk has been retained as an environmental engineer to investigate the nature and extent of impact to soil and groundwater due to a release of degreasing fluid from former Indiana Machine Works property at 135 E Harrison Street. As part of this investigation, we need to collect indoor air samples within buildings near the former Indiana Machine Works building. According to Morgan County tax records, you are the Property owner of 155 E Harrison Street (Property).

We request your permission to collect air samples within your home on behalf of the Former Indiana Machine Works, Inc. There is no cost to you for the sampling and we will provide the results of sample analysis to you, if requested. The results are also posted on-line at Indiana Department of Environmental Management's (IDEM) website. By signing the attached Access Agreement, you give permission for us enter your home to collect air samples. We expect that to collect the air samples we would need to visit your property three times. A description of proposed field activities follows:

<u>Indoor Air Sampling</u>

We propose to collect air samples from the crawl space and indoor air in accordance with IDEM's Vapor Intrusion Pilot Program, as amended. In brief, vapor samples will be collected in evacuated stainless steel six liter canisters over a 24-hour period. We also request to interview the building user to complete the IDEM indoor air building survey checklist during our air sample visit.

Troy Risk will conduct fieldwork in a professional and expeditious manner to minimize any inconvenience to or interruption of ongoing activities. In addition, Troy Risk will restore the property to as close to its original condition as reasonably possible upon completion of each field activity. In addition, Former Indiana Machine Works, Inc., will defend and hold harmless Owner from and against all losses, damage, injuries, or liability arising from any negligence in the performance of Work authorized under this Agreement.

Please sign the Access Agreement in the appropriate section. We will have representative of Indiana Machine Works also sign the Agreement and return a copy to you by mail.

If you have any questions please contact me at 317-570-6730 ext 31, or my cell phone (317) 402-9119, or **jokeefe@troyrisk.com**.

Sincerely,

TROY RISK, INC.

Jeff O'Keefe

Jeff O'Keefe, CHMM
Project Manager

Paul Troy

Paul Troy, LPG
Principal Geologist

Enclosures: Figure 1: Proposed Sample Locations,
Two copies of access agreement,

ACCESS AGREEMENT

This Agreement is made between Ms. Pat Clark ("Owner"), owner of the real estate located at 155 E Harrison Street, Mooresville, Indiana ("the Property") and Indiana Machine Works, Inc. ("135 E Harrison Street").

1. Owner authorizes Indiana Machine Works, Inc., its agents, employees, consultants, contractors and subcontractors permission to enter onto the Property for the purpose of investigating indoor air conditions on the Property, collecting and testing samples of air, and all other work necessary to identify and delineate the extent of contamination on the Property (the Work). Indiana Machine Works, Inc. will perform this Work at its sole cost and expense.

2. Indiana Machine Works, Inc. will defend and hold harmless Owner from and against all losses, damage, injuries, or liability arising from any negligence in the performance of Work authorized under this Agreement.

3. Owner acknowledges and agrees that Indiana Machine Works, Inc., its agents, employees, consultants, contractors and subcontractors may enter the Property and conduct the Work at Indiana Machine Works, Inc. risk. Owner does not assume any risk, liability or responsibility or duty of care as to Indiana Machine Works, Inc., agents, employees, consultants, contractors and subcontractors when on the Property to conduct the Work.

4. Indiana Machine Works, Inc., through its agents, employees, consultants, contractors and subcontractors, will notify Owner in advance of any Work on the Property and will conduct the Work at reasonable times of the day and in a manner which does not unreasonably interfere with Owner's use of or activities on the Property.

5. Owner agrees not to interfere with Indiana Machine Works, Inc., performance of Work authorized under this Agreement and agrees not to damage, tamper with or disturb the monitoring locations or related equipment. For safety reasons, Owner agrees not to enter a Work area when Work is being conducted under this Agreement.

6. Upon Owner's request following completion of the Work, Indiana Machine Works, Inc., will provide a copy of the sample results from the activities authorized under this Agreement.

7. Upon completion of the Work, Indiana Machine Works, Inc., agrees to properly close and decommission all monitoring points it has installed, repair any damage related to its activities, and restore the Property to substantially the same condition it was in prior to Indiana Machine Works, Inc., entry.

8. This Agreement will be effective for a period of 5 years from the date of signing.

OWNER

Priscilla J Clark

Signature

PRISCILLA J. CLARK

Printed

4/22/12

Date

317-831-3183

Phone Number

Indiana Machine Works, INC.

By: [signature]

Title: Exec Vice President

30 JULY 2012

Date

APPENDIX D

Sampling and Analysis Plan (SAP)

SAMPLING AND ANALYSIS PLAN

Laboratory Equipment,
Formerly Indiana Machine Works
135 East Harrison St, Mooresville, Indiana
VRP Site #6051201

February 2015

Prepared for

One Beacon
70 West Monroe
Chicago, Illinois 60603

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

ROUX

2000 Spring Road, Suite 420, Oak Brook, IL ♦ 630-572-3300

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FIGURES

APPENDICES

1.0 INTRODUCTION

On behalf of Beacon One Insurance, and LabeCo Properties, Ltd (Volunteer), Roux Associates, Inc. (Roux) has prepared this Sampling and Analysis Plan (SAP) for implementing the Revised Remedial Work Plan (RWP) at Indiana Machine Works located at 135 East Harrison Street, Mooresville, Indiana (Site). This SAP presents the technical details for completing the scope of work presented in the RWP and serves to ensure that sample collection activities produce samples and analytical data that meet established Data Quality Objectives (DQOs). Remediation activities are being conducted at the Site in order to facilitate appropriate closure under the Indiana Department of Environmental Management (IDEM) Voluntary Remediation Program (VRP).

The SAP is organized as follows:

- Section 1.0 Introduction;
- Section 2.0 Field work objectives and approach;
- Section 3.0 Field team organization and responsibilities;
- Section 4.0 Remediation activities;
- Section 5.0 Sample identification numbers and documentation;
- Section 6.0 Chain of custody; and,
- Section 7.0 Packaging and shipping.

Figure 1 shows the Site location, **Figure 2** shows the Site plan details and utilities layout. Additional information regarding Roux Standard Operating Procedures (SOPs) has been included in **Appendix A**.

2.0 FIELD WORK OBJECTIVES AND APPROACH

The objective of this SAP is to specify the methods and equipment that will be used to collect groundwater, soil gas, and indoor air samples necessary to demonstrate confidence in plume behavior (i.e., "stability") as it pertains to the conceptual site model, and to perform enhanced reductive dechlorination (ERD) via ISCR injections. In addition, this SAP will identify the appropriate field or laboratory methods to be used to analyze each sample.

The planned field activities include the following tasks:

- Compile and review existing data, maps, and plans available for the Site.
- Coordinate remediation activities with the Site owner, current tenants, applicable off-Site property owners, the State of Indiana dig safe organization (Indiana Underground Plant Protection Service [IUPPS]), and a private underground utility locating service.
- Conduct enhanced reductive dechlorination (ERD) injections.
- After a six-month equilibration period, conduct post-remediation groundwater sampling and analysis for VOCs and aquifer geochemistry (including methane) and soil gas/indoor air samples for analysis of VOCs and methane.

The following sections describe the approach and standard operating procedures to be used for: field team organization and responsibilities; remediation activities; groundwater sampling; soil gas/indoor air sampling; decontamination; quality control documentation; sample identification numbers; chain of custody; and packaging and shipping.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Roux has organized a project team designed specifically for this project. The primary members of the project team are the Principal in Charge, Project Manager, Site Manager, Field Team Members, and Health and Safety Officer.

3.1 Principle in Charge

The role of the Principal-in-Charge (PIC) is to facilitate assignment of appropriate personnel and resources to this project. The PIC works with the Project Manager to provide technical guidance and senior review for project reports and deliverables. Although the Project Manager will be the direct point of contact, the PIC will resolve any issues that cannot be satisfactorily managed through the Project Manager.

3.2 Project Manager

The responsibility of the Project Manager (PM) will be to manage the technical and financial aspects of the project. The PM will be the primary client contact and will also be responsible for providing senior peer review of the technical aspects of the project.

3.3 Site Manager

The Site Manager is the overall coordinator of field activities at the Site and is the communication link between field team members and the PM. The Site Manager will have overall responsibility for completion of all field activities in accordance with the SAP, will ensure that field activities follow the SAP and Health and Safety Plan (HASP), and evaluate potential health hazards. The Site Manager will be responsible for mobilization and demobilization of the field team and subcontractors, and will direct the activities of all subcontractors at the Site. The Site Manager will also coordinate sample analysis with the laboratory. Any logistical problems hindering field activities, such as equipment malfunctions or availability, personnel conflicts, or weather dependent working conditions, will be relayed to and resolved by the Site Manager.

Field team members will report directly to the Site Manager and provide daily verbal progress reports of field activities. The Site Manager is responsible for informing the PM of daily activities. The Site Manager is responsible for supplying field team members with appropriate field notebooks and field documentation forms.

3.4 Field Team

Field team members will assist the Site Manager in the collection and management of soil samples. Decontamination of sampling equipment will be conducted by field team members under the direction of the Site Manager. Field team members will complete field documentation forms as indicated in the SAP. Field team members will be responsible for sample packaging and shipping. All field team members will comply with the provisions of the HASP.

3.5 Site Health and Safety Officer

A Health and Safety Officer (HSO) will be designated to the Site and be present during field operations. The HSO primary responsibility will be for health and safety concerns associated with all field activities. The HSO has stop-work authorization that can be executed upon his/her determination of an imminent safety hazard, emergency condition, or other potentially dangerous situations, such as detrimental weather conditions. Authorization to proceed with work will be issued by the HSO in conjunction with the PM after such action. The HSO will initiate and execute all contact with support facilities and personnel when this action is appropriate.

4.0 REMEDIATION ACTIVITIES

As detailed in the RWP, a mixture of Provectus-IR™ as a slurry of 29 percent solid mixture will be injected via Geoprobe®. After completion of the ERD applications, a 6-month equilibration period will be provided, and then post-remediation performance monitoring will be conducted to generate data necessary to demonstrate confidence in plume behavior (i.e., "stability") as it pertains to the conceptual site model.

Roux proposes to sample the 29 monitoring wells listed in the RWP on a quarterly basis for one year followed by a semi-annual basis for two years (8 total sampling events). All groundwater samples will be analyzed for VOCs and samples from select monitoring wells will also be analyzed for supplemental geochemical parameter analysis (e.g. sulfate, sulfide, alkalinity, total organic carbon (TOC), and dissolved gases (ethane, ethane, and methane)) to help evaluate aquifer geochemical conditions following ISCR treatment. Details regarding the groundwater sampling procedures are presented in **Section 4.1**.

Although Provect-IR™ includes natural anti-methanogenic compounds and monitoring conducted by TRI following the ISCR pilot test indicated methane concentrations did not pose a potential explosion risk, Roux proposes to conduct additional methane monitoring after full-scale implementation as an extra safety precaution. Roux will monitor groundwater and soil gas concentrations in accordance with IDEM's Guidance, *Addressing Methane at Anaerobic Bioremediation Sites* (February 2014) to ensure that methane groundwater concentrations remain below 10 milligrams per liter (mg/l) and soil gas concentrations remain below 10% of the lower explosive limit (LEL) of 5% methane. Details regarding methane sampling procedures are presented in **Section 4.2**.

Although paired soil gas/indoor air monitoring previously conducted by TRI indicated vapor intrusion is not a risk, Roux plans to conduct additional monitoring as an extra safety measure. The supplemental paired sampling will be conducted at off-site commercial and residential home properties where the vapor intrusion groundwater screening level (VIGWSL) are exceeded. Details regarding the paired vapor sampling procedures are presented in **Section 4.3**.

4.1 Groundwater Sampling Procedures

Groundwater samples will be collected using low flow purging and sampling techniques. The samples will be analyzed for VOCs via USEPA Method 8260B. Groundwater elevation and field parameter data will be collected during each of the monitoring events. The analytical data collected during the sampling events will be used to determine groundwater plume stability via Mann-Kendall analysis.

4.1.1 Groundwater Elevation Data Collection

Prior to collecting groundwater samples, Roux field personnel will measure the depth to water below the top of the well casing at each well using an electronic water-level meter. The depth–to-water measurements and top of casing elevations will be used to calculate groundwater elevations across the Site. Groundwater elevation will be used to determine groundwater flow patterns below the Site.

4.1.2 Monitoring Well Sampling

During each event, groundwater samples will be collected from a total of 29 monitoring wells. Groundwater samples will be collected in accordance with the United States Environmental Protection Agency (USEPA) Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures guidance document dated April 1996 and Indiana Department of Management (IDEM) Remediation Closure Guide (RCG) Section 3.3. Prior to collecting groundwater samples, each well will be purged using a bladder pump with dedicated 3/8-inch diameter low density polyethylene tubing that was set to the mid-point of the well screen, when possible. The flow rate of the pump will be adjusted to ensure minimal drawdown within the well (to prevent mixing within the well casing and/or disturbance of sediment within or around the well casing). While purging, a multi-parameter aqueous chemistry probe, used in conjunction with a flow-through cell, will measure physical parameters including temperature, pH, Specific Conductance, Dissolved Oxygen (DO), and Oxidation-Reduction Potential (ORP).

The physical parameter measurements and any applicable field observations associated with the groundwater sampling will be documented. After field parameter stabilization, groundwater samples will be collected in laboratory-supplied certified clean containers. The sample containers will be labeled with the sample identification number, analysis requested, time, date, and sampler’s initials. The samples will be placed on ice in coolers and transported to an analytical laboratory, via overnight courier, under standard chain-of-custody procedures. Groundwater samples collected from Site wells will be submitted for VOC analyses by USEPA Method 8260B.

4.1.3 Groundwater QA/QC

In accordance with IDEM requirements and as specified in the Quality Assurance Project Plan (QAPP) for the Site, field sampling, chain-of-custody, laboratory analysis, and reporting must meet certain quality assurance/quality control (QA/QC) objectives. To meet these objectives during groundwater sampling events, field duplicates, equipment rinsate blanks, trip blanks, and matrix spike samples will be collected and analyzed to assess the quality of the data.

Field duplicates will be collected by filling an additional sample container from the well at a frequency of one per 10 or fewer samples. Field duplicates will be submitted to the laboratory with the field samples and analyzed for the target chemical parameters.

Trip blanks will be used to assess the potential for volatile organic contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks will be prepared by the laboratory and included with every sampling kit. The trip blank will remain in the shipping container from the time the sampling kit leaves the laboratory until it is received back from the Site. Trip blanks will be required at a frequency of one per sample package cooler. Trip blanks will be submitted to the laboratory with the field samples and analyzed for the target chemical parameters. Trip blanks should not contain target analytes above 5 times the detection limit (10 times for common laboratory contaminants).

Matrix spike and matrix spike duplicates (MS/MSD) are laboratory duplicates based from the investigative samples split by the laboratory. Matrix spikes provide information will provide information about the effect of the sample matrix on digestion and measurement methodology. All matrix spikes will be performed in duplicate. MS/MSD samples will be analyzed at a frequency of one for every 20 or fewer groundwater samples.

Groundwater sampling equipment will be decontaminated between each sample interval using an Alconox®/water mixture wash followed by a potable water rinse.

4.1.4 Mann-Kendall Concentration Stability Analyses

Upon receipt of the groundwater analytical data, Roux will perform Mann-Kendall statistical analysis useful in identifying groundwater quality trends associated with Site-specific COCs. The Mann-Kendall test is used to evaluate the stability of a solute plume based on concentration trends at individual wells. The Mann-Kendall test for trends is used to help evaluate the presence or absence of a trend in contaminant concentrations over time for individual monitoring points. Specifically, the Mann-Kendall evaluation is a test for zero slope of time-ordered data based on a non-parametric analog of linear regression. The test identifies statistical trends in the plume as stable, increasing, or decreasing within a certain confidence interval.

The field observations, groundwater elevation data, field parameter measurements, analytical results, concentration distribution maps, and statistical analysis will be included in an Annual Groundwater Monitoring Report for the Site.

4.2 Methane Sampling Procedures

Although Provect-IR™ includes natural anti-methanogenic compounds and monitoring conducted by TRI following the ISCR pilot test indicated methane concentrations did not pose a potential explosion risk, Roux proposes to conduct additional methane monitoring after full-scale implementation as an extra safety precaution. Roux will monitor groundwater and soil gas concentrations in accordance with IDEM's Guidance, *Addressing Methane at Anaerobic Bioremediation Sites* (February 2014) to ensure that methane groundwater concentrations remain below 10 milligrams per liter (mg/l) and soil gas concentrations remain below 10% of the lower explosive limit (LEL) of 5% methane.

On a quarterly schedule for one year following full-scale implementation, Roux will conduct the following methane monitoring:

- Groundwater samples collected from at least one source well and one sentinel well from each plume for methane analysis via RSK 175 Modified.
- Soil gas samples collected adjacent to the building slabs at the Site, 205 E Harrison, and 207 E Harrison via a methane detector.
- Soil gas samples collected from the backfill of adjacent sewer lines via a methane detector.

4.3 Vapor Intrusion Sampling Procedures

Although paired soil gas/indoor air monitoring previously conducted by TRI indicated vapor intrusion is not a risk, Roux plans to conduct additional monitoring as an extra safety measure. The supplemental paired sampling will be conducted at off-site commercial and residential home properties where the VIGWSL are exceeded. Soil gas and indoor air samples will be analyzed for VOCs using US EPA TO-15.

Soil gas samples will be collected via pre-evacuated 1-liter Summa canisters equipped with 200 milliliter per minute (mL/min) flow control regulators. Indoor air samples will be collected via pre-evacuated, 6-liter Summa canisters equipped with preset flow regulators for an 8-hour sampling period at a collection rate of approximately 0.0125 liters per minute. During sampling, weather conditions will be recorded (e.g., precipitation, indoor and outdoor temperature, and barometric pressure). In addition, any pertinent outdoor observations (e.g., odors, and significant activities in the vicinity) will be recorded. PID readings of ambient air in the area of the ambient air sampling activities will be collected.

In order to ensure that sample collection time was not abbreviated or exceeded, prior to sample collection the initial vacuum in the Summa canister will be recorded which should measure between -31 inches Hg and -25 inches Hg (-775 to -625 mm Hg). Following sample collection, vacuum will again be recorded and should measure between -10 inches Hg and 0 inches Hg (-250 to 0 mm Hg). Documentation of proper sample identification, date, start and stop times, initial and final vacuum readings, and daily barometric pressure readings were noted on laboratory-supplied chain of custody forms.

One duplicate sample will be collected and analyzed for VOCs using the applicable laboratory method. In addition, a trip blank will accompany each sample set and analyzed for VOCs.

5.0 SAMPLE IDENTIFICATION NUMBERS AND DOCUMENTATION

Each sample will be identified using the identification systems described below. These numbers will be used to complete required sample documentation including sample labels and chain-of-custody forms. Documentation will be completed following the guidelines provided below. Sample Location Identifiers consist of Sample Source Codes and Sample Collection Codes as described below.

5.1 Sample Source Codes

The first component of the Sample Location Identifier is the Sample Source Code. Each sample will be identified by an alpha-code corresponding to the sample medium (or sample type). The alpha-codes are as follows:

MW	- Monitoring Well groundwater sample
SG	- Soil Gas sample
IA	- Indoor Air sample
EB	- Equipment Rinsate Blank Sample
DUP	- Field Duplicate Sample
MS/MSD	- Matrix Spike/Matrix Spike Duplicate
TB	- Trip Blank Sample

5.2 Sample Collection Codes

The second component of the Sample Location Identifier is the Sample Collection Code. This component will identify the sample location, or in the case of QC samples, the sequential number in which the sample was collected during a particular sampling round. Examples of Site-Specific Sample Numbers are as follows:

DUP-1	First field duplicate sample collected during the sampling round in question
TB-2	Trip blank associated with the second sample cooler shipped during the sampling round in question

6.0 CHAIN OF CUSTODY

Upon collection of any samples for off-site laboratory analysis, a Chain-of-Custody form will be completed in triplicate. When transferring the possession of samples off-site, the individuals relinquishing and receiving shall sign, date, and note the time on the Chain-of-Custody form. The original custody form will be sealed in a plastic bag and included with the samples in the shipping cooler. The pink copy of the Chain-of-Custody form will be maintained in the field project files. Two custody seals, signed and dated by the sample collector or shipper, will be placed across the front right and back left of the cooler lid.

7.0 PACKAGING AND SHIPPING

Samples will be packaged for shipment in compliance with current United States Department of Transportation (USDOT) and commercial carrier regulations. All required government and commercial carrier forms will be filled out and shipment classifications made according to current USDOT regulations. Packaging of samples will be accomplished as follows:

- An adhesive sample label will be attached to each sample container. Sample labels will be covered with 3-inch wide clear tape. Each container will be placed in an appropriately sized resealable bag (e.g. Zip-loc) and sealed. Samples will be placed in foam shipping sleeves or wrapped with bubble wrap.

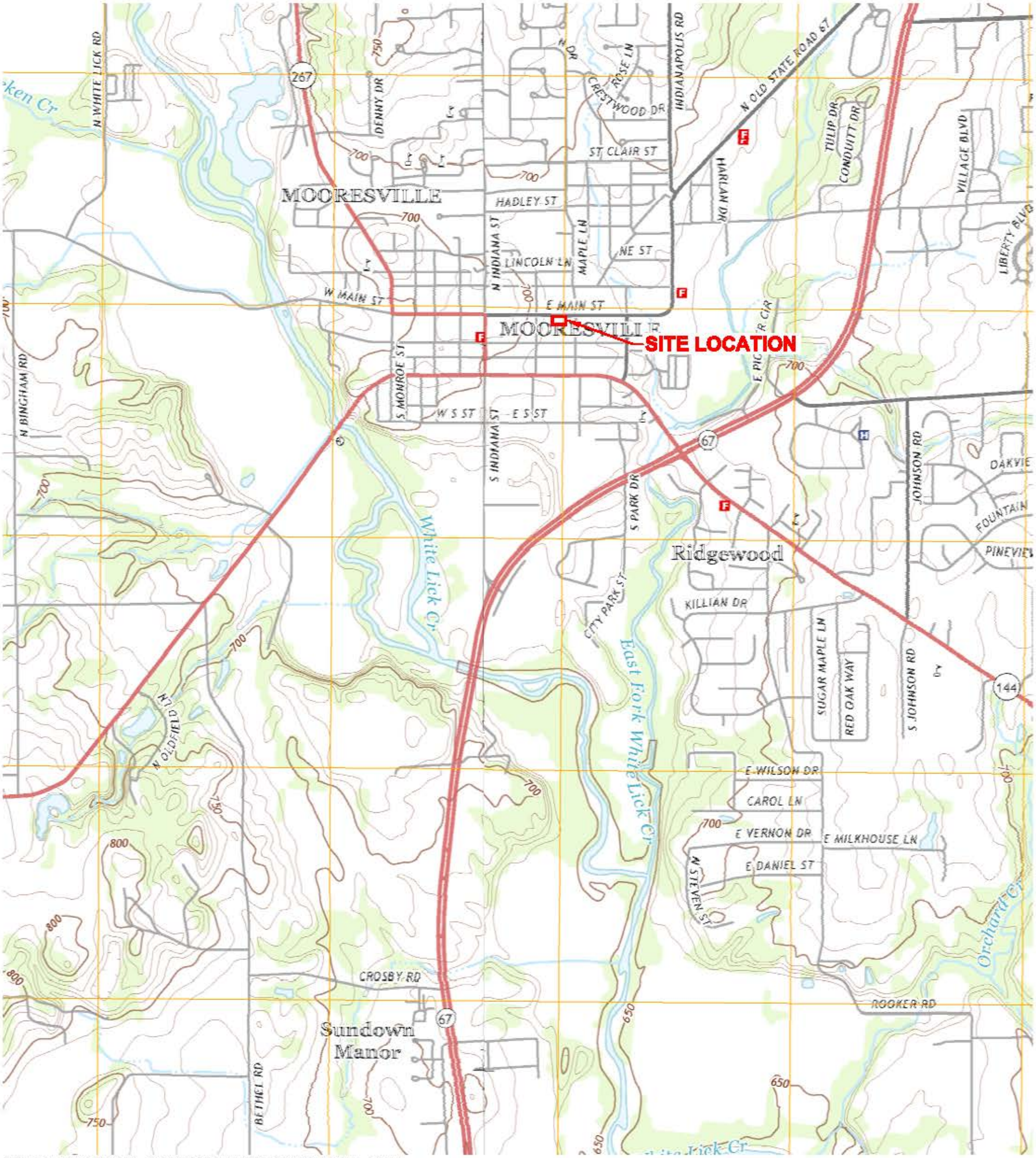
- An appropriately sized metal or plastic cooler will be selected, and drain plugs will be taped on the inside and outside with duct tape. Samples (in sleeves or bubble wrap) will be placed in the cooler. Packaging material (e.g. styrofoam, vermiculite or bubble wrap) will be placed under and around samples (in sleeves or bubble wrap) to minimize the possibility of breakage and/or leakage.

- Completed Chain-of-Custody forms and completed return address labels will be inserted in a resealable (e.g. Zip-loc) bag and taped to the underside of the cooler lid. Blue ice or ice packs will be placed on top of the samples. Ice will be enclosed in sealed plastic bags to prevent soaking of packing materials.

- The closed cooler will be taped in at least two locations. Custody Seals will be placed over cooler latches or at the cooler left back and right front corners, so that seals will break if the cooler is opened. Seals will be covered with clear tape.

- Coolers will be weighed and shipping bills filled out. All samples will be shipped through a reliable commercial carrier, such as Federal Express, Emery, DHL, UPS, or equivalent. Samples may also be picked up directly by the laboratory via one of their couriers.

FIGURES



SOURCE: USGS MAP MOORESVILLE EAST QUADRANGLE; 2013

QUADRANGLE LOCATION

2000' 0 2000'

Title:

SITE LOCATION AND TOPOGRAPHIC MAP

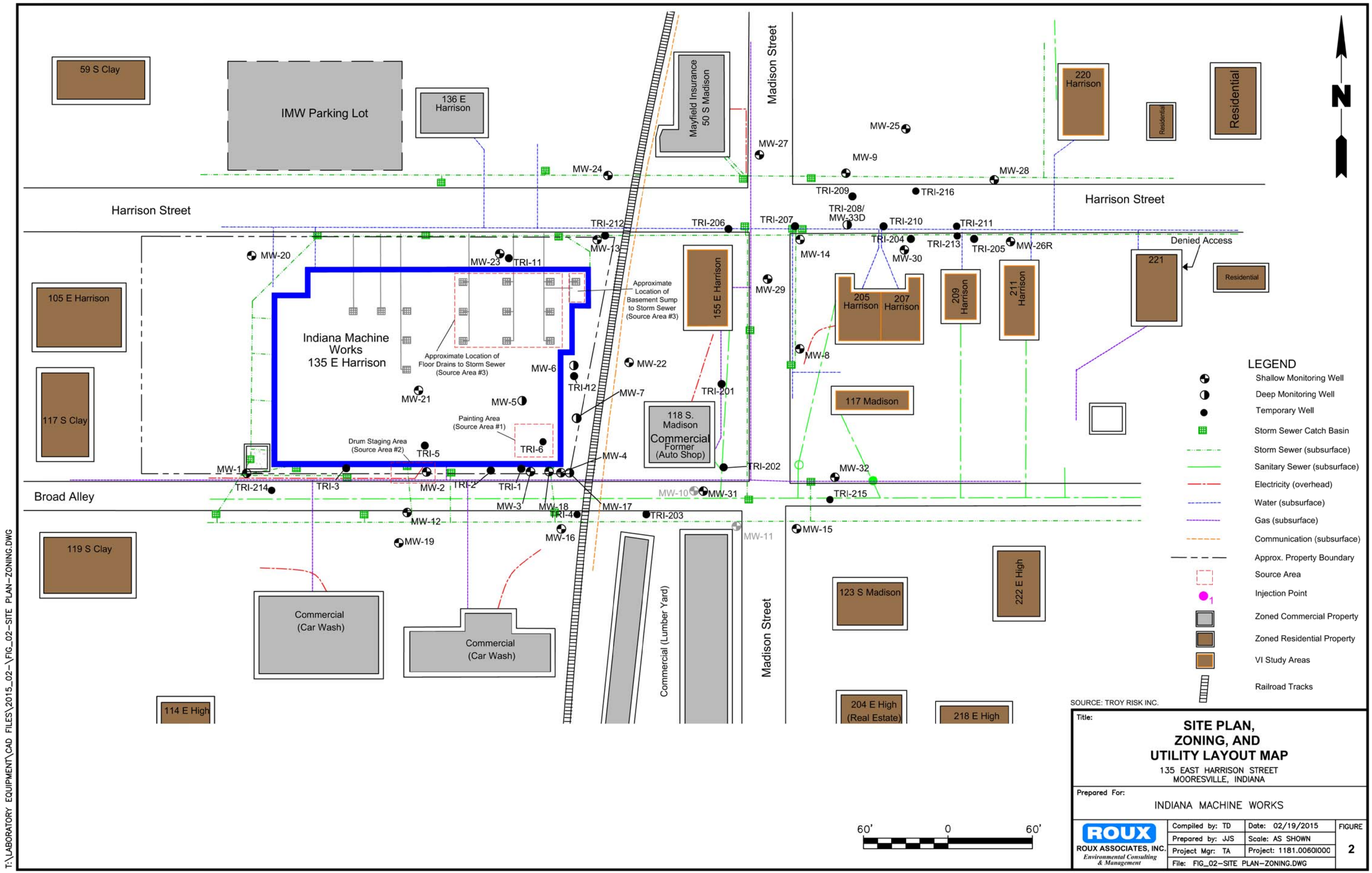
135 EAST HARRISON STREET
MOORESVILLE, INDIANA

Prepared For:

INDIANA MACHINE WORKS

ROUX ASSOCIATES, INC. *Environmental Consulting & Management*	Compiled by: TD	Date: 02/19/2015	FIGURE
	Prepared by: JJS	Scale: AS SHOWN	1
	Project Mgr: TA	Project: 1181.0060I000	
	File: FIG_01-TOPOMAP.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_01-TOPOMAP.DWG



59 S Clay
IMW Parking Lot
136 E Harrison
Mayfield Insurance 50 S Madison
Madison Street
220 Harrison
Residential
Residential
MW-25
MW-27
MW-9
MW-28
MW-24
Harrison Street
Harrison Street
TRI-209
TRI-216
TRI-208/ MW-33D
TRI-210
TRI-211
TRI-212
TRI-206
TRI-207
TRI-204
TRI-213
TRI-205
MW-26R
Denied Access
MW-13
MW-14
MW-30
MW-20
MW-23
TRI-11
105 E Harrison
Approximate Location of Basement Sump to Storm Sewer (Source Area #3)
155 E Harrison
MW-29
205 Harrison
207 Harrison
209 Harrison
211 Harrison
221
Residential
Indiana Machine Works 135 E Harrison
Approximate Location of Floor Drains to Storm Sewer (Source Area #3)
MW-8
MW-22
MW-6
TRI-12
117 S Clay
MW-21
MW-5
MW-7
TRI-201
117 Madison
118 S. Madison
Commercial Former (Auto Shop)
Painting Area (Source Area #1)
Drum Staging Area (Source Area #2)
TRI-5
TRI-6
MW-4
TRI-202
MW-32
MW-1
TRI-214
TRI-3
MW-2
TRI-2
TRI-1
MW-3
MW-18
TRI-4
MW-17
MW-10
MW-31
TRI-215
Broad Alley
MW-12
TRI-203
MW-15
MW-11
MW-16
MW-19
119 S Clay
Commercial (Car Wash)
Commercial (Car Wash)
Commercial (Lumber Yard)
Madison Street
123 S Madison
222 E High
114 E High
204 E High (Real Estate)
218 E High
N
LEGEND
Shallow Monitoring Well
Deep Monitoring Well
Temporary Well
Storm Sewer Catch Basin
Storm Sewer (subsurface)
Sanitary Sewer (subsurface)
Electricity (overhead)
Water (subsurface)
Gas (subsurface)
Communication (subsurface)
Approx. Property Boundary
Source Area
Injection Point
Zoned Commercial Property
Zoned Residential Property
VI Study Areas
Railroad Tracks
60' 0 60'
SOURCE: TROY RISK INC.
T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_02-SITE PLAN-ZONING.DWG
Title:
SITE PLAN, ZONING, AND UTILITY LAYOUT MAP
135 EAST HARRISON STREET MOORESVILLE, INDIANA
Prepared For:
INDIANA MACHINE WORKS
ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management
Compiled by: TD
Prepared by: JJS
Project Mgr: TA
File: FIG_02-SITE PLAN-ZONING.DWG
Date: 02/19/2015
Scale: AS SHOWN
Project: 1181.0060I000
FIGURE
2

APPENDIX A

Roux Associates Standard Operating Procedures

STANDARD OPERATING PROCEDURES
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STANDARD OPERATING PROCEDURE 1.2
WRITTEN HAZARD COMMUNICATION PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	**:**	**Thomas R. Dwyer**
EFFECTIVE DATE	**:**	**03/01/00**
REVISION NUMBER	**:**	**2**

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1.0 INTRODUCTION

There are a multitude of chemical products on the market today and many more are being developed every year. Along with this growth comes the responsibility to handle chemicals safely. Because occupational illness may result from workplace exposures to hazardous materials, the Occupational Safety and Health Administration (OSHA) promulgated regulations to inform people about the hazards of the materials with which they work. OSHA published the Hazard Communication Standard (HCS) at 29 CFR 1910.1200 (General Industry) and 29 CFR 1926.59 (Construction) to provide this information. In addition to the OSHA Standards, many states have enacted hazardous substance laws. State "right-to-know" laws are similar in content to the OSHA HCS, even though there may be differences in the industries and chemicals regulated. This document focuses on the five basic HCS requirements:

- Materials Inventory and Chemicals Lists
- Material Safety Data Sheets (MSDS)
- Labeling
- Training
- Written Programs

2.0 SCOPE AND APPLICABILITY

The Roux Associates, Inc. Hazard Communications (HAZCOM) program provides the basis for making employees aware of the hazards associated with chemicals present in their work place. The Roux Associates, Inc. HAZCOM program applies to all employees who may be exposed to hazardous materials, regardless of position or job description. Some individuals may not require the same level of training as others due to varied types of exposure; however, the HAZCOM appropriate training for their potential exposures. The practices and procedures described here constitute the program by which employees will be made aware of the hazards associated with the chemicals they work with. All information will be provided in English since all employee are required to understand English as a condition of employment.

The Hazcom Program is intended, in part, to fulfill the written hazard communication requirements of the OSHA HCS at 29 CFR 1910.1200 and 1926.59.

3.0 RESPONSIBILITIES

The following positions have specific responsibilities for implementing this SOP:

3.1 The Corporate Health and Safety Manager

Is the Hazard Communication Coordinator and is responsible for:

- Administering the overall program to assure consistent application across all offices.
- Providing assistance when requested by Office/Field Health and Safety Personnel for the development of training and instruction programs.
- Providing assistance when requested by Office/Field Health and Safety Personnel for the evaluation of the hazards associated with chemicals used. These hazard determinations will be made after review of the material safety data sheets and other health, safety and toxicological resources if necessary.
- Conducting periodic audits to determine the degree of each Office's compliance with this procedure.

3.2 Office/Field Health and Safety Personnel

Office/Field Health and Safety Personnel with specific responsibilities under this SOP include Office Managers, Office Health and Safety Managers, Project Principals, Project Managers, Site Health and Safety Officers, and other Staff.

Office Managers are responsible for:

- Overall implementation of this SOP in their respective office.
- Ensuring that Office/Field Health and Safety Personnel understand their responsibilities under this SOP.

Office Health and Safety Managers are responsible for:

- Developing the inventory of chemicals used or stored at their office or off-site storage location.
- Obtaining, maintaining and updating the Material Safety Data Sheets (MSDS) for the materials inventory.
- Development and implementation of training and instruction programs.
- Ensuring that containers used or stored at their office or off-site storage location are properly labeled.

- Providing assistance to Project Managers, SHSO and Other Staff for the implementation of this SOP on a project specific basis.

Project Managers are responsible for:

- Developing the inventory of chemicals used or stored by Roux Associates at their project location.
- Obtaining, maintaining and updating the Material Safety Data Sheets (MSDS) for the materials inventory at their project location.
- Ensuring that Material Safety Data Sheets as well as the written Hazard Communication program are taken on-site.
- Ensuring that containers used or stored at their project location are properly labeled.
- Providing assistance to SHSO and Other Staff for the implementation of this SOP on a project specific basis.

SHSO and Other Staff are responsible for:

- Assisting the OSHM and PM with implementation of this SOP as directed in the office or at project locations.
- Complying with all applicable provisions of the SOP as they relate their specific work tasks.
- Notifying the OSHM and PM of any areas of noncompliance or potential noncompliance with the SOP.
- Notifying the OM if any identified areas of noncompliance are not adequately addressed by the OSHM or PM.

4.0 MATERIALS INVENTORY

Office/Field Health and Safety personnel must identify all of the hazardous materials used at the office and for field projects. A list of these materials must be maintained at each location. The list should include (but not be limited to):

- Chemical and Common Names
- Category
  - Acid
  - Base
  - Solvent
  - Other
- Use
- Location
- Required Safety Equipment
- Hazard
  - Flammable or Combustible
  - Oxidizer
  - Reactive
  - Explosive
  - Compressed Gas
  - Corrosive
  - Irritant
  - Sensitizer
  - Organ Specific Toxin
  - Carcinogen/Teratogen/Mutagen

A copy of the Materials Inventory for each location must be provided to the Corporate Health and Safety Manager.

5.0 MATERIAL SAFETY DATA SHEETS (MSDS)

It is the responsibility of Office/Field Health and Safety personnel to obtain a MSDS for each chemical in their location's Materials Inventory. If a MSDS is not received with the shipment, one must be requested immediately. An example of a MSDS Request letter can be found in Appendix A. It is also the responsibility of Office/Field Health and Safety personnel to update the MSDS as new information is received and to ensure access to the MSDS by all personnel in a timely manner. The purpose of the MSDS is to:

- List the chemical composition of the material.
- Convey physical and chemical properties of the material.
- Relate health, safety and disposal information for the material.
- Discuss proper handling procedures for the material.

6.0 LABELING

Labels on containers shall not be removed or defaced intentionally. Where labels are unintentionally damaged, Office/Field Health and Safety personnel will ensure that a new label, in accordance with DOT, is attached to properly identify the contents and hazards.

All labels must contain the following:

- Product Name
- Hazard Warning Statement
- Safe Handling Procedures

Fixed containers such as storage tanks and buildings containing hazardous chemicals will be labeled with the NFPA diamond. Any container into which a chemical is to be transferred for subsequent use shall be properly labeled (via DOT and HMIS) unless the contents are to be used immediately by the same person who places the chemical into the container. Only approved storage containers are to be used.

Employees are not required to work with hazardous materials stored in containers which are not properly labeled.

7.0 TRAINING

An important control technique for reducing hazard potential is educating employees about the hazardous materials they work with. It is important for employees to understand how to identify hazardous materials and to know how to handle them properly. Employee training, MSDS and labeling are some of the things used in an attempt to achieve this goal. Office/Field Health and Safety personnel shall provide employees with sufficient information and training to enable them to know the following:

- Requirements of the Hazard Communication Standard
- Operations where exposures are, or may be, present
- Location of:
  - Written hazard communication program
  - List of hazardous materials
  - Material Safety Data Sheets
- How to read and understand MSDS and labels
- Physical and health hazards, immediate and potential
- Proper work practices, protective equipment and emergency procedures

An employee's initial training will include a 40-hour OSHA Hazardous Waste Operations and Emergency Response Course.

Additionally, mandatory annual refresher training will be conducted, and will be attended by all personnel exposed to, or potentially exposed to, hazardous materials. . Records and instructor notes for each training session must be maintained at each location.

8.0 HAZARDOUS NON-ROUTINE TASKS

Periodically, employees are required to perform hazardous non-routine tasks. Prior to starting work on such projects, each affected employee will be given information by their supervisor about hazards to which they may be exposed during such activities. This information will include:

- Specific hazards
- Protective equipment/safety measures which must be utilized
- Measures the company has taken to lessen the hazards including ventilation, monitoring, respiratory protection, presence of another employee and emergency procedures.

9.0 CONTRACTOR PERSONNEL

To ensure that outside contractors work safely on our projects, it is the responsibility of Project Managers to provide contractors the following information:

- Hazardous substances to which they may be exposed while on-site.
- Precautions the employees may take to lessen the possibility of exposure by usage of appropriate protective measures.

Information may be transmitted to contractors through the use of Site-Specific Health and Safety Plans.

10.0 APPENDICES

A. MSDS Request Letter

B. Do's and Don'ts for Workplace Safety

C. NFPA Materials Classifications

D. Glossary

E. OSHA 29 CFR 1910.1200 and 1926.59

F. Typical Training Information

G. Typical MSDS Format

Date: February 12, 2015

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the criteria to be considered in the development of a site sampling and analysis plan. Sampling and analysis plans (SAPs) are prepared as part of the Work Plan to direct all activities performed in accordance with field investigations. The field investigations may be performed in response to United States Environmental Protection Agency (USEPA), Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA [Superfund]), Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Toxic Substances Control Act (TSCA) requirements, and/or state and municipal requirements.

As a result, the SAP must conform to the specific regulatory guidance for these programs (i.e., CERCLA, Remedial Investigations/Feasibility Studies [RI/FS] guidance or RCRA/Technical Enforcement Guidance Document [TEGD]). The SAP includes the procedures for sampling all media required (i.e., air, water, soils, sludge, the installation of wells and piezometers, and the investigative techniques (e.g., soil-gas surveys, geophysical surveys, etc.). Therefore, the individual SOPs included in the Roux Associates, Inc. SOP manual would be incorporated into the SAP where appropriate to document field procedures.

The validity of all data will be confirmed by quality assurance/quality control (QA/QC) methods established during sampling, sample handling, and sample analysis. Without checks on the sampling and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of the potentially questionable data.

The SAP will contain all the information required by the field team, on a site-by-site basis, to accomplish study objectives. The SAP will incorporate the protocols (standard and/or nonstandard) to be implemented. Information on the media to be sampled, number of samples, analytical procedures, materials needed, sample preservation requirements, level of QA/QC, and field conditions likely to be encountered must be incorporated into the SAP. Details, if available, on the variety and character of hazardous chemicals that may be encountered must be documented so that special precautions for sampling, handling, storage, and transportation are taken into account.

The SAP must allow ample time for the staff involved to manage the paperwork affiliated with the field work and the input of water-quality data into the data-base management system. The time required for these tasks will be contingent on the magnitude of the sampling program. The SAP will be formulated well in advance of field activities to assure that sufficient time is allocated for preparation, contacts (e.g., client, agency[ies], laboratory), in-house review, finalization, arrangements (e.g., equipment, laboratory), and readiness (i.e., the sampling team).

If need be, a special Health and Safety Plan (HASP) will be prepared by the project manager or project health and safety officer in conjunction with appropriate senior-level, and health and safety personnel throughout the firm. The HASP may be prepared as a separate document.

2.0 PROCEDURE

2.1 Define preliminary site-specific, study objectives based on client needs and Roux Associates, Inc. experience.

2.2 Consider the following items:

a. Sample removal methods that utilize acceptable materials for all equipment and supplies that come in contact with the sample (e.g., bailers, pumps, tubing), dependent on site conditions.

b. Sample processing before shipment (e.g., bottle labeling, bottle filling, filtration, preservation).

c. QA/QC requirements for sampling and handling procedures (e.g., replicates and replicate splits, blanks [trip, field, equipment], matrix spikes and matrix spike duplicates, fortifications) and/or laboratory procedures (blanks [instrument, method, holding]). (Refer to the SOP for Collection of Quality Control Samples.)

d. Record keeping and documentation.

e. Sample shipping (i.e., appropriate cooler and preservative, chain-of-custody form, custody seal).

2.3 Contact appropriate regulatory agency(ies), if relevant, to check if special or different sampling protocols, and/or particular or unconventional decontamination procedures are required.

2.4 Contact analytical laboratory to determine and verify the analytical technique(s) and method(s) to be used for analysis, to ascertain the sample containers and preparations needed, and to make the necessary arrangements so that the sampling and analysis program is performed efficiently, on schedule, and in accordance with the plan.

2.5 Schedule time for the Roux Associates, Inc. chemist/geochemist to work with the laboratory, for senior-level staff to evaluate the analytical data for internal consistency, and assist in data interpretation if appropriate.

2.6 Define individual(s) and responsibility(ies) for:

a. Planning and directing sampling efforts, interacting with the contract laboratory and the Roux Associates, Inc. chemist, overseeing sampling QA/QC, directing the successful completion of the sampling program within the budget and the schedule, and assuring that a copy of the QC manuals for Sampling and Health and Safety are on site and available to field personnel at all times (project manager).

b. Performing sampling tasks in accordance with the site sampling and analysis plan and QA/QC objectives including preparing the appropriate sampling equipment for the field (decontamination, calibration, etc.), performing sampling, preparing necessary sampling documentation and following appropriate health and safety protocols (sampling team).

c. Reducing and initial interpreting of chemical data developed from the sampling program (project scientist).

d. Overseeing QA/QC for the project, periodically reviewing field procedures and activities to ensure the development of representative data in accordance with the site sampling plan, and performing in-house validation of the chemical data, as specified in the site sampling and analysis plan, to determine its representativeness (QA/QC manager).

2.7 Work with Roux Associates, Inc. chemist/geochemist to evaluate client needs, regulatory agency(ies) input, and laboratory information essential to revise or redevelop plan, if need be. The plan must be designed to ensure that samples collected are representative of in situ ground-water conditions based on technically sound standard practices (as set forth in state and federal guidance documents). It must address project needs and maintain Roux Associates, Inc. standards for sampling and analysis.

Date: February 12, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for record keeping and maintenance, for all field activities conducted by Roux Associates, Inc. (Roux Associates).

Strict quality assurance/quality control (QA/QC) is necessary to properly and accurately document and preserve all project-related information. Quality assurance is implemented to corroborate that quality control procedures are followed. Quality control provides a means to monitor investigation activities (e.g., sampling and laboratory performance) as a check on the quality of the data.

Valid data and information are integral to all aspects of Roux Associates' field activities. These aspects include, but are not necessarily limited to, activities that involve: drilling; sediment, sludge, and soil sampling (lithologic, and soil-quality and analysis); well construction and development; aquifer testing and analysis; water-quality sampling and analysis (surface water and ground water); free-product sampling and analysis; air-quality sampling and analysis; geophysical testing; demolition activities; waste removal operations; engineering installations; etc. The data will be confirmed by QA/QC methods established and set forth in the work plan/scope of work. Without checks on the field and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of potentially questionable data.

Documentation will be entered in the field notebook and must be transcribed with extreme care, in a clear and concise manner, as the information recorded will become part of the permanent legal record. Because field notes are the legal record of site activities, they must be taken in a standard and consistent manner. If abbreviations are used, then they must first be spelled out for clarity (i.e., to avoid ambiguity and misunderstanding). All entries must be dated and initialed, and the time (military time) of the entry included. Field notebooks and forms must be assigned to an individual project and properly identified (i.e., client name, project number, location and name of site, individual recording information, dates, times, etc.). Change of possession of field notebooks or forms must be documented with the date and time, and initialed by both individuals. Following each day's entries, the field notebook or form must be photocopied in the event that the original documentation is lost or stolen. All field notebooks must have the company name and address legibly printed in indelible ink along with the message "If found, then please forward to Roux Associates, Inc. at the above address - REWARD OFFERED."

Information must be recorded while onsite because it may be difficult to recall details at a later date. Furthermore, information must be documented immediately as it provides unbiased information which will be used for writing the report when the field activities are completed. Project-related documentation is an irreplaceable, important record for other individuals who may become involved in the project, and provides the project manager with a complete history of project-related activities. Written information must be accompanied by maps, sketches, and photographs where appropriate, especially if these supplemental sources of information assist in the documentation process. A new page must be used in the field notebook for each new day's entries (i.e., unused portions of a previous page must have an "X" placed through it). The end of the day's records must be initialed and dated.

As part of record keeping and QA/QC activities, state and federal regulatory agencies should be contacted to check if special or different protocols are required and/or if particular or unconventional methods are required for the given field activity. Thus, the record keeping and QA/QC activities implemented by Roux Associates are based on technically sound standard practices and incorporate Roux Associates own, extensive experience in conducting hydrogeologic field activities.

2.0 MATERIALS

In order to track investigation activities, specific materials are required. These materials include the following:

a. A bound, waterproof field notebook.

b. Appropriate Roux Associates' forms (e.g., daily log, geologic log, monitoring well construction log, well sampling data form, location sketch, chain of custody, telephone conversation record, meeting notes, etc.).

c. Appropriate labels (e.g., sample, Roux Associates' Custody Seal, etc.)

d. Work plan/scope of work.

e. Health and safety plan (HASP).

f. Appropriate Roux Associates' SOPs.

g. Black pens, and indelible markers.

h. Camera and film.

3.0 DOCUMENTATION

3.1 Before the Roux Associates personnel leave the field, they must ensure that their field notes include comprehensive descriptions of the hydrogeologic conditions, and all investigation-related activities and results (onsite and offsite). This will safeguard against the inability to reconstruct and comprehend all aspects of the field investigation after its completion, and will serve to facilitate the writing of an accurate report. Properly documented information provides the QA/QC tracking (back-up) required for all Roux Associates' projects. General types of information that must be recorded (where pertinent to the investigation being conducted) include, but may not necessarily be limited to, the following:

a. List of Roux Associates personnel on site.

b. Name, date, and time of arrival on site by Roux Associates personnel, including temporary departures from, and returns to, the site during the work day.

c. Client and project number.

d. Name and location of study area.

e. Date and time of arrival on site by non-Roux Associates personnel (names and affiliation) and equipment (e.g., subcontractors and facility personnel, and drilling equipment, respectively, etc.), including temporary departures from, and returns to, the site during the work day, and departure at the end of the work day.

f. List of non-Roux Associates personnel on site.

g. Weather conditions at the beginning of the day as well as any changes in weather that occur during the working day.

h. Health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for Roux Associates and other on-site personnel (e.g., subcontractors, facility personnel, etc.).

i. Health and safety procedures not in compliance with the HASP (for all on-site personnel).

j. Site reconnaissance information (e.g., topographic features, geologic features, surface-water bodies, seeps, areas of apparent contamination, facility/plant structures, etc.).

k. Air monitoring results (i.e., photoionization detector [PID], etc. measurements).

l. Task designation and work progress.

m. Work-related and site-related discussions with subcontractors, regulatory agency personnel, plant personnel, the general public, and Roux Associates personnel.

n. Delays, unusual situations, problems and accidents.

o. Field work not conducted in accordance with the work plan/scope of work, and rationale and justification for any change(s) in field procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

p. QA/QC procedures not conducted in accordance with the QA/QC procedures established in the work plan/scope of work and rationale and justification for any change(s) in QA/QC procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

q. Equipment and instrument problems.

r. Decontamination and calibration procedures.

s. Activities in and around the site and work area by any and all on-site personnel which may impact field activities.

t. Sketches, maps, and/or photographs (with dates and times) of the site, structures, equipment, etc. that would facilitate explanations of site conditions.

u. Contamination evidenced as a result of work-related activities (e.g., visible contaminants [sheen] in drilling fluids or on drilling equipment; sheen on, or staining of, sediments; color of, or separate [nonaqueous] phase on, water from borehole or well; vapors or odors emanating from a borehole or well; etc.); make all observations as objectively as possible (e.g., grey-blue, oil-like sheen; black and orange, rust-like stain; fuel-like odor; etc.) and avoid using nontechnical or negative-sounding terms (e.g., slimy, goopy, foul-smelling).

v. Date and time of final departure from the site of all personnel at the end of the work day.

3.2 In addition to the general types of information that must be recorded (as presented in Section 3.1), task-specific information must also be properly documented. Task-specific information which is required is provided in each respective task-oriented SOP, and the documentation procedures outlined in each SOP must be followed.

END OF PROCEDURE

Date: February 12, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the sampling of ground-water monitoring wells for dissolved constituents. As part of the SOP for the sampling of ground-water monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, sounding wells, and purging wells) must be implemented. Sampling objectives must be firmly established in the work plan before considering the above.

Valid water-chemistry data are integral to a hydrogeologic investigation that characterizes ground-water quality conditions. Water-quality data are used to evaluate both current and historic aquifer chemistry conditions, as well as to estimate future conditions (e.g., trends, migration pathways). Water-quality data can be used to construct ground-water quality maps to illustrate chemical conditions within the flow system, to generate water-quality plots to depict conditions with time and trends, and to perform statistical analyses to quantify data variability, trends, and cleanup levels.

2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample ground water from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

a. Bailers (Teflon™ or stainless steel).

b. Pumps (centrifugal, peristaltic, bladder, electric submersible, bilge, hand-operated diaphragm, etc.).

c. Gas-displacement device(s).

d. Air-lift device(s).

e. Teflon™ tape, electrical tape.

f. Appropriate discharge hose.

g. Appropriate discharge tubing (e.g., polypropylene, teflon, etc.) if using a peristaltic pump.

h. Appropriate compressed gas if using bladder-type or gas-displacement device.

i. Portable generator and gasoline or alternate power supply if using an electric submersible pump.

j. Non-absorbent cord (e.g., polypropylene, etc.).

k. Plastic sheeting.

l. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (blue carpenter's).

m. Electronic water-level indicators (e.g., m-scope, etc.) or electric water-level/product level indicators.

n. Non-phosphate, laboratory-grade detergent.

o. Distilled/Deionized water.

p. Potable water.

q. Paper towels, clean rags.

r. Roux Associates' field forms (e.g., daily log, well inspection checklist, sampling, etc.) and field notebook.

s. Well location and site map.

t. Well keys.

u. Stop watch, digital watch with second increments, or watch with a second hand.

v. Water Well Handbook.

w. Calculator.

x. Black pen and water-proof marker.

y. Tools (e.g., pipe wrenches, screwdrivers, hammer, pliers, flashlight, pen knife, etc.).

z. Appropriate health and safety equipment, as specified in the site health and safety plan (HASP).

aa. pH meter(s) and buffers.

bb. Conductivity meter(s) and standards.

cc. Thermometer(s).

dd. Extra batteries (meters, thermometers, flashlight).

ee. Filtration apparatus, filters, pre-filters.

ff. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

gg. Disposable gloves.

hh. Water jugs.

ii. Laboratory-supplied sample containers with labels.

jj. Cooler(s).

kk. Ice (wet, blue packs).

ll. Masking, duct, and packing tape.

mm. Chain-of-custody form(s) and custody seal(s).

nn. Site sampling and analysis plan (SAP).

oo. Site health and safety plan (HASP).

pp. Packing material (e.g., bubble wrap)

qq. "Zip-lock" plastic bags.

rr. Overnight (express) mail forms.

3.0 DECONTAMINATION

3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the SOP for Decontamination of Field Equipment for detailed decontamination methods, summaries for bailers and pumps are provided below). Use new, clean materials when decontamination is not appropriate (e.g., non-absorbent cord, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.

a. Decontaminate a bailer by: 1) wearing disposable gloves, 2) disassembling (if appropriate) and scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.

b. Decontaminate a pump by: 1) wearing disposable gloves, 2) flushing the pump and discharge hose (if not disposable) first with a non-phosphate, laboratory-grade detergent and potable water solution in an appropriate container (clean bucket, garbage can, or 55-gallon drum) and then with distilled/deionized water or potable water, and 3) wiping pump-related equipment (e.g., electrical lines, cables, discharge hose) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

3.2 Note that the decontamination procedures for bailers and pumps are the minimum that must be performed. Check the work plan to determine if chemicals specified by individual state regulatory agencies must also be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers, pH and conductivity meters, etc.). Refer to the specific SOP for field analysis for each respective piece of equipment. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

5.0 PROCEDURE

5.1 Document, and initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.

5.2 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).

5.3 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.

5.4 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. If fumes or gases are present, then diagnose these with the proper safety equipment. Never inhale the vapors.

5.5 Measure the depth to water (DTW) from the measuring point (MP) on the well using a steel tape and chalk or an electronic sounding device (m-scope). Refer to the specific SOPs for details regarding the use of a steel tape or a m-scope for measuring water levels. Calculate the water-level elevation. Document, and initial and date the information on the appropriate field form and in the field notebook.

5.6 Measuring the total depth of the well from the MP with a weighted steel tape. Calculate and record the volume of standing water in the well casing on the appropriate field form and in the field notebook.

5.7 Decontaminate the equipment used to measure the water level and sound the well with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.

5.8 Purge the well prior to sampling (refer to the SOP for Purging a Well). The well should be pumped or bailed to remove the volume of water specified in the work plan. Usually three to five casing volumes are removed if the recharge rate is adequate to accomplish this within a reasonable amount of time.

If the formation cannot produce enough water to sustain purging, then one of two options must be followed. These include: 1) pumping or bailing the well dry, or 2) pumping or bailing the well to "near-dry" conditions (i.e., leaving some water in the well). The option employed must be specified in the work plan and be in accordance with regulatory requirements.

If the well is purged dry, then all the standing water has been removed and upon recovery the well is ready for sampling. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented: 1) the well may have to be sampled over a period of more than one day; 2) the well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected; or 3) the well may not recover which will preclude sampling. Regardless of the option that must be followed, the sampling procedure must be fully documented. When preparing to conduct a sampling round, review drilling, development and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

5.9 Record the physical appearance of the water (i.e., color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.

5.10 If a bailer is used to collect the sample, then:

a. Flush the decontaminated bailer three times with distilled/deionized water.

b. Tie the non-absorbent cord (polypropylene) to the bailer with a secure knot and then tie the free end of the bailer cord to the protective casing or, if possible, some nearby structure to prevent losing the bailer and cord down the well.

c. Lower the bailer slowly down the well and into the water column to minimize disturbance of the water surface. If a bottom-filling bailer is used, then do not submerge the top of the bailer; however, if a top-filling bailer is used, then submerge the bailer several feet below the water surface.

d. Remove and properly discard one bailer volume from the well to rinse the bailer with well water before sampling. Again, lower the bailer slowly down the well to the appropriate depth depending on the bailer type (as discussed above in 5.11 c). When removing the bailer from the well, do not allow the bailer cord to rest on the ground but coil it on the protective plastic sheeting placed around the well. Certain regulatory agencies require that the first bailer volume collected be utilized for the samples.

5.11 If a pump is used to collect the sample, then use the same pump used to purge the well and, if need be, reduce the discharge rate to facilitate filling sample containers and to avoid problems that can occur while filling sample containers (as listed in Number 5.14, below). Alternately, the purge pump may be removed and a thoroughly decontaminated bailer can be used to collect the sample.

5.12 Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.

5.13 Fill each appropriate, pre-labeled sample container carefully and cautiously to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in a ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lock bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

5.14 "Top-off" containers for volatile organic compounds (VOCs) and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.

5.15 Filter water samples (Procedure 4.6) collected for dissolved metals analysis prior to preservation to remove the suspended sediment from the sample. If water samples are to be collected for total metals analysis, then collect a second set of samples without field filtering.

In the event that the regulatory agency(ies) want unfiltered samples for metals analysis, a second set of filtered samples should also be collected. Because unfiltered samples are indications of total metals (dissolved and suspended) they are not representative of aquifer conditions because ground water does not transport sediment (except in some rare cases). Thus, the results for dissolved metals in ground water should be based on filtered samples even if both filtered and unfiltered sets are presented in a report.

5.16 Add any necessary preservative(s) to the appropriate container(s) prior to, or after (preferred), the collection of the sample, unless the appropriate preservative(s) have already been added by the laboratory before shipment.

5.17 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance. Refer to the SOP for Collection of Quality Control Samples.

5.18 Conduct field analyses after sample collection is complete by measuring and recording the temperature, conductivity, pH, etc. (as called for in the work plan). Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.

5.19 Wipe the well cap with a clean rag, replace the well cap and protective cover (if present). Lock the protective cover.

5.20 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

5.21 Decontaminate bailers, hoses, and pumps as discussed in the decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with site conditions.

5.22 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

5.23 Samples collected from Monday through Friday will be delivered within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Consult the work plan to determine if any of the analytes require a shorter delivery time.

END OF PROCUDURE

Date: February 12, 2015

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth the water content should be noted, since generally “soil sampling” is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6 inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. Another clean bucket auger should then be used to collect the sample. To collect samples at depths of greater than approximately six feet the use of a drill rig and split spoon samples will usually be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines soil sampling requirements.

b. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

c. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, plastic sheeting, etc.).

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable sampling gloves.

g. Laboratory-supplied sample containers with labels.

h. Cooler with blue or wet ice.

i. Plastic sheeting.

j. Black pen and indelible marker.

k. Zip-lock bags and packing material.

l. Tape measure.

m. Paper towels or clean rags.

n. Masking and packing tape.

o. Overnight (express) mail forms.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.

5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.

5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.).

5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet and homogenized. Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.

5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.

5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a zip-lock bag to the laboratory. A custody seal is placed on the cooler prior to shipment.

5.9 Samples collected from Monday to Friday are to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.10 The field notebook and appropriate forms should include, but not be limited to the following: client name, site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Following the final decontamination (after all samples are collected) the sampling equipment is wrapped in aluminum foil. Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

END OF PROCEDURE

FOR SOIL BORING AND/OR MONITORING OR OBSERVATION WELL DRILLING, FORMATION SAMPLING AND BOREHOLE ABANDONMENT IN UNCONSOLIDATED FORMATIONS

Date: February 12, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures, and to establish the guidelines for drilling (soil borings, wells, or piezometers) and formation sampling activities in unconsolidated formations. There are several drilling techniques available which include hollow-stem auger, cable tool, hydraulic rotary, cased-hole rotary, and air rotary. Formation (sediment/soil) sample collection include disturbed (drill cuttings), intact (split-spoon), and undisturbed (Shelby-tube or Denison-core). Borehole abandonment (closure) procedures will also be addressed in this SOP.

The objective of drilling is to collect accurate subsurface information and to prepare a borehole for potential completion as a well or piezometer. Consequently, the lithologic data is the all important, most essential information that can be collected. The lithologic data characterizes subsurface conditions, describes hydrogeologic coefficients qualitatively and/or quantitatively, and identifies optimum locations for screen zones if wells are constructed.

Data can be obtained through the physical examination and testing of formation samples, as well as knowledge regarding ground-water levels. Thus, drill fluid mix, fluid loss, rate of drilling, lengths of split-spoon and Shelby-tube/Denison-core recovery, etc. must be monitored by the on-site hydrogeologist or geologist.

2.0 DRILLING TECHNIQUE-SELECTION

Verify that the drilling technique is the one specified in the investigation work plan, and that the drilling equipment mobilized by the driller is in good condition and proper working order. Do not permit the driller to use a drilling rig that appears to be substandard, in disrepair, etc., and/or is questionable as to whether or not the rig has the capabilities to accomplish the goals of the drilling program. The drilling rig must be capable of:

a. Penetration of all anticipated subsurface materials and formations at a desired rate, and construction of a borehole of desired diameter (for the anticipated well, if applicable, including the placement of a gravel or sand pack through a tremie pipe and necessary formation sealing material such as bentonite or cement).

b. Identification of lithology for development of a geologic log of all unconsolidated formations and materials penetrated, including physical characteristics and visual description of color, grain sizes, sorting and mineralogy.

c. Collection of samples of aquifer fluids during the drilling process and prior to well construction, while at the same time minimizing potential for cross-contamination. The method used should prevent cross-contamination between surface soils and ground water or between different hydrogeologic units.

d. Collection of intact and/or undisturbed soil samples from the center line or sidewall of the borehole. This objective requires the drilling to be halted while soil samples are taken from the bottom or side of the incomplete borehole.

e. Completion of the borehole into a well (monitoring or observation) or piezometer during the initial construction process (i.e., constructing a well or piezometer as the borehole is drilled, or constructing a well or piezometer in the borehole immediately after the drilling tools are removed).

f. Implementation of borehole geophysical logging (when applicable and possible) to enable more accurate vertical and horizontal extrapolation of borehole data to the lithology of the hydrogeologic system.

g. Completion of a well or piezometer, if applicable, in the borehole following a time lapse for interpretation of geologic or geophysical data from the borehole.

3.0 DRILLING TECHNIQUE - DESCRIPTION

3.1 Hollow-Stem Auger - This drilling method is rapid and extremely effective in most cohesive sediments but less so in loose sandy material. Penetration may be up to 150 feet below land surface (bls) depending on the size of the rig, drilling conditions, and the diameter of the auger flight; however, depths up to 250 feet bls have been achieved under compatible conditions. A major advantage of this technique is that normally no fluids are introduced into the formation. If the auger flights can be removed and the integrity of the borehole maintained, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If the auger flights must remain in the borehole, then only radiation geophysical logs can be run. Casing, screen, and sampling devices can then be lowered through the hollow stem by removing the removable plug at the bottom of the auger flights, and gravel packing and cementing can be accomplished within the hollow stem. However, this can be difficult especially below the water table. Auger flight outside diameters (OD) range from 5 inches (in.) to 12 in. The diameter of a well that can be constructed inside the hollow stem is limited, however, to about 4 in.

3.2 Cable Tool (Percussion) - This drilling method is slow because the borehole is advanced by lifting and dropping a heavy string of drilling tools. Cuttings accumulate in the drill casing and are removed by a sand bailer. A steel casing is driven in as the hole is deepened. Cable-tool rigs can be used in unconsolidated sediment and bedrock to depths of hundreds or thousands of feet and often employ telescoping techniques for drilling deep boreholes. Electrical geophysical logs cannot be run through the steel cased borehole, but radiation logs (e.g., gamma, neutron, etc.) can be run. Well casing and screen can be installed within the cased hole after which the outer casing is pulled back (removed). Because the boring is cased as it is being drilled, cross-contamination between various depths is practically eliminated. The method provides an excellent means to collect good, representative formation samples.

3.3 Hydraulic Rotary - This drilling method uses a rotating bit to drill (advance) the borehole. Drill cuttings are removed using a recirculating drilling fluid (mud or water). Although setting up the drilling equipment is slow, the drilling process is reasonably fast. In the mud-rotary method, drilling mud forms a cake on the borehole wall which prevents excessive loss of fluid to the formation being drilled. The hydrostatic pressure combined with the weight and density of the mud slurry keeps the hole open. This allows the drill rods to be removed from the borehole and geophysical logs (electric and radiation) to be run in the open borehole.

In reverse hydraulic rotary drilling, the drilling fluid moves downward through annular space and then upward inside the drill pipe. If the drilling fluid does not contain mud, then sufficient water flow is required as make-up water because the borehole wall is not sealed; therefore, significant water loss can occur to the formation being drilled. The borehole is held open by hydrostatic pressure only. A serious obstacle to this drilling method occurs when the static water level is less than 15 feet below land surface because of insufficient hydrostatic head difference between the borehole and the water table. However, the problems of excessive water loss and shallow depths to water may be overcome by using mud as the drilling fluid.

In mud-rotary drilling, the drilling fluid (mud) moves downward through the drill pipe and then upward through the annular space. Therefore, the borehole is held open by hydrostatic pressure and the mud cake lining the wall of the borehole. The mud-rotary method can be used to construct moderate to deep wells in unconsolidated (and consolidated material), while the reverse rotary technique can be used to construct moderate to deep wells in unconsolidated materials. The principal disadvantage may be the difficulty in removing mud cake from the formation at the screened zone. Extensive well development may be required to remove the mud cake.

3.4 Cased-Hole Rotary - Several new rotary drilling techniques have been developed in which a steel casing is advanced with an air-rotary or mud-rotary drill. This technique is highly desirable for use in exploratory drilling at monitoring sites because water and soil samples may be collected under conditions which preclude contamination from shallower depths. Furthermore, this technique is extremely effective in boulder or cavernous zones which would inhibit or preclude drilling using other techniques. Drilling results are comparable to cable-tool drilling but with greatly enhanced speeds. In all the cased-hole techniques, the main benefit is that the only portion of the borehole which is open, is at the bottom of the drill casing; thus, no soil or water from shallower depths can move down and impact the depth drilled and/or sampled. Electrical geophysical logs cannot be run through the steel-cased borehole, however, radiation logs (e.g., gamma, neutron, etc.) can be run.

Presently, there are three cased-hole rotary techniques which include:

a. The drill-thru casing hammer technique in which the casing is advanced by percussion with a casing hammer or vibratory driver similar to the method used in a borehole drilled by the air-rotary method. The casing hammer can also pull out the casing (air drilling only).

b. The Odex™ Drilling System (European system) which “pulls” the casing using a fixture attached to an air-hammer type drill bit (air drilling only).

c. The Barber™ Drilling System in which drilling is done with a top-head drive and a rotary table that spins casing into the ground. Casing can be fitted with a carbide “shoe” to cut boulders and an air hammer can be used above the bit. Air or mud rotary can be used to lift cuttings.

Two potential problems may be encountered using the cased-hole rotary technique which include: 1) “sand heave” when drilling stops (which can be quickly drilled or bailed out) and 2) possible aeration of water in the cased borehole if volatiles are being tested (which can be overcome by pumping or bailing the standing water out before sampling). The minimum drill casing diameter is 6 inches and depth is limited to approximately 450 feet.

3.5 Air Rotary - This drilling method uses a rotating bit to drill, and high-velocity compressed air to remove cuttings from the borehole. A pneumatic down-hole hammer is often used to add percussion to the rotary drilling action. This drilling method is very fast and, although it is most suitable for penetrating hard bedrock, it can be used in unconsolidated formations. The borehole may be cased or uncased depending on geologic conditions. If an open borehole is drilled, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If a cased borehole is drilled, then only radiation geophysical logs can be run.

Four potential problems may be encountered when using the air-rotary technique:

a. When a prolific aquifer is tapped, the compressed air may not be able to lift the water to the surface.

b. Aeration of water in the borehole (and finished well) immediately prior to sampling can interfere with a number of inorganic and organic water-quality parameters.

c. Low yield water entry zones may not be identified because the air pressure prevents water from entering the borehole. Care should be taken to prevent overdrilling of the borehole.

d. Air rotary drilling can induce the migration of volatile organics to the surface or adjacent structures causing potential aesthetic or health and safety concerns.

If the air-rotary technique is used then the following special procedures will be implemented:

a. The type of air compressor and lubricating oil will be documented on an appropriate field form and in the field notebook and a 1-pint sample of the oil will be retained for characterization in the event organic compounds are detected in a well sample.

b. An air line oil filter will be required and changed per manufacturer's recommendations during operation with documentation of this maintenance on an appropriate field form and in the field notebook. More frequent oil filter changes will be made if oil is visibly detected in the filtered air.

c. The use of any additive will be prohibited, except approved water (e.g., potable water) for dust control and cuttings removal.

4.0 DECONTAMINATION

Drilling equipment decontamination procedures are outlined in the field equipment decontamination SOP. Proper decontamination in accordance with regulatory guidelines must be clearly documented in the field notebook.

5.0 PROCEDURE FOR DRILLING

5.1 Document all drilling-related activities (e.g., starting, stopping, footage, problems, decontamination, etc.) on the daily log form and in the field notebook. Record dates and times of activities, and names of Roux Associates personnel providing oversight.

5.2 Monitor and record drill fluid mix, speed of rotation, pressure on the drill fluid, rate of drilling, and length of drill rods or casing in the borehole.

5.3 Confirm that the drill rods and core barrel are straight, or discontinue drilling.

5.4 Pay particular attention to the advancement of the boring because differences in the rate of drilling may be indicative of differences in subsurface geologic conditions (e.g., sand and gravel versus clay).

5.5 Maintain a continuous dialogue with the driller to track and keep informed of all drilling activities (e.g., the speed of the drill and drilling pressure, difficult and easy drilling conditions, etc.).

5.6 Collect formation samples as described below in Section 6.0. Sample jars must be labeled appropriately (e.g., project number and name, site location, boring number, date, sample interval, blow counts, and initials of Roux Associates personnel collecting sample).

5.7 Record geologic information in the geologic log form and in the field notebook.

5.8 Handle and ship split-spoon sample jars carefully to avoid breakage and handle and ship tubes or cores carefully to prevent disturbance.

6.0 PROCEDURE FOR FORMATION SAMPLING

6.1 Intact formation sampling will be implemented using split-spoon samplers (which are driven), Shelby-tube samplers (which are pushed), or Denison-core samplers (which are rotated) depending on the drilling technique employed. Formation samples will be retained in suitable size (e.g., 1-pint or 0.5-pint) jars for physical descriptions and potential physical and chemical analysis. The appropriately labeled jars and tubes will be stored in a safe place to avoid breakage, agitation, and freezing. Intact formation samples will be collected as described in the work plan at specified intervals (e.g., at 5-foot increments below land surface) and at each major change in subsurface materials. Hydrogeologic information will be recorded on a geologic log form and in the field notebook. Detailed descriptions of the type(s) of intact sample(s) collected, sampling intervals and conditions, and objective(s) of the sample collection will be provided in the work plan.

6.2 Disturbed formation samples (drill cuttings) will be examined continuously throughout the entire depth of the borehole. If applicable to the study and/or stated in the work plan, borehole cuttings will be collected from the circulating auger flights which lift cuttings to land surface (hollow-stem auger technique), from the sand bailer (cable-tool technique), from the recirculating drilling fluid (mudflume) which transports cuttings to land surface (mud-rotary and related techniques), or from the compressed air used to carry cuttings to land surface (air-rotary and related techniques). Formation samples will be retained in appropriate size (e.g., 1-pint or 0.5-pint), properly labeled jars and stored in a safe place to avoid breakage, agitation, and freezing. Hydrogeologic data will be recorded on a geologic log form and in the field notebook.

6.3 The soil cores from the wells drilled at the site are used for lithologic identification. The first 18 inches of soil for each borehole will be collected intact using a split-spoon sample, Shelby-tube sampler, or Denison-core sampler. Split-spoon samples may be collected continuously from boreholes for cluster wells; single well and/or piezometer boreholes may be split-spooned throughout drilling or at specified intervals or changes in lithology. The conditions for sampling will be specified in the work plan.

6.4 Before collecting and retaining soil and/or sediments collected with the split-spoon sampler, the top several inches will be removed from the sampler and discarded to eliminate any sediment that may have caved into the bottom of the borehole.

6.5 Sediment sampling equipment such as split-spoon samplers, spatulas, etc. (but not including Shelby-tube or Denison-core samplers, which area not re-usable) will be decontaminated by steam cleaning and/or a non-phosphate, laboratory-grade and distilled/deionized wash followed by a distilled/deionized water rinse. (Refer to the SOP for Decontamination of Field Equipment for a detailed description of minimum and special decontamination procedures.) Decontamination of sediment sampling equipment will take place prior to the collection of the first sample and following the collection of each subsequent sample.

7.0 BOREHOLE ABANDONMENT OR CLOSURE

7.1 Upon the completion of the investigation, a determination will be made as whether to maintain the borehole (for a well or piezometer) or to close it (i.e., abandon and seal it). If the client and Roux Associates agree to abandon the borehole, then the state will be notified and a request will be presented for borehole abandonment. Upon state approval to seal the borehole, appropriate state borehole abandonment forms will be completed, if required. Following state approval, the abandonment of any borehole (or boring) will be in accordance with local, state and/or Federal regulations.

7.2 For each abandoned borehole, the procedure will be documented on an appropriate field form or in the study notebook. Documentation may include, where appropriate, the following:

a. Borehole designation.

b. Location with respect to the replacement borehole, if replaced (e.g., 30 ft north and 40 ft west of Borehole B-1). A location sketch should be prepared.

c. Open depth prior to grouting and any other relevant circumstances (e.g., formation collapse).

d. Drill casing left in the borehole by depth, size, and composition.

e. A copy of the geologic log.

f. A revised diagram of the abandoned borehole using a supplemental geologic log form.

g. Additional items left in hole by depth, description, and composition (e.g., lost tools, bailers, etc.).

h. A description and daily quantities of grout used to compensate for settlement.

i. The date of grouting.

j. The level of water or mud prior to grouting and the date and time measured.

k. Any other state or local well abandonment reporting requirements.

END OF PROCEDURE

Date: February 12, 2015

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, and soil and water sampling. The objective of decontamination is to ensure that all drilling, and soil-sampling and water-sampling equipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements and because of variability in the requirements of individual states. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non acceptance (invalidation) of the work undertaken and data collected.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

2.1 The rig and all associated equipment should be properly decontaminated by the contractor before arriving at the test site.

2.2 The augers, drilling casings, rods, samplers, tools, rig, and any piece of equipment that can come in contact (directly or indirectly) with the soil, will be steam cleaned onsite prior to set up for drilling to ensure proper decontamination.

2.3 The same steam cleaning procedures will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the study.

2.4 All on-site steam cleaning (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc.

2.5 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.6 Containment of decontamination fluids may be necessary (e.g., rinseate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federal procedures.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

3.1 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.

3.2 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).

3.3 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

3.4 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.

3.5 Scrub all equipment in the bucket with a brush to remove any adhering particles.

3.6 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.

3.7 Place clean equipment on a clean plastic sheet (e.g., polyethylene)

3.8 Reassemble the cleaned sampler, as necessary.

3.9 Transfer the sampler to the driller (or helper) making sure that this individual is also wearing clean gloves, or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil.

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Decontamination procedures for bailers follow:

a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.

c. Disassemble bailer (if applicable) and discard cord in an appropriate manner, and scrub each part of the bailer with a brush and solution.

d. Rinse with potable water and reassemble bailer.

e. Rinse with copious amounts of distilled or deionized water.

f. Air dry.

g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).

h. Rinse bailer at least three times with distilled or deionized water before use.

4.2 Decontamination procedures for pumps follow:

a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.

c. Flush the pump and discharge hose (if not disposable) with the detergent solution, and discard disposable tubing and/or cord in an appropriate manner.

d. Flush the pump and discharge hose (if not disposable) with potable water.

e. Place the pump on clear plastic sheeting.

f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

g. Air dry.

h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

SECTION 1010

GLOSSARY

(**Note:** Appendix A, B, and C refer to 29 CFR Section 1910.1200.)

ACGIH - American Conference of Government Industrial Hygienists. A professional Organization devoted to worker health protection. In particular, the organization publishes “Threshold Limit Values for Chemical Substances in the Work Environment” and the “Documentation of TLVs.” The TLV booklet is one source which may be used in hazard determination. Their address is ACGIH, 6500 Glenway Avenue, Building D-7, Cincinnati, Ohio 45211, 513-661-7881.

ANSI - American National Standards Institute. ANSI is a coordinating body of various trade, technical, professional, and consumer groups who develop voluntary standards. ANSI Z129.1-1982 “American National Standard for Hazardous Industrial Chemicals - Precautionary Labeling” is a recommended labeling system which may be used to achieve compliance with labeling requirements of the law. Another standard from ANSI is the ‘American National Standard Practices for Respiratory Protection,” ANSI Z288.2-1980. The address if ANSI, 1430 Broadway, New York, New York 10018,212-354-3300.

Acute - An adverse effect on the human body with symptoms of high severity coming quickly to a crisis. Acute effects are normally the result of short term exposures and short duration.

Adequacy and reporting data - (Hazard Determination) In terms of complying with the Hazard Determination requirement of the law, Appendix B states: “The results of any studies which are designed and conducted according to established scientific principles, and which report statistically significant conclusions regarding the health effects of a chemical, shall be a sufficient basis for a hazard determination and reported on any material safety data sheet. The chemical manufacturer, Importer, or employer may also report the results of other scientifically valid studies which tend to refute the findings of hazard.” ALSO SEE: CARCINOGENICITY, HUMAN DATA, ANIMAL DATA.

Aerosol - This solid or liquid particulate, natural or manmade, which can remain suspended in air. Paint spray and smoke are examples of aerosols.

Aerosol, flammable - SEE FLAMMABLE AEROSOL

American National Standards Institute - SEE ANSI

American Conference of Governmental Industrial Hygienist - SEE ACGIH

Animal Data (Hazard Determination) - In complying with the Hazard Determination requirements of the law, refer to the use of animal data for such determination. Appendix B states: “Human evidence of health effects in exposed populations is generally not available for the majority of chemicals produced or used in the workplace. Therefore, the available results of toxicology testing in animal populations shall be used to predict the health effects that may be experienced by exposed workers. In particular, the definitions of certain acute hazards refer to specific animal testing results (see Appendix A to 1910.1200)."

Annual Report on Carcinogens - This is a list of substances which are either known or anticipated to be carcinogens. It is published be the National Toxicology Program (NTP). The most recent edition is available from: National Technical Information Service (NTIS), U.S. Dept. of Commerce, 5285 Port Royal Road, Springfield, VA 22161, 703-487-4600.

Appendix A - To assist in effective health hazard determination OSHA has provided standard definitions. They are provided in Appendix A of the law. ALSO SEE: CARCINOGEN, CORROSIVE, HIGHLY TOXIC, IRRITANT, SENSITIZER, TOXIC, TARGET ORGAN EFFECTS.

Appendix B - Appendix B provides mandatory guidance for the use if various criteria for hazard determination. ALSO SEE: CARCINOGENICITY, HUMAN DATA, ANIMAL DATA, ADEQUACY AND REPORTING OF DATA.

Appendix C - This is a list of references, manuals, computer databases which may be accessed in the efforts of hazard determination. The use of the various references is not mandatory, only advisory.

Article (OSHA) - "…a Manufactured item: (i) Which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which does not release, or otherwise result in exposure to a hazardous chemical under normal conditions of use."

Asphyxiant - A chemical, usually in a gas or vapor state, which displaces oxygen or prevents its use in the body by other chemical means. ALSO SEE: BLOOD EFFECTS.

Assistant Secretary (OSHA) - "…means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee." The Assistant Secretary may request to review MSDSs, the written hazard Communication program. and written hazard determination procedures.

Autoignition temperature - this is the lowest temperature at which a substance will ignite and sustain combustion in an ignition souse. Toluene has an autoignition temperature of 896°F. ALSO SEE : FLASHPOINT.

Blasting agent (OSHA) - "…any material or mixture, consisting of a fuel and oxidizer, intended for blasting not otherwise classified as an explosive and in which none of the ingredients are classified as an explosive, provided that the finished product, as mixed and packaged for use or shipment, cannot be detonated by means of a No. 8 test blasting cap when unconfined." ALSO SEE: FLAMMABLE SOLID.

Blood Agents - These are chemicals such as carbon monoxide and cyanides which act on the blood and hematopoietic system and ultimately result in depriving body tissue of adequate oxygen. ALSO SEE: HEMATOPOIETIC SYSTEM.

Boiling point - The temperature at which a liquid changes its physical state to a gas. ALSO SEE: MELTING POINT.

CAS Number - The CAS Number is an identification number assigned by the Chemical Abstracts Service (CAS) of the American Chemical Society. The CAS Number is used in various databases, including Chemical Abstracts, for identification and information retrieval.

CFR - Code of Federal Regulations. This is the collection of rules and regulations originally published in the Federal Register by various governmental departments and agencies. OSHA regulations are found in 29 CFR, EPA regulations are in 40 CFR; and Department of Transportation regulations in 49 CFR.

CFR Title 29 Section 1910.1200 - This is the location of the Federal OSHA regulations dealing with Hazard Communication Standards.

CFR Title 29 Section 1910 Subpart Z - This is the section of OSHA regulations addressing Toxic and Hazardous Substances.

CPC - Chemical Protective Clothing. This is special clothing which may be resistant to permeation, penetration, or degradation by a chemical. Rubber boots, gloves, aprons, and suits are commonly used to protect workers from exposure to hazardous chemicals. ALSO SEE: PERMEATION, PENETRATION, DEGRADATION.

Carcinogen - A carcinogen is a substance which causes cancer. A cancer is characterized by the proliferation of abnormal cells, sometimes in the form of a tumor. Examples of carcinogens include asbestos, vinyl chloride, and benzene.

Carcinogen (Appendix A) - OSHA states that: "A chemical is considered to be a carcinogen if: (a) It has been evaluated by the International Agency for Research on Cancer (IARC), and found to be a carcinogen or potential carcinogen; or (b) It is listed as a carcinogen or a potential carcinogen in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or (c) It is regulated by OSHA as a carcinogen." Substances which are regulated by OSHA as a carcinogen would be found in 29 CFR 1910.1047. ALSO SEE ANNUAL REPORT ON CARCINOGENS AND IARC.

Carcinogenicity (Hazard Determination) - The mandatory hazard determination guidance in Appendix B of the law States that: "As described in paragraph (d)(4) and Appendix A of this section, a determination by the National Toxicology Program, the International Agency for Research on Cancer, or OSHA that a chemical is a carcinogen or potential carcinogen will be considered conclusive evidence for purposes of the section." ALSO SEE: HUMAN DATA, ANIMAL DATA, ADEQUACY AND REPORTING OF DATA.

Catalyst - A chemical Which changes the rate of a chemical reaction between two chemicals without affecting the chemical itself. ALSO SEE: REACTIVITY.

Chemical (OSHA) - OSHA's definition of chemical "means any element, chemical compound or mixture of elements and/or compounds."

Chemical Abstracts Service - SEE CAS NUMBER.

Chemical manufacturer (OSHA) - "…means an employer in SIC Codes 20 through 39 with a workplace where chemical(s) are produced for use or distribution." Manufacturers must evaluate the hazards of chemicals produced, label containers leaving the workplace, obtain or develop a MSDS for each chemical produced, as well as meet the requirements as an employer. ALSO SEE: SIC CODES.

Chemical manufacturer responsibilities - SEE CHEMICAL MANUFACTURER.

Chemical name (OSHA) - "…means the scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name which will clearly identify the chemical for the purpose of conducting a hazard evaluation."

Chemical inventory - The inventory is "A list of the hazardous chemicals known to be present using an identity that is referenced on the appropriate material safety data sheet "the list may be compiled for the workplace as a whole or for individual work areas."

Chemical protective clothing - SEE CPC.

Chronic - An adverse effect on the human body with symptoms which develop slowly over a long period of time or which frequently recur. Chronic effects are the results of long term exposure and are of long duration.

Combustible liquid (OSHA) - "…means any liquid having a flashpoint at or above 100°F(37.8°C), but below 200°F(93.3°C), except any mixture having components with flashpoints of 200°F(93.3°C) or higher, the total volume of which make up 99 percent or more of the total volume of the mixture."

Common name(OSHA) - "…means any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name."

Compliance - This is the state of meeting all the requirements of the law. The best way to be assured of being in compliance with OSHA is to be familiar with OSHA's expectations.

Compressed gas (OSHA) - "…means: (i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); or (ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C); or (iii) A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D-323-72."

Confined space - As defined in NIOSH's "Criteria for Recommended Standard: Working in Confined Spaces," " Confined Space refers to a space which by design has limited openings for entry and exit; unfavorable natural ventilation which could contain or produce dangerous air contaminant, and which is not intended for continuous employee occupancy. Confined spaces include but are not limited to storage tanks, compartments of ships, process vessels, pits, silos, vats, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, and pipelines." A confined space entry would be considered a non-routine task. ALSO SEE: NON-ROUTINE TASK.

Consumer products - Consumer products and hazardous substances as defined by the Consumer Product Safety Act are not subject to the labeling requirements of the Hazard Communications Standard when they are regulated under the Consumer Product Safety Act.

Container (OSHA) - "…means any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of the section, pipes and piping systems are not considered to be containers." Please note that some state right to know laws do consider pipes to be containers.

Contractors - The written hazard communication program must address "The methods the employer will use to inform any contractor employees with employee working in the employer's workplace of the hazardous chemical their employees may be exposed to while performing their work, and any suggestions for appropriate protective measures."

Contractor employee training - SEE CONTRACTORS.

Corrosive (Appendix A) - "A Chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. For example, a chemical is considered to be a corrosive if, when tested on the intact skin of albino rabbits by the method described by the U.S. Department of Transportation in Appendix A to 49 CFR Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term shall not refer to action on inanimate surfaces."

Cutaneous hazards (Appendix A) - A chemical which affects the dermal layer of the body by causing rashes, irritation, or defatting of the skin. Examples include ketones and chlorinated compounds.

DHHS - Department of Health and Human Services.

DOL - Department of Labor.

DOT - Department of Transportation.

Decomposition - Chemical breakdown of a material brought on by some adverse condition.

Degradation - This is the destructive effect a chemical may have on a piece of chemical protective clothing. Protective clothing that has been degraded may be partially dissolved, softened, hardened, or completely destroyed. If not destroyed, the material may have reduced strength and flexibility. this may result in easy tearing or punctures, opening up a direct route to skin contact by penetration. ALSO SEE: CPC.

Density - The density of a substance is a number which relates its weight to its volume. Density values in references are given in grams/cubic centimeter (g/cc). The densities of solid and liquids are usually compared to the density of water. The density of water is 1. Substances with a density greater than 1 skin in water and those less than 1 float. Lead has a density of 11.35g/cc. Toluene has a density of 0.86g/cc. ALSO SEE: SPECIFIC GRAVITY.

Dermal - Relating to the skin. ALSO SEE: CUTANEOUS HAZARDS.

Designated representative (OSHA) - "…means any individual or organization to who an employee give written authorization to exercise such employee's rights under this section. A recognized or certified collective bargaining gent shall be treated automatically as a designated representative without regard to written employee authorization." The following items must be made available to employees or their designated representative: The Company Hazard Communication Program, Material Safety Data Sheets, written procedures and methods used in the evaluation of a chemical hazard.

D**irector (OSHA)** - "…means the Director, National Institute for Occupational Safety and Health, US Department of Health and Human Services, or designee." The Director may access upon request, the following documents: Written methods and procedures used to determine the hazards of chemicals under evaluation, Company Hazard Communication Program, Material Safety Data Sheets.

Distilled spirits (beverage alcohol), wine, or malt beverage - As defined in the Federal Alcohol Administration Act (FAAA), are not subject to the label requirements of the Hazard Communication Standard when they are subject to the labeling requirements of the FAAA.

Distributor (OSHA) - "…means a business, other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to the manufacturing purchasers." Distributors have responsibility for proper labeling of containers and supplying MSDSs to other distributors or manufacturing purchasers. ALSO SEE: LABELS, MSDS, EFFECTIVE DATES.

Distributor responsibilities - SEE DISTRIBUTOR.

Documentation - Documentation is the record of compliance that a company should maintain. The Hazard Communication Law requires that certain requirements be met including employee information and training. Complete training record should be kept to prove compliance in the event of an inspection. Other areas where documentation should be maintained include the written program, MSDS maintenance, hazard determination, and quality assurance audits.

EPA - Environmental Protection Agency. Responsible for enforcing regulations related to the Resource Conservation and Recovery Act, Toxic Substance Control Act, Superfund, and others. ALSO SEE: FIFRA, RCRA

Effective dates - The compliance schedule for the OSHA Hazard Communications Standard is as follows: "Employers shall be in compliance with this section within the following time periods: (1) Chemical manufacturers and imported shall label containers of hazardous chemicals leaving their workplaces, and provide material safety data sheets with initial shipments by November 25, 1985. (2) Distributors shall be in compliance with all provisions of this section applicable to them by November 25, 1985. (3) Employers shall be in compliance with all provisions of this section by May 25, 1986, including initial training for all current employees."

Employee (OSHA) - "…means a worker employed by an employer in a workplace in SIC Codes 20 through 39 who may be exposed to hazardous chemicals under normal operating conditions or foreseeable emergencies, including, but not limited to production workers, line supervisors, and repair or maintenance personnel. Office workers, ground maintenance personnel, security personnel, or nonresident management are generally not included, unless their job performance routinely involves potential exposure to hazardous chemicals." Employees are to be provided with information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new hazard is introduced into the work area. ALSO SEE: EMPLOYEE INFORMATION REQUIREMENTS, EMPLOYEE TRAINING REQUIREMENTS.

Employee information requirements - "Employees shall be informed of : (i) The requirements of this section; (ii) Any operations in their work area where hazardous chemicals are present; and, (iii) The location and availability of the written hazard communications program, including the required list(s) of hazardous chemicals, and material safety data sheets required by this section."

Employee training requirements - "Employee training shall include at least: (i) Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.); (ii) The physical and health hazards of the chemicals in the work area; (iii) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and, (iv) the details of the hazard communications program developed by the employer, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information."

Evaporation rate - A measure of the length of time required for a given amount of substance to evaporate, compared with time required for an equal amount of ether or butyl acetate to evaporate. The evaporation rate of toluene is 2.24 (butyl acetate = 1).

Exemptions for labeling requirements - SEE FIFRAM FDAM CONSUMER PRODUCTS, DISTILLED SPIRIT

Explosive (OSHA Hazard Communication Standard) - "…means a chemical that caused a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature."

Explosive limits - SEE FLAMMABLE LIMITS, LFL, UFL

Explosive (OSHA) - "…any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion, i.e., with substantially instantaneous release of gas and heat, unless such compound, mixture, or device is otherwise specifically classified by the US Department of Transportation; see 49 CFR Chapter 1. The term 'explosives' shall include all material which is classified as Class A, Class B, and Class C explosives by the US Department of Transportation, and includes, but not limited to dynamite, black powder, pellet powders, initiating explosives, blasting caps, electric blasting caps, safety fuse, fuse lighters, fuse igniters, squibs, cordeau detonate fuse, instantaneous fuse, igniter cord, igniters, small arms ammunition, small arms ammunition primers, smokeless propellant cartridges for propellant-actuated powder devices, and cartridges for industrial guns. Commercial explosives are those explosives which are intended to be used in commercial or industrial operations." 29 CFR 1910.109(a)(3). ALSO SEE: FLAMMABLE SOLID.

Exposed (OSHA) - "…means that an employee is subjected or a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.), and includes potential (e.g. accidental or possible) exposure.

Eye hazards (Appendix A) - Chemicals which affect the eye or visual capacity. Examples include organic solvents and acids.

FDA - Food and Drug Administration. Responsible for enforcing regulations issued under the federal Food, Drug, and Cosmetic Act. Labeling is not required for any food, food additive, drug, or cosmetic, when subject to labeling requirements of the Act. SEE (b)(4)(ii) of law.

FIFRA - Federal Insecticide, Fungicide, and Rodenticide act. Labeling is not required for any pesticides defined in FIFRA when subject to labeling regulations by EPA under FIFRA. SEE (b)(4)(i) of law.

Flammable (OSHA) - "…means a chemical that falls into one of the following categories:" flammable, flammable gas, flammable solid. ALSO SEE: FLAMMABLE AEROSOL, FLAMMABLE GAS, FLAMMABLE LIQUID, FLAMMABLE SOLID.

Flammable gas (OSHA) - "…means: (a) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of thirteen (13) percent by volume or less; or (b) A gas that, at ambient temperature and pressure forms a range of flammable mixtures with air wider than twelve (12) percent of volume, regardless of the lower limit." ALSO SEE: FLAMMABLE LIMITS, LFL, UFL.

Flammable limits - The range defined by the lower (LFL) and upper (UFL) flammability limit. May sometimes be referred to as explosive limits (LEL & UEL) in other sources of information. This is the range of concentration in the air that may readily ignite when exposed to a flame or a spark. ALSO SEE FLASHPOINT, COMBUSTIBLE LIQUID.

Flammable liquid (OSHA) – "…means any liquid having a flashpoint below 100°F(37.8°C), except any moisture having components with flashpoints of 100°F(37.8°C) or higher, the total of which make up 99 percent or more of the total volume of the mixture." ALSO SEE: FLASHPOINT, COMBUSTIBLE LIQUID.

Flammable solid (OSHA) - "…means a solid, other than a blasting agent or explosive as defined in section 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical charge, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be flammable solid if, when tested by method describes in 16 CFR 1500.44, it ignites and burns with self-sustained flame at a range greater than one-tenth of an inch per second along its major axis." ALSO SEE: BLASTING AGENT, EXPLOSIVE.

Flashpoint (OSHA) - "…means the minimum temperature at which a liquid gives off vapor in sufficient concentration to ignite when tested as follows: (i) Tagliabue Closed Tester; or (ii) Pensky-Martens Closed Tester; or (iii) Setaflash Closed Tester." For detail on acceptable flashpoint tests see the regulations (c) Definitions, Flashpoint. Flashpoint is measured at the surface of the flammable liquid. The flashpoint of toluene is 40°F. ALSO SEE: LFL, UFL.

Foreseeable emergency (OSHA) - "…means any potential occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace." This definition refers to (b)(2) of the law: "This section applies to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use in a foreseeable emergency."

Gas, flammable - SEE FLAMMABLE GAS

Hazard Communication Standard - This is the end result of special measures and activities conducted by employers. The purpose is to reduce and eliminate adverse health effects due to unnecessary exposures to hazardous materials. Hazard communication is achieved by recognition and evaluation of workplace hazards, accurate labeling of hazards, and effective training of employees about proper handling and use of those hazardous materials in the workplace. The OSHA Hazard Communication Standard describes how employers are to inform employees of workplace chemical hazards. The OSHA Standard is enforced under the regulations found in 29 CFR 1910.1200. ALSO SEE: RIGHT TO KNOW.

HMIS - Hazardous Materials Identifications System. This is an integrated approach to working with hazardous materials. The system includes information on assessing hazards, labeling and training. It was devised by the National Paint and Coating Association. The label includes information such as chemical identification acute hazard ratings, long term health hazard potential and appropriate personal protective equipment. To get more information write to the National Paint and Coatings Association, 1500 Rhode Island Avenue NW, Washington, DC 20005.

Hazard determination - This is the evaluation of a chemical to determine if it is hazardous. OSHA considers a chemical hazardous if it is a physical hazard or a health hazard. Chemical manufacturers and importers must complete this evaluation by guides in the law. Employers are not required to perform a hazard determination. ALSO SEE: HEALTH HAZARD, PHYSICAL HAZARD.

Hazard warning (OSHA) - "…means any words, pictures, symbols, or contamination thereof appearing on a label or other appropriate form of warning which convey the hazards of the chemical(s) in the container(s)." A hazard warning is one of the types of information required on a container. ALSO SEE LABEL

Hazardous chemical (OSHA) - "…means any chemical which is a physical hazard or a health hazard." ALSO SEE: HAZARD DETERMINATION, PHYSICAL HAZARD, HEALTH HAZARD.

Hazardous Material Identification System - SEE HMIS.

Health hazard (OSHA) - "…means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term 'health hazard' includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. Appendix A provides further definitions and explanations of the scope of health hazards covered by this section, and Appendix B describes the criteria to be used to determine whether or not a chemical is to be considered hazardous for purpose of this standard." SEE definitions of the above listed terms in this glossary.

Hematopoietic system - The means by which blood cells are produced in the body. ALSO SEE: BLOOD AGENTS.

Hepatoxins (Appendix A) - Chemicals which cause liver damage such as liver enlargement or dysfunction. Examples include nitrosamines and carbon tetrachloride.

Highly toxic (Appendix A) - "A chemical falling within any of the following categories: (a) A chemical that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each. (b) A chemical that has a continuous contact for 24 hours (or less of death occurs with 24 hours) with the bare skin of albino rats weighing between two and tree kilograms each. (c) A chemical that has a median lethal concentration(LC50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each." ALSO SEE: HEALTH HAZARD.

Human data (Appendix B) - "Where available, epidemiological studies and case reports of adverse health effects shall be considered in the evaluation." One of the mandatory considerations for health hazard determination in Appendix B. ALSO SEE: APPENDIX B, CARCINOGENICITY, ANIMAL DATA, ADEQUACY AND REPORTING OF DATA.

IARC - International Agency for Research on Cancer. IARAC publishes "Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man." This is one of the publications that is to be used when conducting a hazard determination. To obtain information on this publication write to: World Health Organization, International Agency for Research on Cancer, 49 Sheridan Street, Albany, NY 12210. ALSO SEE: CARCINOGENICITY.

Identity (OSHA) - "…means any chemical or common name which indicated on the material safety data sheet (MSDS) for the chemical. The identity used shall permit cross-references to be made among the required list of hazardous chemicals, the label and the MSDS."

Immediate use (OSHA) - "…means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred." Employers are not required to label containers designated or an "immediate use" purpose.

Importer responsibility - SEE IMPORTER

Importer (OSHA) - "…means the first business with employees within the customs territory of the United States which receives hazardous chemicals produces in other countries for the purpose of supplying them to distributors or manufacturing purchases within the United States." Importers must evaluate chemicals for hazards label containers and develop MSDSs in addition to the requirements as an employer.

Ingestion - Chemicals which enter the body by this route of entry may have local effects and/or may be absorbed into the bloodstream through the small intestine.

Inhalation - Chemicals which enter the body by this route of entry may have local effects and/or may be absorbed into the bloodstream through the lungs.

Inhibitor - A chemical which is added to another substance to prevent an unwanted chemical change from occurring.

Inspections by OSHA - SEE COMPLIANCE

International Agency for Research on Cancer - SEE IARC

Inventory - A list or inventory of hazardous chemicals known to be present in the workplace is a required component of the written hazard communications program. This list is to be cross referenced with the MSDS and the label. ALSO SEE IDENTITY.

Irritant (Appendix A) - " A chemical which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of 16 CFR 1500.41 for four hours exposure or by other appropriate techniques, it results in an empirical score of five or more. A chemical is an eye irritant if so determined under the procedure listed in 16 CFR 1500.42 or other appropriate techniques."

Job hazard analysis - This is a process by which a job is studied to determine the hazards involved and ways to safely complete the job by procedures and/or personal protective equipment.

LC50 - Lethal concentration 50. This is the concentration in air of toxic substance that was required to cause the death of half the test animal population under controlled administration. This evaluates inhalation as a potentially harmful route of entry. LC50 data are used to assess the toxicity of a chemical. ALSO SEE: APPENDIX A.

LD50 - Lethal dose 50. This is the dose or amount of toxic substance that was required to cause death in half the test animal population under controlled administration. Either ingestion or skin contact may be evaluated. LD50 data are used to access the toxicity of a chemical. ALSO SEE: APPENDIX A.

LEL - SEE LFL.

LFL - The lowest concentration of a combustible or flammable gas or vapor in air that will produce a flash of fire. Mixtures below this concentration are to lean to burn. The LFL of toluene is 1.27%. ALSO SEE: FLASHPOINT, UFL.

Lab responsibilities - All laboratories in manufacturing facilities (including research and quality control labs) are covered under the law, but to a limited extent. (b)(3) states that: (i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced; (ii) Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees: and (iii) Employers shall ensure that laboratory employees are apprised of the hazards of the chemicals in their workplaces in accordance with paragraph (h) of this section. "A written hazard communication program is not required for lab employees. ALSO SEE: EMPLOYEE INFORMATION REQUIREMENTS, EMPLOYEE TRAINING REQUIREMENTS.

Label (OSHA) - "…means any written, printed, or graphic material displayed on or affixed to containers of hazardous chemicals." Containers in the workplace must be labeled, tagged, or marked with the following information: Identity of hazardous chemical and appropriate hazard warnings. In addition, containers leaving the workplace must also have the name and address of the responsible party (manufacturer or importer). ALSO SEE: HAZARD WARNING, IDENTITY.

Label requirements - SEE LABEL.

Labeling systems - SEE HMIS, NFPA 704.

Labeling exemptions - SEE FIFRA, FDA, CONSUMER PRODUCTS, DISTILLED SPIRITS.

Language requirements - All labels and other forms of warning are to be in English. The label may also present the information in a different language in addition to English.

Lethal concentration - SEE LC50.

Lethal dose - SEE LD50.

Liaisons with fire departments/other authorities - see the section on Liaison with Local Authorities for information on working with local agencies and authorities as may be required under state right to know laws.

Liquid, flammable (OSHA) - SEE FLAMMABLE LIQUID.

List of hazardous chemicals - SEE INVENTORY.

Lung agents (Appendix A) - Chemicals which irritate or damage lung tissue. Examples include asbestos, silica.

MSDS (OSHA) - "Material safety data sheet means written or printed material concerning a hazardous chemical which is prepared in accordance with paragraph (g) of this section." Information such as hazards, personal protective equipment, and emergency procedures is the type of information required on MSDSs.

MSHA - Mine Safety and Health Administration. Along with NIOSH, MSHA is responsible for testing and approving respirators.

Manufacturing purchaser (OSHA) - "…means an employer with a workplace classified in SIC Codes 20 through 39 purchases a hazardous chemical for use within that workplace." The term is used in regard to obtaining MSDSs in(g) of the law.

Material safety data sheet - SEE MSDS.

Medical surveillance - Many of the chemicals that are regulated by OSHA have requirements that the employer conduct medical surveillance on employees to assure that chemical exposure is within the acceptable limits. Substances with requirements for medical surveillance are covered in 298 CFR 1910.1001 through 1910.1047.

Melting point - This is the temperature at which a solid changes state to a liquid. The melting point of toluene is 139°F.

Mixture (OSHA) - "…means any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction." There are specific requirements for preparing MSDSs for chemical mixtures. Section (g)(2)(i)(b-c) and (g)(4) deal with mixtures. ALSO SEE: MSDS.

Mutagen - A substance which causes genetic mutations. ALSO SEE: REPRODUCTIVE TOXINS.

NFPA - National Fire Protection Association. NFPA is a non-profit organization which provides information on fire protection and prevention. Among the publications the NFPA develops is the 704 Standard for the Identification of the Fire Hazards of Materials. This publication describes a hazard warning system suitable for labels on containers.

NFPA 704 System - SEE NFPA.

NIOSH - National Institute for Occupational Safety and Health. NIOSH is involved in research on health effects due to workplace exposures. Research is used to make recommendations for reducing or preventing worker exposures. NIOSH is also responsible for testing and certifying respirators. ALSO SEE: DIRECTOR.

NTP - National Toxicology Program. The Annual Report on Carcinogens is a result of work completed under NTP. ALSO SEE: ANNUAL REPORT ON CARCINOGENS.

National Toxicology Program - SEE NTP.

National Fire Protection Association - SEE NFPA.

Nephrotoxins (Appendix A) - Chemicals which cause damage to the kidneys. Trichloroethylene is an example of a nephrotoxin.

Neurotoxins (Appendix A) - Chemicals which have their primary toxic effects on the central nervous system. Examples of neurotoxins include mercury and carbon disulfide.

Non-covered materials - The OSHA standard does not apply in any way to the following: (i) Any hazardous waste as such term is defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901 et seq), when subject to the regulations issued under that Act by the Environmental Protection Agency; (ii) Tobacco or tobacco products; (iii) Wood or wood products; (iv) Articles; and(v) Foods, drugs, or cosmetics intended for personal consumption by employees while in the workplace." ALSO SEE: ARTICLE.

Non-routine tasks - These are job assignments which are not part of an everyday work schedule. Occasional assignments such as confined space entry for tank cleaning might be considered nonroutine. The written hazard communication program requires employers to describe the methods that will be used to inform workers of hazards associated with nonroutine tasks.

OSHA - Occupational Safety and Health Administration. OSHA is responsible for enforcing the regulations related to the Hazard Communications Standard, 29 CFR 1910.1200.

OSHA labeling requirements - These are twenty-two specific chemicals that OSHA regulates. Each chemical has specific labeling requirements which must be followed in addition to the labeling requirements of the hazard communications law.

Oral dose - SEE LD50.

Organic peroxide (OSHA) - "…means an organic compound that contains the bivalent-O-O-structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical." The law considers organic peroxide to be a physical hazard. ALSO SEE: PHYSICAL HAZARD.

Oxidizer (OSHA) - '…means a chemical other than a blasting agent or explosive as defined in section 1910.109(a), that initiates or promotes combustion in other materials thereby causing fire either of itself or through the release of oxygen or other gases." The law considers an oxidizer to be a physical hazard. ALSO SEE: PHYSICAL HAZARD.

Oxidizing agent - A species that accepts electrons in a redox reaction.

ppb - parts per billion

ppm - parts per million.

psi - pounds per square inch.

PEL - Permissible Exposure Limit. The PEL referees to the maximum air containment concentration a worker can be exposed on a repeated basis without developing adverse effects. The PELs are listed in 29 CFR 1910.100 Tables Z-1, Z-2, Z-3. ALSO SEE: CFR 29 Section 1910 Subpart Z.

Penetration - This is the passage of a chemical through an opening in a protective material. Holes and rips in protective clothing can allow as can stitch holes, space between zipper teeth, and open jacket and pant cuffs. ALSO SEE: CPC.

Permeation - Permeation is the passage of a chemical through a piece of clothing on a molecular level. If a piece of clothing is permeated, the chemical may collect on the inside, increasing the chance of skin contact with that chemical. Permeation is independent of degradation. Permeation may occur even though the clothing may show no signed of degradation. ALSO SEE: CPC.

Permissible Exposure Limit - SEE PEL.

Physical Hazard (OSHA) - "…means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive), or water-reactive." Any chemical which can be classified as a physical hazard is considered to be a hazardous chemical under the law. ALSO SEE: HAZARDOUS CHEMICAL.

Placard - A placard is a notice or poster placed in a hazardous work area that can be observed and read by workers. The placard can be attached to stationary process containers as long as it contains the same information as a label would carry. ALSO SEE: LABEL

Polymerizeration - A chemical reaction in which two or more small molecules combine to form larger molecules.

Portable containers - Portable containers need not be labeled if they are for "immediate use." ALSO SEE: IMMEDIATE USE.

Produce (OSHA) - "…means to manufacture, process, formulate, or repackage."

Pulmonary agents - SEE LUNG AGENTS.

Pyrophoric (OSHA) - "…means a chemical that will ignite spontaneously in air at a temperature of 130°F (54.5°C) or below. Pyrophoric chemicals are considered to be physical hazards. ALSO SEE: PHYSICAL HAZARD.

RCRA - Resource Conservation and Recovery Act. ALSO SEE: NONCOVERED MATERIALS, EPA.

RTECS - Registry of Toxic Effects of Chemical Substances. This NIOSH publication is one of the information sources OSHA recommends for hazard determination. RTECS provides data on toxicity for over 50,000 different chemicals. It has an extensive cross reference listing trade names and synonyms. It is available as hard copy, computer tape, microfiche, and on-line through the National Library of Medicine.

Reactive (OSHA) - "…means a chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature." Considered a physical hazard under the law. ALSO SEE: POLYMERIZATION, DECOMPOSITION, PHYSICAL HAZARD.

Reactivity - A measure of the tendency of a substance to undergo chemical reaction with the release of energy.

Recordkeeping - Section(g)(10) states that MSDSs must be made readily available in accordance with 29 CFR 1910.20(e). In general, this regulation states that "whenever an employee or designated representative requests access to a record, the employer shall assure that access is provided in a reasonable time, place, manner but in no event later than fifteen (15) days after the request for access is made."

Reducing agent - A chemical which absorbs oxygen in a chemical reaction.

Registry of Toxic Effects of Chemical Substances - SEE RTECS.

Reporting of data - SEE ADEQUACY AND REPORTING OF DATA

Reproductive toxins (Appendix A) - Chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis). Examples of reproductive toxins include lead and DBCP.

Respirator use - Respirators are commonly used to protect workers from hazardous vapors and gases and particulates. There are respirators that remove hazards and those which supply the worker with air. Each type has limitations and advantages. Proper selection and use is essential to worker health. OSHA and ANSI provide guidance for respirator use.

Responsible party (OSHA) - "…means someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary." Responsible party information is required on all containers leaving the workplace and on MSDSs.

Right to Know law - This is a term applied to a variety of laws and regulations enacted by municipal, county and state governments that provides the availability of information on chemical hazards. This also includes the OSHA Hazard Communications Standard. The different laws that have been enacted around the country vary greatly from the OSHA Standard. Some require that information be made available not only to employees, but to emergency personnel and the community as a whole. Many of the local and state laws require submission of work area surveys as well as annual activity reports. The basic intent of these laws is the same as the OSHA Standard. ALSO SEE: HAZARD COMMUNICATIONS,

SIC Codes - Standard Industrial Classification Codes. The OSHA Hazard Communication Standard applies to employees in SIC Codes 20-39. These are the following.

(20) Food and Kindred Product.

(21) Tobacco Manufacturers

(22) Textile Mill Products

(23) Apparel and Other Textile Products.

(24) Lumber and Wood Products.

(25) Furniture and Fixtures

(27) Paper and Allied Products

(28) Chemicals and Allied Products

(29) Petroleum and Coal Products.

(30) Rubber and Plastic Products.

(31) Leather and Leather Products.

(32) Stone, Clay, and Glass Products.

(33) Primary Metal Industries

(34) Fabricated Metal Products.

(35) Machinery, Equipment and Supplies

(36) Electrical Equipment and Supplies

(37) Transportation Equipment

(38) Instruments and Related Products.

(39) Misc. Manufacturing Products.

STEL - Short Term Exposure Limit. This is a term used by the ACGIH to denote “a 15-minute time-weighted average exposure which should not be exceeded at any time during a work day even if the eight hour time-weighted average is within the TLV.” As with the TWA-TLV, the STEL is only a recommendation. ALSO SEE: TLV, TWA.

Sensitizer (Appendix A) - “A chemical that causes a substantial portion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemicals.”

Short Term Exposure Limit - -SEE STEL.

Signs, placards, process, batch, tickets, operating procedure, or other such written material - These types of methods may be used in lieu of labels on stationary process containers as long as the requires information and accessibility is present.

Skin notation - The ACGHI TLV booklet includes the “skin” notation with those listed substances where the overall exposure to a chemical may increased by the skin route of entry.

Solid Flammable - SEE FLAMMABLE SOLID

Solubility - A measure of the amount of the substance that will dissolve in a given amount of water or other substance. Solubility data may be given in ppm or percent.

Specific chemical identity (OSHA) - “…means the chemical name, Chemical Abstracts Service (CAS) Registry Number, or any information that reveals the precise chemical definition of the substance. ALSO SEE: CAS

Specific gravity - The specific gravity is the comparison of densities between two different substance. Normally, the density of a substance is compared to the density of water, which is one. ALSO SEE DENSITY

Spontaneous heating - An increase in the internal temperature of a substance due to a chemical or physical change without the application of external heat.

Stability - A measure of the ability of a substance to be handled and stored without undergoing unwanted chemical changes.

Synonym - A particular chemical substance may be known by several names. Different names for the same substance are synonyms. Methylbenzene is a synonym for toluene. ALSO SEE: RTECS

TLV - Threshold Limit Value. The TLVs are a group of recommended concentration established by the ACGIH for worker protection. They are based on toxicity data generated from human and animal studies and industrial experience. TLVs are only recommendations to industry, whereas OSHA enforces the PELs. ALSO SEE: TWA, Ceiling, STEL, Skin notation, PEL, ACGIH.

TSCA - Toxic Substances Control Act. TSCA provides for the evaluation of chemical substances before they are used in the workplace.

TWA - Time-weighted average. This type of Threshold Limit Value established by the ACGIH is “the time-weighted average concentration for a normal 8-hour day and 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.” ALSO SEE: TLV, ACGIH

Target organ effects - Those effects which are recognized to be a result of exposure to a specific chemical. ALSO SEE: HEPATOTOXINS, NEPHROTOXINS, NEUROTOXINS, BLOOD AGENTS, LUNG AGENTS, REPRODUCTIVE TOXINS, CUTANEOUS HAZARDS, EYE HAZARDS.

Teratogen - A substance which causes birth defects as a result of exposure during fetal development. ALSO SEE: REPRODUCTIVE TOXINS.

Threshold Limit Value - SEE TLV.

Toxicity - The measure of the adverse effect exerted on the human body by a poisonous material.

Trade secret (OSHA) - “…means any confidential formula, pattern, process, device, information, or compilation (including chemical name or their unique chemical identifier) that is used in an employer’s business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it.” Trade secret information is required to be divulged under certain circumstances as defined in section (i) of the Hazard Communications Standard. Circumstances include medical emergencies, and for occupational health evaluations.

UEL - SEE UFL.

UFL - The highest concentration of a combustible or flammable gas or vapor in air that will produce a flash of fire. Mixtures above this concentration are to rich to burn. The UFL of toluene is 7.1%. ALSO SEE: LFL, FLAMMABLE LIMITS.

Unstable - SEE REACTIVE.

USE (OSHA) - "…means to package, handle, react or transfer." This term is used to define the scope of the Hazard Communication Standard n (b)(2). ALSO SEE: FORESEEABLE EMERGENCY

Vapor density - This is the comparison of the density of a vapor or gas to the density of air. A vapor density of less than 1 means it is lighter than air, and greater than 1 means it is heavier than air

Vapor pressure - A measure relating the tendency of a liquid to give off vapors, usually given in millimeters of mercury (mmHg). The vapor pressure of toluene at 68°F is 22 mmHg and 7660 mmHg at 231°F (the boiling point).

Volatility - A measure relating the tendency of a liquid to change to a vapor at a specific temperature. ALSO SEE: EVAPORATION

Water-reactive (OSHA) - "…means a chemical that reacts with water to release a gas that is either flammable or presents a health risk.." ALSO SEE: PHYSICAL HAZARD.

Work area (OSHA) - "…means a room or defined space in a workplace where hazardous chemical are produced or used, and where employees are present." Work area is referred to in the description of the written hazard communication program. ALSO SEE: USE, WORKPLACE, PRODUCE.

Workplace (OSHA) - "…means an establishment at one geographical location containing one or more work areas." An important term related to the scope of the Hazard Communications Standard. ALSO SEE WORK AREA.

DOs AND DON'Ts FOR WORKPLACE SAFETY

DO	**DON'T**
Read the container label and MSDS before starting a job	Leave containers open when not in use.
Keep your work area CLEAN.	Siphon by mouth.
Use protective clothing and equipment.	Depend on a "funny smell" to detect hazardous gases in the air - some are odorless.
Follow safety rules.	Mix a chemical with another substance - even water - unless you are instructed to. Even then, follow instructions exactly.
Use approved containers for storing and transporting hazardous materials.	Breath gases produced from chemical reactions.
Follow company instructions when removing hazardous liquids from containers.	Pour water into acid.
Make sure there is enough ventilation - especially in a confined space.	Smoke, eat, or drink around hazardous substances.
Keep compressed gas, flammable and explosive materials away from heat.	Store hazardous chemicals next to each other without checking the MSDS for possible reactions.
Check that containers and hoses are in good working condition.	Wear contact lenses around toxic vapors.
Take safety training seriously.	Cut corners on hazardous substance handling procedures.

SAMPLE LETTER REQUESTING MSDS

DATE

MANUFACTURER'S NAME AND ADDRESS

DEAR MANUFACTURER:

Our company has purchased your product, ____________________________, but do not have the Material Safety Data Sheet (MSDS). You are required under the OSHA Hazardous Communication Standard (HCS), 29 CFR 1910.1200 to provide users with MSDS for all hazardous chemicals that you produce.

It is our intent to comply with the provisions of this standard, and the MSDS is an integral part of this program.

Your cooperation is greatly appreciated. Thank you for your timely response.

Sincerely,

ROUX ASSOCIATES, INC.

(<u>A COPY OF ALL CORRESPONDENCE TO YOUR SUPPLIERS SHOULD BE KEPT WITH THE MSDS FILE UNTIL THE MSDS FORM IS PROVIDED</u>). Follow up letters and dates, and records of telephone inquiries should also be noted.

APPENDIX E

Quality Assurance Project Plan (QAPP)

Quality Assurance Project Plan

Indiana Machine Works
135 East Harrison Street
Mooresville, Indiana
VRP Site #6051201

February 2015

Prepared for

One Beacon
70 West Monroe
Chicago, Illinois 60603

ROUX ASSOCIATES, INC.

Environmental Consulting & Management

ROUX

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1.0 INTRODUCTION

The Quality Assurance Project Plan (QAPP) was developed for activities associated with additional subsurface investigations, operation and maintenance of the remediation system and groundwater monitoring at the Indiana Machine Works Facility (Site), Mooresville, Indiana. This QAPP is based on the Voluntary Remediation Program (VRP) Model QAPP, dated July 1996, published by the Indiana Department of Environmental Management (IDEM). An associated Health and Safety Plan (HASP) has also been prepared for this project.

1.1 Site Background

The Voluntary Remediation Program (VRP) Site #6051201, referred to as Indiana Machine Works, is located 135 East Harrison Street, Mooresville, Indiana in Brown Township of Morgan County (**Figure 1**). The Site consists of approximately 1.1 acres improved with three buildings: one approximately 28,500-square feet (ft^2) main building constructed of mason block construction on a concrete slab and two wooded utility sheds (approximately 160 ft^2 combined) (**Figure 2**). The buildings encompass approximately 70 percent of the total footprint of the Site, and the remainder of the Site is covered with concrete pavement in areas to the north and south of the main building (approximately13 percent of the total footprint) and grass-covered or gravel areas along the eastern, southern and western perimeters of the main building (approximately17 percent of the total footprint). The Site is bounded on the west by residential properties; on the south by a car wash and lumber yard (across Broad Alley); on the east by an automobile repair shop and residential property (across the Conrail Railroad line), and on the north by a residential property, automobile repair shop and parking lot (across Harrison Street).

Historically, the Site was part of six lots owned and operated by Laboratory Equipment Corporation. The aggregate property consisted of three main buildings: the Administrative Building/Machine Shop located at 156 East Harrison Street, the Storage Building located at 142 East Harrison Street, and the Engineering/Fabrication/Assembly building (the current Site main building), located at 135 East Harrison Street. Additionally, the aggregate property consisted of outdoor storage areas, two parking lots, a trash incinerator, and various access driveways.

The lots were vacant land or housed residences until the 1960's. From 1962 to 1966, Laboratory Equipment Corporation purchased the lots and developed the land for metal fabrication operations. In 1983, LabeCo Properties, Ltd purchased the property and leased it to Indiana Machine Works, Inc. (now Indiana Technology Development, Inc.) until 2005 as a metal fabrication and machining shop. Currently, the main Site building is leased to Advance Aero for aircraft repair and machining.

The general topography of the Site is relatively flat with an approximate surface elevation of 690 feet above mean sea level. There are no surface water bodies located on the Site. East Fork of White Lick Creek is the nearest surface water, which is located approximately ¾ miles east of the Site (A&W, December 2001).

The property is serviced by public utilities including municipal water, sanitary sewer, and storm sewer. Natural gas, sanitary sewer, storm sewer, and communications cable are all located within a utility corridor in Broad Alley, along the southern boundary of the Site (**Figure 2**). Additionally, water, sanitary sewer, and storm sewer are located in Harrison Street, along the northern boundary of the Site, and a mega-fiber optic cable is located along the eastern edge of the Conrail Railroad line, east of the Site.

Analytical results from soil and groundwater sampling indicate the Site COCs are as follows:

- Tetrachloroethylene (PCE) and its daughter breakdown products trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), and vinyl chloride (VC).
- 1,1,1-Trichloroethane (1,1,1-TCA) and its daughter breakdown product 1,1-dichloroethane (1,1-DCA).

1.2 Project Scope and Objectives

The scope of the work covered by this QAPP includes:

- Sampling and analysis of groundwater monitoring wells for:
  - Volatile organic compounds (VOCs) – SW 846 Method 8260
  - Water levels – field measurement
  - Wellhead vacuum – field measurement

The objectives of the activities covered by this QAPP include:

- Assessment of the current distribution of selected volatile organic compounds in groundwater in the vicinity of the Site
- Enhanced reductive dechlorination (ERD) approach via ISCR for Plumes #1 and #2

1.3 Monitoring and Operation and Maintenance of Remedial Technologies

Sections 1.3.1 through **1.3.4** describe the monitoring activities that will satisfy the scope and objectives described above.

1.3.1 Groundwater Monitoring Well Sampling and Analysis

Roux Associates (Roux) will perform groundwater monitoring in accordance with IDEM's purge policy. A list of monitoring wells to be sampled are provided in the RWP. Refer to **Section 4.1** of this QAPP for the detailed methodology to be used during groundwater sampling. Groundwater samples collected from monitoring wells will be submitted for analysis of VOCs by SW 846 Method 8260 using Level 4 QA/QC. Roux will measure water levels in the field using an electronic water level meter.

1.3.2 ERD Approach

Roux proposes to use ERD via ISCR to treat groundwater at the Site (Plumes #1 and #2). Similar to the ISCR pilot test conducted during July 2013 at Plume #2 MW-14 area. Roux proposes to contract with Redox Tech, LLC in order to mix and inject Provectus-IR™ to promote ERD in Plume #1 and #2 areas. Provectus-IR™ is a mixture of Zero Valent Iron (ZVI), hydrophilic organic carbon sources, natural anti-methanogenic compounds, chemical oxygen scavengers, as well as vitamin and mineral sources. The corrosion of the ZVI yields ferrous iron and hydrogen, both of which are reducing agents. The hydrogen gas produced is also an excellent energy source for a wide range of bacteria. This product is designed to promote reductive dechlorination of chemicals present in soil and groundwater. Refer to **Section 4.2** for the detailed methodology to be used during ISCR injections.

1.3.4 Data Analysis

Roux will perform a review of the data collected during monitoring activities as described in **Section 3.0**.

1.3.5 Monitoring Results

Groundwater results will be updated quarterly and sent to IDEM in an Annual Groundwater Monitoring Report for review.

2.0 PROJECT ORGANIZATION AND KEY PERSONNEL

Tim Zei, Project Manager and Field Site Manager, Roux Associates. 2000 Spring Road, Oak Brook, IL Phone: 630-655-5024 Email: tzei@rouxinc.com Role: project management, quality assurance, field work, performance and system audits, corrective action.

Tim Adams, Project Principle, Roux Associates. 2000 Spring Road, Oak Brook, IL Phone: 630-572-3300 Email: tadams@rouxinc.com Role: quality assurance, performance and system audits, corrective action.

Leo Kurylo, Office Health and Safety Manager, Roux Associates, 2000 Spring Road, Oak Brook, IL Phone: 630-468-1060 Email: lkurylo@rouxinc.com Role: Health and Safety Management.

Damon Ridley, IDEM Project Manager Voluntary Remediation Program Indiana Department of Environmental Management 100 North Senate Avenue, Room 1101 Indianapolis, IN 46204 Phone: (317) 234-0972.

3.0 QUALITY ASSURANCE OBJECTIVE FOR MEASUREMENT DATA

During the course of performing the field work at the site, several types of data will be collected. Since data ranges from field screening, site characterization, and risk assessment, data will be generated consistent with DQO Levels 1 and 4 as defined by IDEM's July 1996 VRP Resource Guide. The following discussion summarizes the sampling associated with each task described above and its intended DQO Level.

Quarterly water samples collected from the site wells and system influent/effluent will be analyzed for VOCs using USEPA SW846 Method 8260 by a laboratory in a manner consistent with DQO Level 4. Groundwater and soil samples collected during the confirmation sampling will be performed using DQO Level 4.

The overall QA objective for DQO Level 4 data is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet this DQO Level.

Specific procedures for sampling, chain-of-custody, laboratory calibration, laboratory analysis, reporting of data, internal quality control, preventative maintenance of field equipment, and corrective action are described herein. **Sections 3.1** through **3.3** details the DQ objectives for accuracy, precision, and representativeness for samples intended to meet DQO Level 4.

Field screening techniques and field measurements obtained during the O&M of the remedial system will be consistent with DQO Level 1 as defined by the March, 1987 USEPA document: "Data Quality Objectives for Remedial Response Activities, Development Process" and the IDEM VRP Model QAPP. The results of these field analyses will be documented in the operator's logbook and on the field sampling summary forms. Records of the calibration of the field equipment will be maintained on a calibration form for each particular piece of equipment.

3.1 QA Objectives for DQO Level 4

Accuracy is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes component of both systematic error (bias) and random error. The analytical laboratory will assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix) through the measurement of "standards" (materials of acceptable reference value). Accuracy is expected to vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured and expressed in terms of the recovery of spiked or surrogate compounds. This gives an indication of expected recovery for analytes tending to behave chemically like the spike or surrogate compounds.

Precision is the agreement among a set of replicate measurements without consideration of the "true" or accurate value, and is represented by the variability between measurements of the same material for the same analyte. The precision of the analytical method is measured statistically (such as by calculating the variance or the standard deviation). Details regarding QA procedures employed by the analytical laboratory are included in their respective quality Assurance Manuals.

Representativeness expresses the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, process conditions, or an environmental condition. Representativeness is a qualitative parameter that is dependent upon the proper design of the sampling program and on the laboratory quality control protocol. The sampling program for this site, including information regarding the appropriate sampling and sample handling techniques, is described in the Field Sampling Plan (**Section 4.0**).

3.2 Quality Control Effort for Sample Collection for DQO Level 4

As described below, and as consistent with IDEM requirements, field duplicates, equipment rinsate blanks, trip blanks, and matrix spike samples will be collected and analyzed to assess the quality of the data resulting from the field sampling program.

Field duplicate samples will also be collected as a check of sampling and analytical reproducibility; these duplicates will be collected from the same locations as their investigative samples, labeled as a separate field sample, and will be handled and analyzed together with the field samples. One field duplicate sample will be collected for every ten field samples collected

Groundwater sampling equipment will be decontaminated between each sample interval using an Alconox®/water mixture wash followed by a potable water rinse. In order to confirm decontamination procedures adequately prevent cross-contamination between samples, one equipment rinseate blank will be collected every sampling event.

Trip blanks will be used to assess the potential for volatile organic contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks will be prepared by the laboratory and included with every sampling kit. One trip blank, containing distilled water and prepared by the analytical laboratory, will be included in each shipping container with groundwater samples to be analyzed, and will be subjected to the same storage, preservation, and analytical procedures as the investigation derived field samples. The trip blank will remain in the shipping container from the time the sampling kit leaves the laboratory until it is received back from the Site. Trip blanks will be required at a frequency of one per sample package cooler. Trip blanks will be submitted to the laboratory with the field samples and analyzed for the target chemical parameters. Trip blanks should not contain target analytes above 5 times the detection limit (10 times for common laboratory contaminants).

Matrix spike and matrix spike duplicates (MS/MSD) are laboratory duplicates based from the investigative samples split by the laboratory. Matrix spikes provide information will provide information about the effect of the sample matrix on digestion and measurement methodology. All matrix spikes will be performed in duplicate. MS/MSD samples will be analyzed at a frequency of one for every 20 or fewer groundwater samples.

3.3 Level of Effort by the Analytical Laboratory for DQO Level 4 Samples

In addition to the field QA/QC samples described above, one matrix spike/matrix spike duplicate sample (MS/MSD) will be analyzed by the laboratory for every twenty field samples. Also, as detailed in the NELAC-certified lab SOP, the laboratory will perform initial and continuing calibration procedures, and initial and continuing calibration blanks with each analytical run.

4.0 FIELD SAMPLING PLAN

4.1 Groundwater Sampling Analysis

Sampling equipment required for collecting groundwater samples at the site include:

- Site maps with well locations
- Disposable bailers and string
- Sample containers
- Purge water containers
- Water level indicator
- Field forms (chain-of-custody, field notebook or field observation sheets)

Prior to sampling, a depth to water measurement will be taken to ±0.01ft from the top of the PVC riser using an electronic water level meter. The total depth of the well will also be recorded. Based on these measurements, the volume of standing water in the well will be calculated. The formula to determine a single volume is:

$$V=[\pi \times (D/2)^2 \times H] \times 7.48$$

Where V = total volume of water (gallons), D = inside diameter of casing (ft), and H = height of water column (ft).

A minimum of three times the standing volume of water in the well casing will be purged, or the well will be purged until dry. Upon completion of purging, VOC vials (preserved with hydrochloric acid) will be filled directly from the bailer and immediately placed on ice. Duplicate samples will be collected by alternately filling the original sample then the duplicate sample container.

4.2 ERD via ISCR Injection Methodology

Provectus-IR™ will be injected as a slurry at a 29 percent solid mixture per the manufacturers recommendations. Since the slurry is very viscous the injection point spacing will be reduced to approximately 12 to 15 feet based on the site geology and manufactures specifications.

Plume #1

The Plume #1 Area (South Plume) will require an estimated 15,700 lbs of Provectus-IR™. This will be mixed with potable water to form a slurry volume of approximately 5,700 gallons. Based on the proposed 12 to 15 foot injection point spacing, approximately 55 injection points will be required. It is estimated that this work could be completed in 7 work days.

Plume #2

The North Plume Area will require approximately 1,200 of Provectus-IR™. This will be mixed with potable water to form approximately 450 gallons of solution. Based on a proposed 12 to 15 foot injection point spacing, approximately nine (9) injection points will be required. It is estimated that this work could be completed in 3 work days.

The exact location and number of injections will be dependent on building accessibility and field conditions. Additionally, the ERD injections will be focused along the underground utility corridors that may be providing a preferential contaminant flow paths. To facilitate this objective, Roux intends to contract with a private utility locating company to help field check/map the underground utilities prior to ERD remediation using electromagnetic and ground-penetrating radar techniques and visual assessment.

The proposed injection locations will be spaced approximately 12 to 15 feet apart, and the Provectus-IR™ will be injected in approximately 1 to 2 foot vertical increments at each injection location to ensure proper vertical distribution.

5.0 CUSTODY PROCEDURES

5.1 Field Custody Procedures

Field logs describe in as much detail as possible so that persons going to the facility could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound, field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control center when not in use.

The title page of each logbook will contain the following:

- Person to whom the logbook is assigned
- Project name
- Project start date, and
- End date

At the beginning of each entry, the date, start time, weather, and names of all sampling team members present will be entered. The names of visitors to the site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in ink, dated and no erasures will be made. Whenever a sample is collected, or a measurement is made, a detailed description shall be recorded. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the Field Sampling Plan. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume and number of containers. A site specific sample identification number will be assigned prior to sample collection. The sample will be identified by the monitoring well number (e.g., MW-1, MW-2, etc.) or by the QA/QC sample type (e.g., Duplicate, Trip Blank, etc.).

The sample packaging and shipment procedures summarized below will ensure that samples will arrive at the laboratory with the chain-of-custody intact.

(a) The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

(b) All sample bottles will be labeled. Sample ID, date/time of collection, and initials of the sampler, will be included on the label and also recorded in the field notebook.

(c) The chain-of-custody is to be completed for each sample in ink. The original record and yellow copy will accompany the shipment, and the pink copy will be retained by the sampler.

(d) Samples are accompanied by a properly completed chain-of-custody form. The sample identification and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing the receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to the laboratory, or to/from a secure storage area.

(e) Samples will be properly packaged on ice at 4 ° C and maintained at that temperature +/- 2° C for shipment to the appropriate laboratory for analysis.

(f) If the samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent documentation by the Contractor. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on custody form as long as the custody forms are sealed inside the sample cooler and the custody seals remain intact.

5.2 Laboratory Custody Procedures

Laboratory custody procedures for sample receiving and log-in; sample storage and numbering; tracking during sample preparation and analysis; and storage of data are described in the laboratory procedures in the Quality Assurance Plan for a NELAC-certified lab of Roux's choice, which will be available upon request.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

6.1 Field Equipment

Field equipment will be operated in accordance with the manufacturer's instructions. The equipment to be used during the investigations will be calibrated prior to the day's investigations in accordance with the manufacturer's instructions. The calibration range chosen will be designed to bracket the concentrations of concern present at the Site.

Bound field notebooks, field data sampling sheets, and laboratory COC forms will be used to document the collection of samples and any associated data so that any individual sample or data set can be traced back to the point of origin, sampler, and/or sampling equipment used.

6.2 Laboratory Equipment

Soil and groundwater samples collected from the Site will be analyzed by a NELAC-certified lab of Roux's choice. QA/QC for these analyses are included in the lab's respective SOPs and will be available upon request.

Calibration of the laboratory analytical instrumentation is essential for the generation of reliable data that will meet the stated project data quality objectives. Analytical instrument calibration is monitored through the use of control limits that are established for individual USEPA analytical methods and detailed in the laboratories respective SOPs. These procedures specify the type of calibration, the calibration materials to be used, the range of calibration, and the frequency of calibration. Instruments are initially calibrated in accordance with specific procedures, and these calibrations are confirmed by analyzing "standards' at required intervals. If the acceptance limits are exceeded, a recalibration is performed. The acceptance limits are documented in each individual procedure program and data will be rejected or flagged for any non-compliance with these limits.

7.0 ANALYTICAL PROCEDURES

Soil and groundwater samples collected from the Site will be analyzed by a NELAC-certified lab of Roux's choice. The NELAC-certified lab will implement the project required SOPs.

8.0 INTERNAL QUALITY CONTROL CHECKS

NELAC-certified labs have a QC program to ensure the reliability and validity of the analysis performed at the laboratory. All analytical procedures are documented in writing as SOPs and each SOP includes a QC section that addresses the minimum QC requirements for the procedure. The internal quality control checks might differ slightly for each individual procedure but in general the QC requirements include the following:

- Reagent/preparation blanks
- Instrument blanks
- MS/MSDs
- Laboratory duplicates
- Laboratory control sample (LCS)
- Serial dilution
- Interference check sample
- Surrogates

The data package will include a deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. The laboratory will reanalyze any samples analyzed in nonconformance with the QC criteria, if sufficient volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary.

9.0 DATA REDUCTION AND VALIDATION

All field and laboratory data reduction and validation will be done in accordance with the procedures described below.

9.1 Data Reduction

Raw data obtained from meter and instrument readings, and physical measurements, will be reduced to concentrations of analytes by use of the appropriate equations specified in the analytical methods. The interpretation of raw data and the calculation of results will be initialed by the individual performing the data reduction.

9.2 Data Validation and Acceptance Criteria

Water samples collected during the course of this project will be used to assess groundwater quality. As such, this data is required to meet DQO Level 4, which will require validation consistent with EPA guidelines. The data will be independent of the analytical laboratory.

The data will be considered acceptable when the QC results are within control limits. When the results fall outside of the control limits, suggesting sample data may be biased high or low, the data is estimated to indicate uncertainty in its quantitation.

9.2.1 Field Data

For field tasks, the Project Manager will perform the validation of data generated by cross-referencing the field log books, the sampling records, and the final reduced data to verify that the data under review contains an accurate summary of the information collected.

9.2.2 Laboratory Data

With regard to the laboratory data validation, data for the blanks, duplicates, matrix spike/matrix spike duplicates, and the control samples will be evaluated. Specific to this project analyses will include method blanks, matrix spikes/matrix spike duplicates, serial dilution, interference check samples, LCS, initial and continuing calibrations. Calculations of the percent recovery and the relative percent differences will be performed by the analyst and recorded. The completed sample data and QA data will be posted to the Quality Assurance Officer for review. This review includes compliance with the QC standards and documentation completeness.

10.0 PERFORMANCE AND SYSTEM AUDITS

10.1 Field

If anomalous results are present in the data, the Project Manager will conduct audits of the field techniques. These audits will include a review of the field logs, the instrument calibration notebooks, the field sampling sheets, and the COC documents.

10.2 Laboratory

If warranted due to QA/QC concerns, a performance audit consisting of the analysis of appropriate blanks, spiked samples, and standard solutions will be performed. The audit will test not only the total system response, but also the major measurement methods. Recommendations to correct any deficiencies in the analytical protocols or the data will be formulated. These corrective measures will be in accordance with on-going good laboratory practices and with the overall QA/QC program.

System audits for the analytical laboratory may include the following items:

- Review of the laboratory standard operating procedures;
- Evaluation of the analysts' experience; and, if deemed necessary,
- An audit of the off-site laboratory facility.

11.0 PREVENTATIVE MAINTENANCE

11.1 Field

Preventative maintenance procedures will be carried out on the field equipment in accordance with the procedures outlined by the manufacturer's equipment manual. The field equipment used during this project will have a specific maintenance instruction sheet. Maintenance activities involving the field equipment will be recorded in a field notebook.

11.2 Laboratory

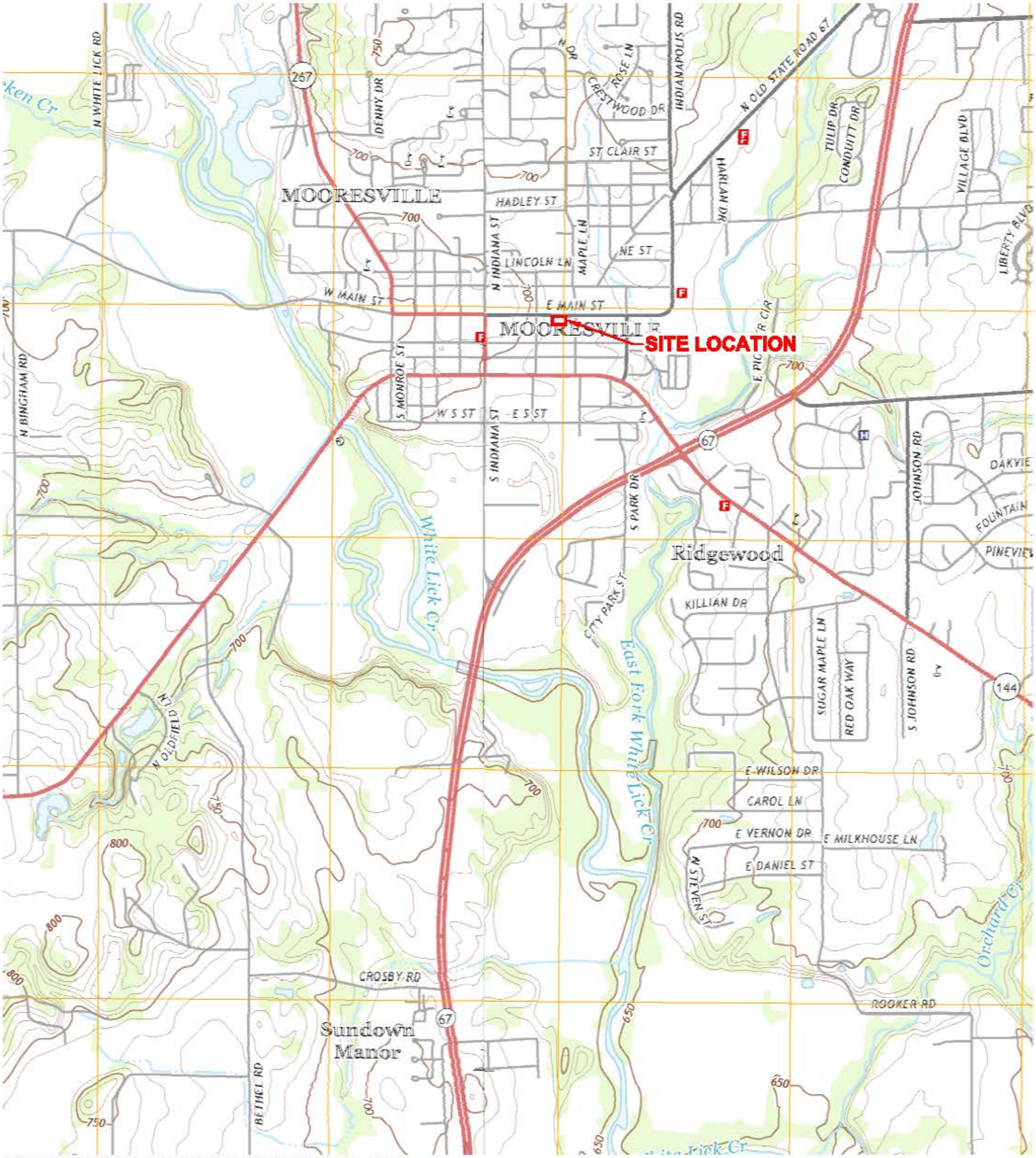
A specific preventative maintenance schedule for each piece of equipment is recommended by the manufacturer. Critical spare parts such as probes and batteries are maintained in inventory to avoid delays in repair. Maintenance logs are kept for all of the major pieces of equipment. Service contracts are in effect for critical equipment to reduce the response time needed to resolve problems. Service, both by in-house personnel and vendors, will be documented and the documentation retained in individual equipment files.

12.0 CORRECTIVE ACTION

The need for corrective action may be identified by system or performance audits or by standard QC procedures. The essential steps in the corrective action system will be:

1) Checking the pre-determined limits for data acceptability beyond which corrective action is required;
2) Identifying and defining problems;
3) Assigning responsibility for investigating the problem;
4) Investigating and determining the cause of the problem;
5) Determining a corrective action to eliminate the problem (this may include re-analyses or re-sampling and analyses);
6) Assigning and accepting responsibility for implementing the corrective action;
7) Implementing the corrective action and evaluating its effectiveness;
8) Verifying that the corrective action has eliminated the problem; and
9) Documenting the corrective action taken. For each measurement system, the analyst will be responsible for identifying the need for corrective action and initiating the corrective action procedure. The laboratory supervisor will be responsible for implementing the corrective action and evaluating its effectiveness.

FIGURES



SOURCE: USGS MAP MOORESVILLE EAST QUADRANGLE; 2013

QUADRANGLE LOCATION

2000' 0 2000'

Title:

SITE LOCATION AND TOPOGRAPHIC MAP

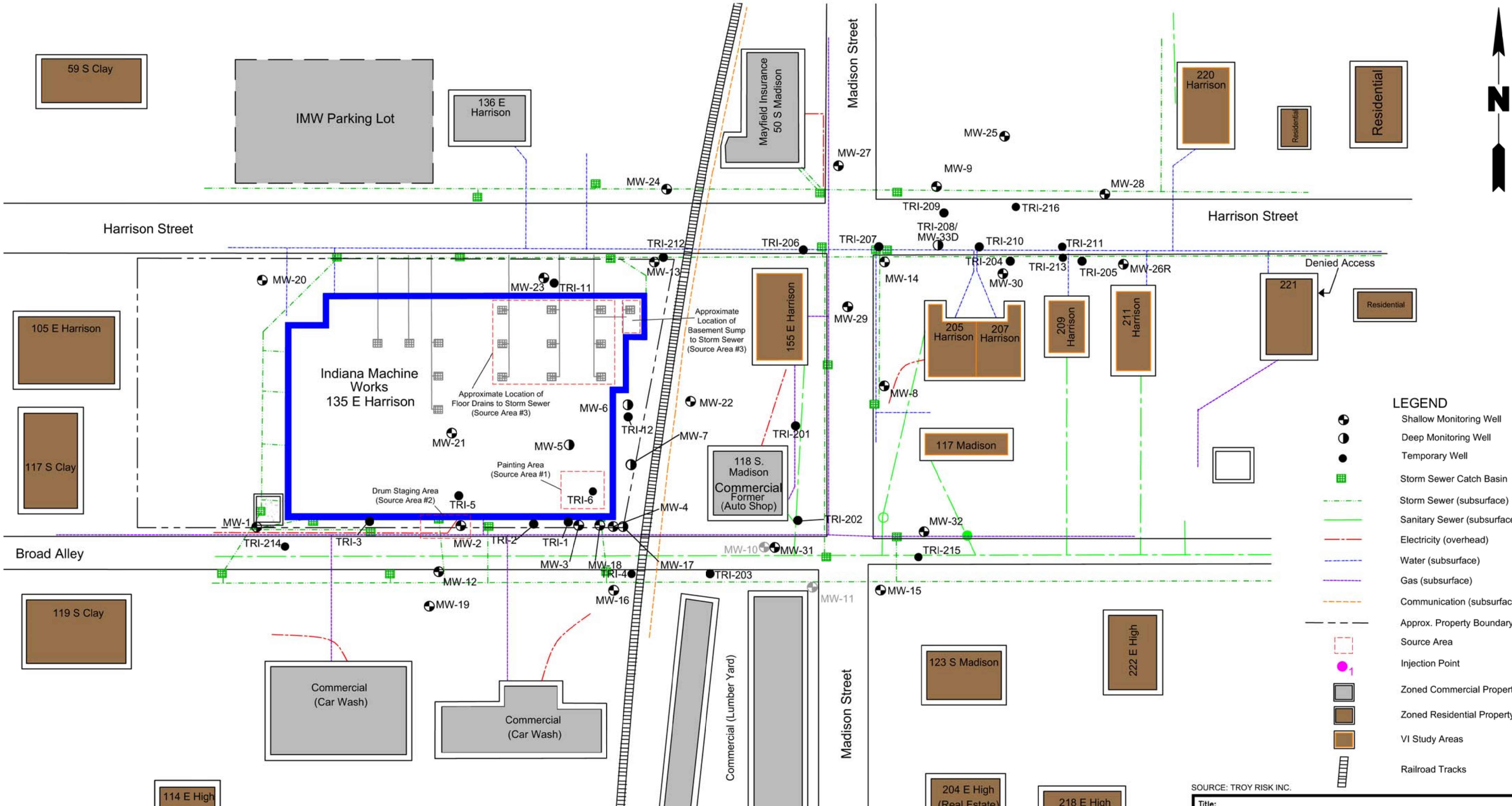
135 EAST HARRISON STREET
MOORESVILLE, INDIANA

Prepared For:

INDIANA MACHINE WORKS

ROUX ASSOCIATES, INC. *Environmental Consulting & Management*	Compiled by: TD	Date: 02/19/2015	FIGURE
	Prepared by: JJS	Scale: AS SHOWN	1
	Project Mgr: TA	Project: 1161.0060I000	
	File: FIG_01-TOPOMAP.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_01-TOPOMAP.DWG



SOURCE: TROY RISK INC.

Title:

SITE PLAN, ZONING, AND UTILITY LAYOUT MAP

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

Prepared For:

INDIANA MACHINE WORKS

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/19/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	2
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_02-SITE PLAN-ZONING.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\FIG_02-SITE PLAN-ZONING.DWG

APPENDIX F

Health and Safety Plan (HASP)

SITE HEALTH AND SAFETY PLAN

Laboratory Equipment,
Formerly Indiana Machine Works
135 East Harrison Street
Mooresville, IN

VRP Site #6051201

February 2015

Prepared for:

One Beacon America Insurance
70 West Monroe
Chicago, Illinois 60603

ROUX ASSOCIATES, INC.

Environmental Consulting & Management

ROUX

2000 Spring Road, Oak Brook, Illinois 60523 ♦ 630-572-3300

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1.0 INTRODUCTION

Roux Associates, Inc. prepared this site-specific Health and Safety Plan (HASP) in accordance with the Occupational Safety and Health Administration's (OSHA's) Hazardous Waste Operation and Emergency Response Standard (29 CFR 1910.120 and 1926.65) and other OSHA requirements for job safety and health protection (**Appendix A**), and our Standard Operating Procedures. In addition, various guidance documents were also consulted in preparing this HASP including the National Institute for Occupational Safety and Health's (NIOSH's) *Occupation Safety and Health Guidance Manual for Hazardous Waste Site Activities.* The HASP attempts to identify all potential hazards at the site; however, site conditions are dynamic and new hazards may appear constantly. Personnel must remain alert to existing and potential hazards as site conditions change and protect themselves accordingly.

Compliance with this HASP is required for Roux Associates, Inc. personnel and subcontractors who enter this site. Assistance in implementing this HASP can be obtained from the Roux Associates, Inc. Office Health and Safety Manager (OHSM). The content of this HASP may undergo revision based upon additional information made available. Any changes proposed must be reviewed and approved by the Roux Associates, Inc. OHSM or his designee and documented on the Field Change Request form included as **Appendix B**. Following are key personnel involved with this project.

Responsibility	Name	Telephone Number
Project Principal	Tim Adams	630-572-3300
Project Manager	Tim Zei	630-468-1047
Field Site Manager	Tim Zei	630-303-0042
Site Health and Safety Officer	Tim Zei	630-303-0042
Office Health and Safety Manager	Leo Kurylo	630-632-5702

1.1 Scope of Work

Roux may perform the following activities:

1. Soil boring and monitoring well installation (indoor and outdoor) including soil and groundwater sampling along with associated analyses;
2. On-site private utility survey and preferential pathway assessment;
3. Source removal via in-situ destruction of constituents of concern (COCs);
4. Injection of remedial compounds into site soils;
5. Installation of sub-slab soil vapor ports; and
6. Indoor air sampling coupled with sub-slab vapor sampling.

1.2 Emergency Contacts

Type	Name	Telephone Numbers
Police	Mooresville Police Department	911 or 317-831-3434
Fire	Mooresville Fire Department	911 or 317-831-5354
Hospital (see **Figure 3**)	St. Francis Hospital and Health Center	911 or 317-831-1160
State Poison Control Center	Indiana Poison Center	800-222-1222
Utility Clearance	Indiana Underground Plant Protection Services	811 or 800-382-5544
Ambulance	Priority One EMS - Ambulance	317-542-1111

ENVIRONMENTAL EMERGENCY
(e.g., release or spill)

Type	Name	Telephone Numbers
Project Principal	Tim Adams	630-572-3300
Project Manager	Tim Zei	630-655-5024
Office Health and Safety Manager	Leo Kurylo	630-468-1060
Site Health and Safety Officer	Tim Zei	630-303-0042
Field Site Manager	Tim Zei	630-468-1047
National Response Center		800-424-8802
Client Contact		
Resolute Management	Tom Barriball	312-345-2491
Facility Contact	John Stimson Jr.	j.stimson@att.net

(Additional emergency information is provided in **Section 13.0**).

2.0 HEALTH AND SAFETY PERSONNEL RESPONSIBILITIES

2.1 Office Health and Safety Manager

The Office Health and Safety Manager (OHSM) serves in assuring that the policies and procedures of the HASP are implemented by the Site Health and Safety Officer (SHSO). The OHSM provides guidance regarding the appropriate monitoring and safety equipment and other resources necessary in implementing the HASP. The OHSM ensures that all Roux Associates, Inc. personnel designated to work on-site are qualified according to applicable EPA, OSHA and state requirements.

2.2 Site Health and Safety Officer

The SHSO will be on site during intrusive field operations. On a site-specific basis, routine activities such as ground-water sampling and gauging may be performed when the SHSO is not on site. The SHSO is responsible for health and safety activities and has the authority to make related decisions. The determination of hazard levels will be made by the SHSO. The SHSO has stop-work authorization which he or she will execute upon determination of an imminent safety hazard, emergency situation, or other potentially dangerous situation, such as detrimental weather conditions. Authorization to proceed with work will be issued by the OHSM in consultation with the Project Principal (PP) or his/her designee, e.g. Project Manager (PM). The SHSO or PP will contact emergency facilities and personnel when appropriate. Alternate SHSOs may be designated by the SHSO, if required, but must be pre-qualified and approved by the OHSM. The SHSO is responsible for ensuring that a duplicate office copy of this HASP is placed in the central project files.

2.3 Project Principal

The Project Principal is responsible for defining the overall project objectives (field and office related activities) determining chain-of-command, evaluating program outcome and serves as final technical review of deliverables. For Roux Associates, Inc., the Project Principal is ultimately responsible for overall site activities including health and safety issues. The day-to-day management of health and safety issues is the responsibility of the Project Manager. The SHSO, OHSM, Project Manager, and Project Principal shall consult and make an agreeable determination should Site information or unforeseen circumstances indicate a change in field procedures may be warranted. Changes to the HASP must be made by formal addendum and be approved by the Project Principal, Project Manager, OHSM and SHSO. The Project Principal is responsible for ensuring that all required signatures are in place prior to implementing field work.

2.4 Project Manager

The Project Manager is responsible for day-to-day activities associated with his/her project including health and safety. Because there may be more than one Project Manager for each site (for example, a Remedial Project Manager and a Site Investigation Project Manager), each Project Manager must ensure that the HASP addresses the hazards associated with each phase of the project and is appropriate for the current specified scope of work.

2.5 Field Crew Personnel

All field crew personnel are responsible for reporting unsafe or hazardous conditions to SHSO. All field personnel (including the above listed personnel) are responsible for understanding and complying with this HASP.

3.0 SITE HISTORY AND PHYSICAL DESCRIPTION

- Location

135 East Harrison Street, Mooresville, Indiana, in Brown Township of Morgan County

- Description

The Site in Mooresville, IN, (**Figure 1**) consists of approximately 1.1 acres improved with three buildings: one approximately 28,500-square feet (ft^2) main building constructed of mason block construction on a concrete slab and two wooded utility sheds (approximately 160 ft^2 combined) (**Figure 2**). The buildings encompass approximately 70 percent of the total footprint of the Site, and the remainder of the Site is covered with concrete pavement in areas to the north and south of the main building (approximately 13 percent of the total footprint) and grass-covered or gravel areas along the eastern, southern and western perimeters of the main building (approximately17 percent of the total footprint). The Site is bounded on the west by residential properties; on the south by a car wash and lumber yard (across Broad Alley); on the east by an automobile repair shop and residential property (across the Conrail Railroad line), and on the north by a residential property, automobile repair shop and parking lot (across Harrison Street).

- History

The Site was part of six lots owned and operated by Laboratory Equipment Corporation. The aggregate property consisted of three main buildings: the Administrative Building/Machine Shop located at 156 East Harrison Street, the Storage Building located at 142 East Harrison Street, and the Engineering/Fabrication/Assembly building (the current Site main building), located at 135 East Harrison Street. Additionally, the aggregate property consisted of outdoor storage areas, two parking lots, a trash incinerator, and various access driveways. The lots were vacant land or housed residences until the 1960's. From 1962 to 1966, Laboratory Equipment Corporation purchased the lots and developed the land for metal fabrication operations. In 1983, LabeCo Properties, Ltd purchased the property and leased it to Indiana Machine Works, Inc. (now Indiana Technology Development, Inc.) until 2005 as a metal fabrication and machining shop. Currently, the main Site building is leased to Advance Aero for aircraft repair and machining.

4.0 SITE-RELATED INCIDENTS, COMPLAINTS AND ACTIONS

In 2001, Alt & Witzig Engineering, Inc. (Alt & Witzig) performed a Phase I Environmental Assessment of the six lots that comprised the original Laboratory Equipment property and recorded the following for the main building of Site:

- Engineering offices in the western portion of the building, a sandblasting room along the eastern portion of the building, and assembly, fabrication, painting, and testing in the central portion of the building;
- The building was serviced with floor drains that connect to the sanitary sewer;
- There was stained concrete flooring in the building; and
- There was stained soil east of the building.
- Chlorinated solvent contaminated groundwater is present in the subsurface. Primary compound of concern is tetrachloroethylene.

Alt & Witzig reported that overflow oil and previous use of parts washing solvent may have accumulated in floor drains.

From 2001 to 2005, Alt & Witzig conducted Phase II soil and groundwater subsurface investigations to evaluate the areas of concern identified in the Phase I ESA. Alt & Witzig detected chlorinated volatile organic compounds (CVOC) in soil and groundwater in the southeast corner of the Site building. From 2005 to the present, Troy Risk, Inc. (TRI) conducted additional subsurface investigations to delineate the vertical and horizontal extent of the CVOC groundwater plume. TRI also conducted slug testing and vapor intrusion (VI) assessment to characterize the Site.

5.0 WASTE DESCRIPTION AND CHARACTERIZATION

Wastes may be encountered or generated during site activities. These wastes are anticipated to be characterized as follows:

- Waste Types

Liquid	☒	Solid	☒	Gas	☐
Sludge	☐	Semi-Solid	☐		

- Waste Characteristics

Corrosive	☐	Toxic	☒	Ignitable	☒
Volatile	☒	Carcinogen	☒	Radioactive	☐
Reactive	☐				

For purposes of this HASP, toxic chemicals are those materials as defined by OSHA in 29 CFR 1910.1200 Appendix A. In general, toxicity is defined by OSHA on the basis of median lethal dose (LD_{50}) or median lethal concentration (LC_{50}) based upon the effects of the chemical in laboratory studies. A chemical is considered a carcinogen, as defined by OSHA in 29 CFR 1910.1200 Appendix A, if "(a) It has been evaluated by the International Agency for Research on Cancer (IARC), and found to be a carcinogen or potential carcinogen; or (b) It is listed as a carcinogen or a potential carcinogen in the *Annual Report on Carcinogens* published by the National Toxicology Program (NTP) (latest edition); or (c) It is regulated by OSHA as a carcinogen."

- Waste Containment

Pond	☐	Process Vessel	☐	Tank	☐
Lagoon	☐	Piping	☐	Lab	☐
Lake	☐	Drum	☒	Other (describe)	garbage bag
Tank Car	☐	Soil Stockpile	☒		____________

- See **Table 1** entitled "Site-Specific Hazards - Toxicological, Physical, and Chemical Properties of Compounds" which addresses exposure limits, routes of exposure, toxic properties, target organs, carcinogenicity, and physical and chemical properties.

6.0 HAZARD ASSESSMENT

- Chemical Hazards

The toxicological, physical and chemical properties of potential contaminants are presented on **Table 1**. The compounds listed in **Table 1** may pose a potential exposure hazard through inhalation, skin absorption, ingestion, or a combination of these routes. These exposures will be further controlled through the use of personal protective equipment (PPE), designated action levels based upon on-site air monitoring, and the assignment of experienced field personnel. The chemical hazards include: VOCs (tetrachloroethylene, trichloroethylene, cis-1,2-dichloroethylene, vinyl chloride, 1,1,1-trichloroethane, and 1,1-dichloroethylene).

- Ambient Air Hazards

The potential for exposure to impacted airborne particulates may occur as a result of subsurface drilling activities. The Contractor will employ dust control measures (water sprinkling or engineering controls) to prevent generation of airborne dust, as necessary. In addition, the potential exposure to organic vapors may exist as a result of the drilling activities. All personnel will remain up-wind as the task allows. The ambient air hazards include: dust, mold, methane.

- Flammability Hazards

The possibility of flammable vapors exists at the site due to the process of methanogenesis that is taking place in the subsurface. Site workers will analyze air close to the suspected sources, at the start of any new work activity, with a combustible gas indicator (CGI). During intrusive work activities, work space air near the suspected source will be continuously monitored with a CGI. If detected, combustible gasses/vapors will be removed from the work area by ventilation and/or other appropriate engineering controls. If work space air near the suspected source contains a concentration of flammable gasses/vapors that exceeds 25% of the lower explosive limit (LEL), work will stop, all potential ignition sources will be removed from the area, and workers will be evacuated. Suspected sources may include building foundation cracks, drain openings, recently exposed soil surfaces, and/or underground utility corridors. The flammability hazards at the site include: methane, hydrogen sulfide.

- Heat Stress and Sun Exposure

Heat stress may result from work performed in summer months in Mooresville, Indiana. Heat stress symptoms, prevention, and treatment are described in Appendix C. Protection against sun exposure by wearing a sun screen, hat, and long-sleeved shirts must be implemented when warranted.

- Cold Stress and Wind Exposure

Cold stress may result from work performed in winter months in Mooresville, Indiana. Cold stress symptoms, prevention, and treatment are described in Appendix C. Protection against cold and wind exposure by wearing proper cold-weather apparel such as a hat, coat, boots, and gloves must be implemented when warranted.

- Noise

Noise associated with close proximity to the drilling equipment, power tools, pumps, generators, and trucks is to be expected while performing the scope of work on Site. Personnel with 8-hour time weighted average (TWA) exposures exceeding 85dBA must be included in a hearing conservation program in accordance with 29 CFR 1910.95. High noise operations will be evaluated by the SHSO. Noise exposure will be controlled through the use of hearing protection such as ear plugs or ear muffs or by maintaining set-backs from high noise equipment as warranted.

- General Safety Hazards
  - Heavy equipment and motor vehicle traffic, and trains. Workers shall wear fluorescent vests in high traffic areas and utilize traffic cones, barricades and caution tape to protect work areas, as necessary. Workers will avoid contact with rail lines for train safety.
  - Slip, trip, fall hazards associated with uneven terrain, obstacles and slippery or icy surfaces. General housekeeping will be performed to reduce slip, trip and fall hazards.
  - Sharp edges, broken glass, exposed nails, rusty metal.
  - Pinch points.
  - Overhead hazards (wear hard hats as applicable).
  - Flying objects and airborne particulate hazards. Wear safety glasses, goggles, or face shields when appropriate.

- Electrical Hazards
  - Portable pumps, generators, and other power tools require proper grounding and/or a ground fault circuit interrupter (GFCI) before operation. Personnel should never attempt to move an operating pump or generator.
  - Overhead and underground utility lines.

- Biological Hazards

Biological hazards include the possibility of snake bites, potentially rabid stray or wild animal bites, ticks or other insect bites and bee and wasp stings. Ticks may carry lyme disease and/or rocky mountain spotted fever. Personnel shall examine themselves for ticks. Insect repellents containing DEET or permethrin may be an effective tick repellent. Personnel allergic to bee and/or wasp stings shall provide medicine and antidotes to treat allergic reactions as prescribed by their personal physician.

Other biological hazards include poison ivy, poison oak and poison sumac. If exposed to these plants, wash skin thoroughly with soap and water. See a physician if an adverse reaction persists after washing.

7.0 TRAINING REQUIREMENTS

7.1 Basic Training

Site personnel who will perform work in areas where there exists the potential for toxic exposure will be health and safety trained prior to performing work on site per OSHA 29 CFR 1910.120(e). Training records will be maintained by the on-site SHSO and as described in **Section 7.2**.

7.2 Site-Specific Training

Training will be provided by the SHSO and FTL that will specifically address the activities, procedures, monitoring, and equipment for the site operations to site personnel and visitors. The training will include site and facility layout, hazards, emergency services at the site, and will detail provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Site-specific training will be documented as part of the project records. In addition, any facility Health and Safety requirements will be followed.

7.3 Safety Briefings

Project personnel will be given briefings by the FTL or SHSO on an as-needed basis to further assist them in conducting their activities safely. Safety briefings will be provided when new operations are to be conducted, changes in work practices must be implemented due to new information made available, and before work is begun at each project site. Records of safety briefings will be part of the project records.

7.4 Record Keeping Requirements

Record keeping requirements mandated by OSHA 29 CFR 1910.120 will be strictly followed. Specifically, all personnel training records, incident reports (Appendix D), and medical examination records will be maintained by Roux Associates, Inc. for a period of at least 30 years after the employment termination date of each employee. The SHSO will maintain a daily written log of health and safety monitoring activities and monitoring results will become part of the project records.

8.0 PROTECTION AND COMMUNICATIONS

8.1 Personal Protection

8.1.1 General

Appropriate personal protective equipment (PPE) shall be worn by site personnel when there is a potential exposure to chemical hazards or physical hazards (e.g., falling objects, flying particles, sharp edges, electricity, noise) and as otherwise directed by the SHSO. The level of personal protection, type and kind of equipment selected depends on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors must be made before work can be safely carried out.

Roux Associates, Inc. maintains a comprehensive written PPE program that addresses proper PPE selection, use, maintenance, storage, fit and inspection. PPE to be used at the site will meet the appropriate American National Standards Institute (ANSI) standards and the following OSHA (General Industry) standards for PPE.

- Head Protection - 29 CFR 1910.132
- Eye and Face Protection - 29 CFR 1910.133
- Respiratory Protection - 29 CFR 1910.134
- Hand Protection - 29 CFR 1910.138
- Foot Protection - 29 CFR 1910.136
- Protective Clothing - Not specifically regulated

The level of protection to be worn by field personnel will be defined and controlled by the SHSO in conjunction with the Project Principal or his/her designee. Where more than one hazard area is indicated, further definition will be provided by review of site hazards, conditions, and operational requirements and by monitoring at the particular operation being conducted. Any upgrades or downgrades must be immediately communicated to the Project Principal or his/her designee. Protection may be upgraded or downgraded by the SHSO in conjunction with the Project Principal on the basis of action levels presented below:

Task	Level of Protection
Groundwater Sampling	Level D
Auger/Geoprobe Drilling	Level D
Monitoring Well/Vapor Port Installation	Level D
Remedial Injections	Level D
Indoor Air Sampling/Utility Survey	Level D

Action Levels for Respiratory Protection

ORGANIC VAPOR CONCENTRATIONS		
PID[1]	**BENZENE**[2]	**ACTION**[3]
< 5 ppm	Not detected	No Action
< 5 ppm	Detected but < 5 ppm	Ventilate space until Benzene is not detected. If non-detect concentrations of benzene cannot be achieved, upgrade to Level C.
5 ppm - < 25 ppm	< 5 ppm	Ventilate space until PID reads < 5 ppm. If < 5 ppm cannot be achieved, upgrade to Level C.
5 ppm - < 25 ppm	5+ ppm	Ventilate space until Benzene is not detected and the PID reads < 5 ppm. If benzene is detected and the PID reads = or >25 ppm, upgrade to Level B.
25 ppm - <100 ppm	5+ ppm	Ventilate space and evacuate the area.

1 Based on relative response/sensitivity of PID to benzene.

2 Colorimetric indicator tube readings.

3 Measured air concentrations of known organic vapors will be reduced by the respirator to at or below one half the permissible exposure limit, and the individual and combined compound concentrations are within the service limit of the respirator cartridge.

OVM Action Levels

If organic vapor meter measurements are above five ppm-v but below 25 ppm-v above background for five minutes in the breathing zone, employee protection will be upgraded to Level C with the use of a full-face respirator with an organic vapor cartridge.

If organic vapor detector measurements exceed 25 ppm-v above background for five minutes in the breathing zone, work activities will cease until airborne vapor levels can be reduced to less than 25 ppm-v and are quantified or the SHSO determines alternate methods to be followed in order to proceed.

Action Levels for Flammable Gasses and Vapors

FLAMMABLE GAS CONCENTRATIONS	
CGI[1] LOWER EXPLOSIVE LIMIT (LEL) READING	**ACTION**
< 5%	No Action
> 5%, but <25%	Ventilate space until combustible gasses are reduced to < 5%. If detectible concentrations of combustible gas cannot be reduced to < 5%, then continuously monitor air with CGI meter alarm set at 25%. Check CGI readings continuously.
> 25%	Remove all potential ignition sources from work area. Ventilate work space and evacuate the area.

[1] Based on relative response/sensitivity of Combustible Gas Indicator (CGI) to methane.

8.1.2 Respiratory Protection and Clothing

The type of respiratory protection and clothing to be worn in each level of protection indicated above includes the following:

Level D
Coveralls (as appropriate)
Boots/shoes - chemical resistant with steel toes and shanks
Safety glasses
Hard hat*
Nitrile and Cut-resistant Gloves
Hearing protection (as required)

Level C
Full-face, air-purifying, HEPA cartridge-equipped respirator (MSHA/NIOSH specifically approved for protection from organic va*pors and particulates per OSHA 1910.1028)*
Chemical-resistant clothing (coverall; hooded, two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls)
Gloves (outer), chemical-resistant - latex
Gloves (inner), chemical-resistant – nitrile and cut resistant
Boots (inner), chemical-resistant, steel toe and shank
Boots (outer), chemical-resistant (disposable)
Hard hat*
Hearing protection (as required)

* Hard hat is not required where there is no overhead hazard, as approved by the SHSO.

8.1.3 Safety Equipment

Basic emergency and first-aid equipment will be available at the work site, as appropriate. This may include HASP-specified communications, first-aid kit, emergency eyewash or emergency shower or drench system, fire extinguisher, and other safety-related equipment. Other safety equipment will be located at the site of specific operations, e.g., drilling, as appropriate. Traffic cones, barricades, and traffic vests will be used when work is required in high traffic areas.

8.2 Communications

Telephones will be employed for communication with emergency support services/facilities. Each member of the field team will carry a cellular phone with them at all times when on Site.

9.0 MONITORING PROCEDURES FOR SITE OPERATIONS

9.1 Monitoring During Site Operations

The SHSO will monitor wind direction and approximate temperature during all invasive site activities and record the data in a log book. An air monitoring program is important to the safety of on-site and off-site personnel. A preliminary survey, to establish background conditions in the immediate sampling area, may be made prior to the initiation of site work. This survey will be conducted with the appropriate air monitoring instrument(s) as warranted by the field activity. Once this survey has been completed, any change in the type of personal protective equipment will be determined.

Air monitoring may be performed to verify that the proper level of equipment is used and to determine if increased protection or work stoppage is required. The following equipment may be used by Roux Associates, Inc. on-site to monitor conditions:

- Explosimeter/Oxygen Detector
- MiniRam Fugitive Dust Monitor
- Colorimetric Tubes
- Photoionization Detector (PID)
- Flame Ionization Detector (FID)
- Other (as needed)

Section 8.0 lists the acceptable ranges for each piece of monitoring equipment and the action levels for changes in respiratory protection. Monitoring equipment will be calibrated in accordance with the owner's manual. Air monitoring during non-invasive site activities will be performed as appropriate as specified in **Section 8.2**. All air monitoring results will become part of the project records.

9.2 Personnel Monitoring Procedures

Personal breathing zone samples, 8-hour, time-weighted average (TWA) sampling, may be conducted if sustained operations in Level C are required. The personal breathing zone samples will be collected according to NIOSH analytical methods and analyzed by an AIHA-certified laboratory.

9.3 Medical Surveillance Requirements

Medical surveillance specifies any special medical monitoring and examination requirements as well as stipulates that all Roux Associates, Inc. personnel and subcontractors are required to pass the medical surveillance examination or equivalent for hazardous waste work required by 29 CFR 1910.120. As a minimum, the examination will include:

- Complete medical and work histories
- Urinalysis
- Physical Exam
- Vision and Hearing Exam
- Blood Chemistry
- Pulmonary Function Test
- Audiometry

The examination will be annual, at a minimum, and upon termination of employment with the company. Additional medical testing may be required by the OHSM in consultation with the company physician and the SHSO if an overt exposure or accident occurs, of if other site conditions warrant further medical surveillance.

10.0 SAFETY CONSIDERATIONS FOR SITE OPERATIONS

10.1 General

Field sampling will be performed under the level of personal protection described in **Section 8.0**. In this section, non-monitoring safety-related procedures are described.

10.2 Site Walk-Throughs

Safety considerations during site walk-throughs precede all other field operations. The field team will maintain line of sight with each other at all times and regularly maintain communications with the Support Zone. Air monitoring will be performed as indicated in **Section 9.0** and will be used to alert the walk-through team if a dangerous situation exists. Air monitoring will assist in prescribing levels of protection for future site operations, designating site layout, and identifying hazard areas, if any.

10.3 Heavy Equipment and Drill Rig Safety

The SHSO will be present on site during invasive operations such as excavation and drilling, and will provide health and safety monitoring to ensure that appropriate levels of protection and safety procedures are followed by Roux Associates, Inc. personnel. The proximity of chemical, water, sewer and electrical lines will be identified by a utility mark-out service before any subsurface activity or sampling is attempted. The SHSO and Project Manager shall confirm that the utility mark-out service has been notified at least 72 hours prior to earth disturbing activities.

Hazardous waste sites use all of the mechanical equipment used on any major construction site. Typical machinery to be found includes pumps, compressors, generators, portable lighting systems, pneumatic tools (drum openers), hydraulic drum crushers, pug mills, fork lifts, trucks, dozers, backhoes, and drill rigs. The equipment poses a serious hazard if not operated properly or if personnel near machinery cannot be seen by operators.

Drilling crews are confronted with all of these heavy equipment hazards. They must be responsible for good housekeeping around the rig because of the rods, auger sections, rope, and hand tools used for the operation. Maintenance is a constant requirement. Overhead and buried utilities require special precautions because of electrical and natural gas hazards. Electrical storms may seek out a standing derrick. The hoist or cathead rope poses specific hazards; always use clean, dry, sound rope. Keep hands away from the test hammer. Hearing loss, while not an immediate danger, is considerable over time. Use hearing protection.

Proper containment and disposal practices will be followed in regard to the potential amount of waste generated during operations. The location of safety equipment and evacuation procedures will be established prior to initiation of operations according to this HASP. The use of hard hats, eye protection, ear protection, and steel-toed boots will be required during heavy equipment operations. Contaminated equipment will be placed on liner material when not in use, or when awaiting and during decontamination. Communications with the Support Zone will be regularly maintained.

10.4 Sampling

Personnel must wear prescribed clothing, especially eye protection and chemical resistant gloves when sampling (for protection from chemical preservatives and contaminants). Sample bottles may be bagged prior to sampling to ease decontamination procedures. The sampling team must be aware of emergency evacuation procedures described in this HASP and the location of emergency equipment, including spill containment materials, prior to sampling. Contamination avoidance will be practiced at all times. In some situations, additional monitoring by the SHSO may be needed to confirm or establish the proper level of protection before the sampling team can proceed.

10.5 Sample Handling

Personnel responsible for the handling of samples will wear the level of protection described in **Section 8.0**. Samples will be identified as to their hazard and packaged to prevent spillage or breakage. Any unusual sample conditions will be noted. Lab personnel will be advised of sample hazard level and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or inclusion of a written statement with the samples. It may be necessary for the SHSO to review safety procedures in handling site samples to assist or assure that these practices are appropriate for the type of suspected contaminants in the sample.

10.6 Waste Disposal

Waste disposal operations will be monitored by the SHSO and performed under the appropriate level of personal protection described in **Section 8.0**. Personnel will wear the prescribed clothing, especially eye protection and chemical resistant gloves, when handling or drumming waste materials. Contamination avoidance will be practiced at all times. Also see **Section 12.0**.

10.7 Heavy Equipment Decontamination

A steam cleaner or pressure washer will be used to decontaminate the drilling equipment. Personnel will exercise caution when using a steam cleaner. The high pressure steam can cause severe burns. Protective gloves, face shields, hard hats, steel-toed boots, and Tyvek suits or rain gear will be worn as needed when using steam cleaners.

10.8 Hazard Communication

Personnel working at this site have the right to know about the chemical hazards associated with hazardous materials used and stored onsite. This information will be readily available to all site workers as required by OSHA's Hazard Communication Standard (29 CFR 1910.1200). This information will be communicated to personnel through the maintenance of a chemical inventory system, chemical labeling, material safety data sheets (MSDSs), hazard communication training, and a written hazard communication program.

Chemicals imported to the site will bear the original Department of Transportation (DOT) required labeling on the chemical's container. In addition, a new label will be affixed to the original containers, if necessary, and to a new container to which the chemical is dispensed providing the chemical name and specific hazard warnings (e.g., flammability, health, reactivity). Hazard warnings will follow either the National Fire Protection Association (NFPA) format or the Hazardous Material Information System (HMIS) format. Both systems are easy to use and rely on numerically ranking hazards on a 0 to 4 scale. Most chemicals used onsite which are subject to the Hazard Communication Standard are related to sampling activities. These chemicals may include hexane, methanol, acetone, hydrochloric acid, sodium bisulfate and nitric acid.

10.9 Additional Safe Work Practices

Refer to the SHSO for specific concerns on each individual site task. The safety rules listed below must be strictly followed:

- Use the buddy system when possible.
- Practice contamination avoidance, both on and off site.
- Plan activities ahead of time.
- Do not climb over/under obstacles.
- Be alert to your own physical condition.
- Watch your co-workers for signs of fatigue, exposure, heat or cold stress, etc.
- Report all accidents, no matter how minor including near-misses, immediately to the SHSO.
- Do not eat, drink, chew gum, apply cosmetics, or use tobacco products while working on site (except in the support zone).
- Be aware of traffic, heavy equipment, and other obstacles around you.
- Do not work on-site while under the influence of drugs or alcohol, including prescription drugs that may cause drowsiness.
- Copies of this HASP shall be readily accessible at all times.
- Note wind direction. Personnel shall remain upwind wherever possible during on-site activities.
- **READ AND SIGN YOUR HEALTH AND SAFETY PLAN BEFORE ENGAGING IN SITE ACTIVITIES.**

A work/rest regimen will be initiated when ambient temperatures and protective clothing cause a stressful situation. Work will not be conducted without adequate light or without supervision. Safety briefings may be held prior to beginning each task.

11.0 DECONTAMINATION PROCEDURES

11.1 Contamination Prevention

One of the most important aspects of decontamination is contamination prevention. Contamination prevention practices will minimize worker exposure and ensure valid sample results by precluding cross contamination. Procedures for contamination prevention include the following:

- For Personnel
  - Do not walk through areas of obvious or known contamination;
  - Do not handle or touch contaminated materials directly;
  - Make sure all personal protective equipment (PPE) has no cuts or tears prior to donning;
  - Fasten all closures on suits, covering with tape, if necessary;
  - Take particular care to protect any skin injuries;
  - Stay upwind of airborne contaminants; and
  - Do not carry cigarettes, gum, etc. into contaminated areas.
- Sampling/Monitoring
  - When required by the SHSO, cover instruments with clear plastic, leaving opening for sampling and exhaust ports; and
  - Bag sample containers prior to the placement of sample material.
- Heavy Equipment
  - Care should be taken to limit the amount of contamination that comes in contact with heavy equipment;
  - If contaminated tools are to be placed on non-contaminated equipment for transport to the decontamination pad, plastic should be used to keep the equipment clean; and
  - Excavated soils should be contained and kept out of the way of workers.

11.2 Decontamination

All personnel and equipment exiting the Exclusion Zone will be thoroughly decontaminated. Safety briefings will explain the decontamination procedures for personnel and portable equipment for the various levels of protection indicated in **Section 8.0**. Heavy equipment will be decontaminated with a steam cleaner. Rinsates will be collected, handled, and/or drummed as potentially hazardous waste (see **Section 12.0**).

11.3 Equipment Decontamination

Sampling equipment will be decontaminated through the following steps, if necessary:

- Fresh water rinse;
- non-phosphorus detergent wash;
- fresh water rinse;
- distilled water rinse;
- acetone rinse; and
- distilled water rinse.

12.0 DISPOSAL PROCEDURES

Discarded materials, waste materials, or other objects will be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left on site. Potentially contaminated materials as determined by the SHSO, e.g., soil, clothing, gloves, etc., will be bagged or drummed, as necessary, and segregated for disposal. Contaminated materials will be disposed in accordance with appropriate regulations. Non-contaminated materials will be collected and bagged for appropriate disposal as normal domestic waste. Waste disposal operations conducted by Roux Associates, Inc. will be monitored by the SHSO and carried out under the appropriate level of personal protection described in **Section 8.0**.

13.0 EMERGENCY PLAN

As a result of the hazards on site and the conditions under which operations are conducted, the possibility of an emergency exists. An emergency plan is required by OSHA 29 CFR 1910.120 to be available for use and is included below. A copy of this plan will be posted in the Support zone at each work site.

13.1 Site Emergency Coordinator(s)

The Site Emergency Coordinator(s) are the Field Team Leader/Field Site Manager and the Site Health and Safety Officer. The Site Emergency Coordinator(s) will contact the local fire, police, and other emergency units prior to beginning work on site. In these contacts, the Site Emergency Coordinator(s) will inform the emergency units about the nature and duration of work expected on the site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants. Also at this time, the coordinators and the emergency response units will make arrangements to handle any emergencies that might occur.

The Site Emergency Coordinator(s) will implement the emergency plan whenever conditions at the site warrant such action. The coordinator(s) will be responsible for assuring the evacuation, emergency treatment, emergency transport of site personnel as necessary, and notification of emergency response units, and the appropriate management staff.

13.2 Evacuation

In the event of an emergency situation, such as fire, explosion, significant release of particulates, etc., an air horn, automobile horn, or other appropriate device will be sounded by the SHSO or field crew personnel for approximately ten seconds indicating the initiation of evacuation procedures. All persons in both the restricted and non-restricted areas will evacuate and assemble near the Support Zone or other safe area as identified by the Site Emergency Coordinator(s). The Site Emergency Coordinator(s) will have authority to initiate proper action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been sounded. The SHSO must see that access for emergency equipment is provided and that all combustion apparatus has been shutdown once the alarm has been sounded. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency. Then, other personnel listed in **Section 13.4** will be notified.

13.3 Potential or Actual Fire or Explosion

If the potential for a fire exists or if an actual fire or explosion occurs, the following procedures will be implemented:

- Immediately evacuate the site as described above (**Section 13.2**)
- Notify fire, security, and police departments

13.4 Emergency Site Control

In the event of an emergency, the SHSO will prevent any unauthorized personnel from entering the site. If necessary, the SHSO will contact the proper authorities.

13.5 Environmental Incident (Release or Spread of Contamination)

If possible, the spread of contamination will be controlled or stopped. The Site Emergency Coordinator(s) will instruct a person on-site to immediately contact police and fire authorities to inform them of the possible or immediate need for nearby evacuation. If a significant release has occurred, the National Response Center and other appropriate groups will be contacted. Those groups will alert National or Regional Response Teams as necessary. Following these emergency calls, the remaining personnel listed in the table below will be notified, as necessary.

Responsibility	Contact	Telephone
Fire Department	Mooresville Fire Department	911 or 317-831-5354
Police Department	Mooresville Police Department	911 or 317-831-3434
Ambulance	Priority One EMS - Ambulance	317-542-1111
Hospital (see **Figure 3**)	St. Francis Hospital and Health Center	911 or 317-831-1160
Utility Clearance	Indiana Underground Plant Protection Services Inc	811
Chemical Transport Emergency Center (CHEMTREC)		800-424-9300
Site Health and Safety Officer	Tim Zei	630-303-0042
Project Principal	Tim Adams	630-572-3300
Office Health and Safety Manager	Leo Kurylo	630-468-1060
Client Contact	Tom Barriball	312-345-2491
Facility Contact	John Stimson Jr.	j.stimson@att.net

13.6 Personal Injury

If on-site personnel require emergency medical treatment, the following steps will be taken:

1) Notify the Fire Department or Ambulance service and request an ambulance or transport the victim to the hospital, as appropriate.

2) Decontaminate to the extent possible prior to administration of first aid or movement to emergency facilities.

3) First aid will be provided by emergency medical services (EMS) or by on-site personnel trained in first aid, CPR, and bloodborne pathogens, if available.

4) The OHSM will supply medical data sheets (Appendix F) on the victim (if a Roux Associates, Inc. employee) to appropriate medical personnel.

13.7 Overt Personnel Exposure

If an overt exposure to toxic materials occurs, the exposed person will be treated on site as follows:

Skin Contact:	Remove contaminated clothing. Wash immediately with water. Use soap if available. Contact EMS, if necessary.
Inhalation:	Remove from contaminated atmosphere. Contact EMS, if necessary. Transport to hospital.
Ingestion:	Never induce vomiting on an unconscious person. Also, never induce vomiting when acids, alkalis, or petroleum products are suspected. Contact the poison control center. Contact EMS, if necessary.
Puncture Wound or Laceration:	Decontaminate and transport to emergency medical facility or contact EMS. Do not contact blood or bodily fluids. SHSO or OHSM will provide medical data sheets to medical personnel as requested.

13.8 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO will determine if work can continue without risking the health and safety of on-site workers. Some of the items to be considered prior to determining if work should continue are the following:

- Heavy rainfall
- Potential for heat stress (see Appendix C)
- Potential for cold stress and cold-related injuries (see Appendix C)
- Limited visibility
- Potential for electrical storms – Work will cease until 15 minutes after last sighting of lightning
- Potential for malfunction of H&S monitoring equipment or gear
- Potential for accidents
- Unsafe driving and working conditions due to snow or ice
- High wind

14.0 FIELD TEAM REVIEW

Each Roux Associates, Inc. field member shall sign this section after site-specific training is completed and before being permitted to work on site.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provision contained herein. I have been provided with an opportunity to have questions and concerns addressed by the Project Manager.

Site/Project: Laboratory Equipment, formerly Indiana Machine Works / Mooresville, IN

Name Printed	Signature	Date

Site/Project: Laboratory Equipment, formerly Indiana Machine Works / Mooresville, IN

Name Printed	Signature	Date

Site/Project: Laboratory Equipment, formerly Indiana Machine Works / Mooresville, IN

Name Printed	Signature	Date

15.0 APPROVAL PAGE

The Approval Page must be attached and signed by the SHSO, OHSM, Project Manager and Project Principal.

By their signature, the undersigned certify that this HASP is approved and will be utilized by Roux Associates, Inc. personnel at the former Indiana Machine Works Facility, Mooresville, Indiana.

______________________	2/11/2015
Site Health and Safety Officer	Date
______________________	2/11/2015
Office Health and Safety Manager	Date
______________________	2/11/2015
Project Manager	Date
______________________	2/11/2015
Project Principal	Date

16.0 DIRECTIONS TO HOSPITAL

In an emergency situation, the nearest hospital is located at 1201 Hadley Road in Mooresville, IN, approximately 0.8 miles from the Site.

- From the site, turn right (east) onto East Harrison Street.
- At the corner, turn right (south) onto South Madison Street for one block.
- Turn left (east) onto East High Street/IN-42 E and follow the curve to the intersection of IN-42 E/IN-144 and IN-67.
- Turn left (northeast) onto IN-67 N, and
- make the first right (east) onto County Road 1250 N.
- Take an immediate right into the hospital campus (Hadley Road).
- The hospital is up the hill and to the left.
- Follow the signs to the emergency room.

The approximate driving time with traffic from the site to the hospital is less than 5 minutes.

A map depicting the above-described route is provided as **Figure 3**.

17.0 DIRECTIONS TO OCCUPATIONAL HEALTH CLINIC

In a non-emergency situation, staff in need of medical treatment should patronize the nearest approved occupational health clinic. The nearest Occupational Health Clinic to the site is the Concentra Urgent Care, located at 5940 Decatur Boulevard in Indianapolis. The telephone number for the clinic 317-856-2945. Directions from the site to the clinic are located below.

- From the site, turn right (east) onto East Harrison Street.
- At the corner, turn right (south) onto South Madison Street for one block.
- Turn left (east) onto East High Street/IN-42 E and follow the curve to the intersection of IN-42 E/IN-144 and IN-67.
- Turn left (northeast) onto IN-67 N, and continue for 6 miles.
- Turn left (west) onto Ameriplex Parkway and follow for roughly 0.3 miles.
- Turn right onto Decatur Blvd, and the destination is the first building on the left.

The approximate driving time from the site to the clinic is 10 minutes without traffic.

A map depicting the above-described route is provided as **Figure 4**.

TABLES

Table 1. Potential Site-Specific Hazards - Toxicological, Physical and Chemical Properties of Compounds. Indiana Machine Works; 135 E. Harrison St, Mooresville, IN

Compound (ACGIH TLVs® TWA STEL (ppm) (ppm))	CAS#	OSHA PEL TWA (mg/m^3)	NIOSH REL (TWA) (mg/m^3)	OSHA STEL (ppm)	IDLH (ppm)	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Acetone 500 750	67-64-1	2,400 1,000 ppm	590 250 ppm	NE, Carcinogenic	2,500	dermal, inhalation, ingestion	eyes/nose/throat/skin irritant, headache, dizziness, CNS depressant	eyes, skin, resp. system, CNS	colorless liquid with a mint-like odor UEL = 12.8% LEL = 2.5% Fl.P. = 0°F
Ammonia 25 35	7664-41-7	35 50 ppm	18 25 ppm	NE	300 ppm	dermal (liquid), inhalation, ingestion (liquid)	eyes/nose/throat/skin irritant, dyspnea bronchospasm, chest pain pulmonary edema skin burns, vesic frostbite	eyes, skin, resp. system	colorless gas with a pungent suffocating odor
Ammonium Chloride 10 mg/m^3 20mg/m^3	12125-02-9	NE	10 20 STEL	NE	NE	Inhalation, eye/skin contact	Eye/skin/respiratory system irritant, cough, pulmonary sensitization, difficulty breathing	Eyes, skin, respiratory system	Odorless, noncombustible solid Sp. Gr. = 1.53, BP = sublimes
Arsenic 0.01 mg/m^3	7440-38-2	0.010	Ca 0.002 C [15minute]	NE	Ca 5 mg/m^3	Inhalation, ingestion, skin absorption, skin/eye contact	Potential occupational carcinogen, ulceration of nasal septum, dermatitis, gastrointestinal disturbance, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin	Liver, kidneys, skin, lungs, lymphatic system	Silver-gray or tin-white, brittle, odorless metal, incompatible with strong oxidizers, bromine azide and H_2 gas, insoluble, Sp. Gr. 5.73
Asphalt 0.5 mg/m^3	8052-42-4	5 (fumes) (15-min)	5 (fumes) (15-min)	NE, Carcinogenic	NE	dermal, inhalation, ingestion	irritates eyes, severe burns, dermatitis, photosensitization, pyloric obstruction	skin, eyes, stomach, resp. system	black or dark brown mass BP = <470° Fl.P = 464°F LEL = 0.7% UEL = 6.0%

PEL = Permissible Exposure Limit
TWA = Time Weighted Average exposure concentration for a conventional 8-hour (PEL) or up to a 10-hour workday (REL) in a 40-hour work week.
BP = Boiling Point
Fl. P. = Flash Point
NE = Not Established
CNS = Central Nervous System
PNS = Peripheral Nervous System
GI = Gastrointestinal
CVS = Cardiovascular System
IDLH = Immediately Dangerous to Life and Health
UEL = Upper Explosive Limit
LEL = Lower Explosive Limit
REL = Recommended exposure limit.
NIOSH = National Institute for Operational Safety and Health
STEL = Short Term Exposure Limit (15 min)

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Barium 0.5 mg/m^3	7440-39-3 or 10361-37-2	0.5	0.5	NE	1100 mg/m^3	Ingestión, inhalation, skin/eye contact	Acute toxicity, gastrointestinal effects, hypokalemia	Eyes, skin, respiratory system, heart, CNS	Soft, silvery alakaline earth metal, highly reactive, never found in nature as a free element
Benzene 0.5 2.5	71-43-2	1 ppm	Ca 0.1 ppm [ST 1 ppm]	5 ppm	Ca [500 ppm]	Inhalation, skin absorption, ingestion, skin/eye contact	Potential occupational carcinogen, eye/skin/nose/respiratory system irritant, dizziness, headache, nausea, imbalance, anorexia, exhaustion, dermatitis, bone marrow depression	Eyes, skin, respiratory system, blood, CNS, bone marrow	Aromatic odor, VP=75 mm Hg, IP=9.24eV, Sp.Gr.=0.88, Fl.P.=12°F, UEL=7.8%, LEL=1.2%
Benzidine	92-87-5	NE	NE, Ca	NE	Ca	Inhalation, dermal, ingestion, eye contact	Blood in urine, 2^{nd}-ary anemia, acute cystitis, liver disorders, dermatitis, painful urination, potential occupational carcinogen	Bladder, skin, kidneys, liver blood	Sp.Gr.=1.25 VP=Low Grayish or white crystalline powder, combustible but difficult to burn
bis(2-ethylhexyl) phthalate	117-81-7	5	5 ST 10	NE	Ca [5000 mg/m^3]	Inhalation, ingestion, skin/eye contact	Eye irritation, mucous membrane; in animals: liver damage; teratogenic effects; potential occupational carcinogen	Eyes, respiratory system, CNS, liver, reproductive system, GI tract	Colorless oily liquid with a slight odor VP < 0.01 mmHg Sp. Gr. = 0.99 Fl. P. = 420°F UEL = NE LEL (474°F) = 0.3%

PEL = Permissible Exposure Limit
TWA = Time Weighted Average exposure concentration for a conventional 8-hour (PEL) or up to a 10-hour workday (REL) in a 40-hour work week.
BP = Boiling Point
Fl. P. = Flash Point
NE = Not Established

CNS = Central Nervous System
PNS = Peripheral Nervous System
GI = Gastrointestinal
CVS = Cardiovascular System
IDLH = Immediately Dangerous to Life and Health

UEL = Upper Explosive Limit
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STEL = Short Term Exposure Limit (15 min)

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2-Butanone	78-93-3	590	590 885 STEL	NE	3000ppm	Inhalation, ingestion, skin/eye contact	Eye/skin/nose irritant, headache, dizziness, vomiting, dermatitis	Eyes, skin, respiratory system, CNS	Colorless liquid with sharp, fragrant, mint- or acetone-like odor; VP=78mmHg IP=9.54eV Sp.Gr.=0.81 Fl.Pt.=16°F Incompatible with ammonia
Cadmium 0.01 mg/m^3	7440-43-9	0.005	Ca	NE	Ca 9 mg/m^3	Inhalation, ingestion	Potential occupational carcinogen, pulmonary edema, dyspnea, cough, chest tightness, substernal pain, headache, chills, muscle ache, neasea, vomiting, diarrhea, anosmia, emphysema, proteinuria, mild anemia	Respiratory system, kidneys, prostate, blood	Silver-white, blue-tinged lustrous metal; odorless; incompatible with sulfur, selenium & tellurium; Sp. Gr. 8.65
Carbon Dioxide 5000 30,000	124-38-9	9000	9000	30,000[NIOSH]	NE	Inhalation, (and skin/eye contact as liquid/dry ice)	Asphyxia, headache, dizziness, restlessness, paresthesia, sweating, breathing difficulty, malaise, increased heart rate, blood pressure rise, coma, convulsions, frostbite (as liquid/dry ice)	Respiratory system, cardiovascular system	VP=56.5atm, IP=13.77eV, Non-flammable gas, colorless & odorless gas
Carbon Monoxide 25	630-08-0	50ppm	35ppm (C 200ppm)	NE	1,200ppm	Inhalation	Carboxyhemoglobemia (reduced capacity for blood to transport oxygen)	Blood	Colorless, odorless gas

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TWA = Time Weighted Average exposure concentration for a conventional 8-hour (PEL) or up to a 10-hour workday (REL) in a 40-hour work week.
BP = Boiling Point
Fl. P. = Flash Point
NE = Not Established

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Compound (ACGIH TLVs® TWA STEL (ppm) (ppm))	CAS#	OSHA PEL TWA (mg/m^3)	NIOSH REL (TWA) (mg/m^3)	OSHA STEL (ppm)	IDLH (ppm)	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Chloroform 10 Ca	67-66-3	C 240	Ca ST 9.78 [60-minute]	NE	Ca 500	Inhalation, skin absorption, ingestion, skin/eye contact	Potential occupational carcinogen, eye/skin irritant, dizziness, mental dullness, nausea, confusion, headache, lassitude, anesthesia, enlarged liver	Liver, kidneys, heart, eyes, skin, CNS	Colorless liquid with a pleasant odor, VP = 160mmHg, IP = 11.42eV, Sp. Gr. = 1.48, BP = 143^0F, UEL/LEL = NA
Chromium 0.5 mg/m^3	7440-47-3	1	0.5	NE	250 mg/m^3	Inhalation, ingestion, skin/eye contact	Skin/eye irritant, lung fibrosis	Eyes, skin, respiratory system	Incompatible with strong oxidizers & alkalis, Sp. Gr. = 7.14
Coal Tar Pitch Volatiles (e.g. benzo(a)pyrene, chrysene, etc.)	65996-93-2	0.2	Ca 0.1	NE	80 mg/m^3	Inhalation, skin/eye contact	Potential occupational carcinogen, dermatitis, bronchitis	Respiratory system, skin, bladder, kidneys	Black/brown amorphous residue, properties vary depending on the specific compound
Copper 1 mg/m^3	7440-50-8	1	1	NE	100 mg/m^3	Inhalation, ingestion, skin/eye contact	Eye/nose/pharynx irritant, nasal septum perforation, dermatitis	Eyes, skin, respiratory system, liver, kidneys	Reddish, lustrous, malleable metal; odorless; incompatible with oxidizers, alkalis, acetylene, sodium azide, Sp. Gr. = 8.94
1,2-Dichlorobenzene 25 50	95-50-1	C 50 ppm	C 50 ppm	NE	200	Inhalation, skin absorption, ingestion, skin/eye contact	Eye/nose irritant, liver & kidney damage, skin blisters	Eyes, skin, respiratory system, liver, kidneys	Colorless to pale-yellow liquid with a pleasant, aromatic odor; IP = 9.06eV, VP = 1mmHg, Sp. Gr. = 1.30, Fl. P. = 151^0F, UEL = 9.2%, LEL = 2.2%

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1,4-Dichlorobenzene 10 Ca	106-46-7	450	Ca	NE	Ca 150	Inhalation, skin absorption, ingestion, skin/eye contact	Potential occupational carcinogen, eye irritant, periorbital swelling, profuse rhinitis, headache, anorexia, nausea, vomiting, weight loss, jaundice, cirrhosis	Liver, respiratory system, eyes, kidneys, skin	Colorless to white crystalline solid, mothball-like odor, Melting Pt. = 128°F, IP = 8.98eV, VP = 1.3mmHg, Sp. Gr. = 1.25, Fl. P. = 150^{0}F, UEL = ?, LEL = 2.5%
1,1-Dichloroethane	75-34-3	400 100 ppm	400 100 ppm	NE	3000 ppm	Inhalation, ingestion, skin/eye contact	Skin irritation, CNS depression, liver, kidney, lung damage	Skin, liver, kidney, lungs, CNS	Colorless oily liquid with chloroform-like odor BP = 135°F VP = 182 mm Hg IP = 11.06 eV Sp. Gr. = 1.18 Fl. Pt. = 2°F LEL = 5.4% UEL = 11.4%
Dichloroethyl ether	111-44-4	90	30	NE	Ca [100ppm]	Inhalation, dermal, ingestion, eye contact	Nose/throat/respiratory system irritant, tearing, cough, nausea, vomiting, potential occupational carcinogen	Eyes, respiratory system, liver	Colorless liquid with chlorinated solvent-like odor,VP=0.7mmHg Sp.Gr.=1.22 Fl.Pt.=131°F LEL=2.7%
Diesel Fuel 100 mg/m^3	68334-30-5	NE	NE	NE	NE	dermal, inhalation	resp. irritant, dizziness, nausea, skin disorders, liver disorders	lungs, CNS, skin, liver	light amber liquid Fl.P. = >100°F LEL = 0.6% UEL = 7.0%

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1,4-Dioxane	123-91-1	360 [skin] 100 ppm	Ca C 3.6 1 ppm [30-minute]	NE	Ca [500 ppm]	Inhalation, skin absorption, ingestion, eye contact	Eye/skin/nose/throat irritation, drowsiness, headache, nausea, vomiting, liver damage, kidney failure, potential occupational carcinogen	Eyes, skin, respiratory system, liver, kidneys	Colorless liquid w/ mild ether-like odor Fr. Pt. = 53°F BP = 214°F VP = 29 mmHg IP = 9.13 eV SP. Gr. = 1.03 Fl. Pt. = 55°F LEL = 2.0% UEL = 22%
Di-sec Octyl Phthalate	117-81-7	5	5, Ca 10 STEL	NE	Ca 5000mg/m^3	Inhalation, ingestion, skin/eye contact	Eye/mucous membrane irritant, potential occupational carcinogen	Eyes, respiratory system, CNS, liver, reproductive system, GI tract	Colorless, oily liquid with a slight odor, VP<0.01mmHg Sp.Gr.=0.99 Fl.Pt.=420°F
Ethanol None 1000	64-17-5	1,900 1,000 ppm	1,900 1,000 ppm	NE	3,330 (LEL)	dermal, inhalation, ingestion	eye/skin/nose irritant, headache drowsiness, fatigue	resp. system, eyes, skin, CNS, liver, blood, repro. system	clear colorless flammable liquid, miscible Fl.P. = 55°F LEL = 3.3% UEL = 19% Sp. Gr = 0.79
Ethylbenzene 20	100-41-4	435 100 ppm	435 100 ppm	NE, Carcinogenic	800 ppm	dermal, inhalation, ingestion	sensory irritant, CNS depressant, narcosis, hematological disorders	eyes, skin, CNS, resp. system, blood	liquid aromatic odor BP = 277°F Fl.P = 55°F LEL = 0.8% UEL = 6.7%
Fuel Oil None	68476-33-5	NE	NE	NE	none	dermal, inhalation, ingestion	skin cancer, liver damage, blood disorders	skin, liver, bone marrow	dark liquid LEL = 1.0% UEL = 3.0% Fl.P. = >140°F

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Gasoline 300 500	8006-61-9	NE	Carcinogen	NE, Carcinogenic	Carcinogen	dermal, inhalation, ingestion, contact	eye/skin irritant, CNS depression, sensory irritant, dermatitis, pulmonary edema, potential carcinogen	CNS, eyes, skin, resp. system, liver, kidneys	liquid, aromatic Fl.P. = -45°F LEL = 1.4% UEL = 7.6%
Hexane 50 (176 mg/m^3)	110-54-3	1800 (500ppm)	180 (50ppm)	NE	1100 [10% LEL]	Inhalation, ingestion, skin/eye contact	Eye/nose irritant, nausea, headache, peripheral neuropathy, numb extremities, weakness, dermatitis, dizziness, chemical pneumonitis	Eyes, skin, respiratory system, CNS, peripheral nervous system	Colorless liquid with gasoline-like odor, Sp. Gr. = 0.66, IP = 10.18eV, VP = 124 mm Hg, Fl. P. = -7^{0}F, BP = 156^{0}F, LEL = 1.1%, UEL = 7.5%
Hydrochloric Acid 2ppm (3 mg/m^3) Ceiling	7647-01-0	7 (ceiling) 5 ppm (ceiling)	7 (ceiling) 5 ppm (ceiling)	5	50	dermal, inhalation, ingestion (solution)	eyes/nose/throat/ larynx irritant, cough, choking, eyes, skin burns, frostbite (liquid)	eyes, skin, resp. system	colorless to slightly yellow gas with a pungent irritating odor, often used in an aqueous solution BP = -121°F non-flammable 86°F (solid) LEL = NE UEL = NE
Hydrogen Sulfide 1 5 * ExxonMobil = 5 ppm	7783-06-4	20 50 ppm (10-min max)	15 10 ppm (10-min)	20	100 ppm	dermal, inhalation, ingestion	CNS depression, resp. distress, coma, fatigue conjunctivitis	resp. system, eyes, CNS	colorless gas, rotten egg odor BP = -77°F UEL = 44% LEL = 4.0%

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Isopropyl alcohol 200 400	67-63-0	980	980	NE	2000	Inhalation, ingestion, skin/eye contact	Eye/nose/throat irritant, drowsiness, headache, dizziness, dry cracking skin	Eyes, skin, respiratory system	Colorless liquid, rubbing alcohol odor, VP = 33mmHg, IP = 10.10eV, Sp. Gr. = 0.79, BP = 181^{0}F, Fl. P. = 53^{0}F, UEL = 12.7%, LEL = 2.0%
Lead 0.05 mg/m^3	7439-92-1	0.050	<0.100	NE, Carcinogenic	100 mg/m^3 (as Pb)	dermal, inhalation, ingestion	abdominal pain, CNS depressant, anemia, nephropathy, reproductive effects	GI tract, CNS, blood, eyes gingival tissue, kidneys	metal - soft gray BP = 3164°F
Mercury 0.025 mg/m^3	7439-97-6	0.1mg/m^3	Vapor: 0.05 mg/m^3 [skin] Other: C 0.1 mg/m^3 [skin]	NE	10 mg/m^3	Inhalation, skin absorption, ingestion, skin/eye contact	Skin/eye irritant, cough, chest pain, difficulty breathing, bronchitis, tremor, insomnia, headache, exhaustion, salivation, anorexia, gastrointestinal disturbance	Eyes, skin, respiratory system, CNS, kidneys	VP=0.0012mmHg; Sp.Gr.=13.6 FRZ=-38°F
Methanol 200 250	67-56-1	260 200 ppm	260 200 ppm	NE	6,000 ppm	inhalation, ingestion, contact, skin absorption	irritant, drowsiness, nausea, light headedness, vomiting, visual disturbance, visual failure, digestive disturbance	eyes, skin, CNS, respiratory system GI tract	Liquid BP = 147°F Fl.P. = 52°F
Methyl-tertiary-Butyl Ether (MTBE) 50	1634-04-4	NE	NE	NE	NE	Inhalation, ingestion, skin absorption	Possible human carcinogen, nausea, vomiting, sleepiness	CNS, liver, kidneys	Colorless liquid, pungent odor, BP=55.2°C Fl.P=-28°C LEL=1.65% UEL=8.4%

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Naphthalene None	91-20-3	50 10 ppm	50 10 ppm	NE, Carcinogenic	250 ppm	dermal, inhalation, ingestion	resp. irritant, eye irritant, liver	eye, resp. tract, CNS, kidney, liver	clear to brown solid, moth-ball odor, flammable
Nitric Acid 2 4	7697-37-2	5 (2 ppm)	5 (2 ppm) ST 10 ST 4 ppm	NE	25	Inhalation, ingestion, skin/eye contact	Eye/skin/mucous membrane irritant, delayed pulmonary edema, pneumonitis, bronchitis, dental erosion	Eyes, skin, respiratory system, skin, teeth	Colorless/yellow or red fuming noncombustible liquid with acrid, suffocating odor, increases combustibility of flammables, Sp. Gr. = 1.50 BP = 181^0F
Nitric Oxide 25	10102-43-9	30	30	NE	100	inhalation	Eye irritant, wet skin/nose/throat, drowsiness, unconsciousness	Eyes, skin, respiratory system, blood, CNS	Colorless, non-flammable gas; BP=-241^{o}F, accelerant to combustibles, incompatible with water, F, O_3, NH_3, chlorinated hydrocarbons, metals, CS_2
N-Nitrosodiethylamine	62-75-9	NE	Ca	NE	Ca [NE]	Inhalation, dermal, ingestion, eye contact	nausea, vomiting, diarrhea, abdominal cramps; headache; fever; enlarged liver, jaundice; decreased liver, kidney, pulmonary function; potential occupational carcinogen	Liver, kidneys, lungs	Yellow, oily liquid with faint characteristic odor, VP=3mmHg IP=8.69eV, Sp.Gr.=1.005, Combustible liquid

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Petroleum naphtha None	8002-05-9	2000 500 ppm	350 100 ppm	NE	1,100	dermal, inhalation, ingestion	eye/skin irritant, CNS depressant, dizziness, drowsiness	eyes, skin, respiratory system CNS	clear, flammable liquid aromatic odor Fl.P. = -40 to -86°F LEL = 1.1% UEL = 5.9%
Phenol	108-95-2	5ppm (19 mg/m^3) [skin]	5ppm (19 mg/m^3) C 15.6ppm (60 mg/m^3) [15-minute] [skin]	NE	250	Inhalation, skin absorption, ingestion, skin/eye contact	Eye/nose/throat irritant, anorexia, exhaustion, muscle ache, pain, dark urine, cyanosis, liver/kidney damage, skin burns, dermatitis, ochronosis, tremor, convulsions, twitching	Eyes, skin, respiratory system, liver, kidneys	Colorless to light-pink, crystalline solid, sweet acrid odor, Sp. Gr. 1.06, IP = 8.50eV, VP = 0.4mm Hg, Fl. P = 175^{0}F, LEL= 1.8%, UEL = 8.6%
Polybutadiene None	9003-17-2	NE	NE	NE	NE	Inhalation, ingestion, eye/skin contact	Possible eye/skin irritant, toxicological properties have not been fully investigated	None	Clear, colorless liquid; Fl. Pt. = 500^{0}F, Sp. Gr. = 8900g/cm^3
Slop Oil None	68477-26-9	NE	NE	NE	NE	dermal	eye irritant, skin irritant	eyes, skin	dark liquid Fl.P. = >300°F LEL = 0.6% UEL = 7.0%
Sodium Hydroxide	1310-73-2	2	C 2	NE	10 mg/m^3	Inhalation, ingestion, skin/eye contact	Eye/skin/mucous membrane irritant, pneumonitis, eye/skin burns, temporary hair loss	Eyes, skin, respiratory system	Colorless to white odorless solid, Sp. Gr. = 2.13, reactive with water, acids, flammable liquids and metals

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Styrene 20 40	100-42-5	100 ppm C 200 ppm (600 ppm 5-minute max. peak in any 3 hours)	215 (50 ppm) ST 425 ST 100 ppm	NE	700 ppm	Inhalation, ingestion, skin/eye contact, skin absorption	Eye/nose/respiratory system irritant, headache, exhaustion, dizziness, confusion, malaise, drowsiness, narcosis, defatting dermatitis, unsteady gait, liver injury, reproductive effects	Eyes, skin, respiratory system, CNS, liver, reproductive system	Colorless to yellow oily liquid with sweet floral odor, Sp. Gr. = 0.91, Fl. Pt. = 88^0F, IP = 8.40eV, UEL = 6.8%, LEL = 0.9%
Sulfur Dioxide None 0.25	7446-09-5	13	5	NE	100	Inhalation, skin/eye contact	Eye/nose/throat irritant, choking, cough, nasal mucus discharge	Eyes, skin, respiratory system	Colorless, non-flammable gas; pungent odor, BP=14^oF, reactive with water & metals
Sulfuric Acid 0.2 mg/m^3 None	7664-93-9	1 mg/m^3	1 mg/m^3	NE, Carcinogenic	15 mg/m^3	dermal, inhalation, ingestion	apnea, eye irritant, resp. irritant, depression, suffocation	eyes, resp. system, teeth, skin	colorless gas, rotten egg odor BP = 554°F UEL = NA LEL = NA
1,1,2,2-Tetrachloroethane	79-34-5	35 [skin] 5ppm [skin]	Ca 7 [skin] 1ppm [skin]	NE	Ca 100 ppm	Inhalation, skin absorption, ingestion, skin/eye contact	Nausea, vomiting, abdominal pain, finger tremor, jaundice, hepatitis, liver tenderness, dermatitis, kidney damage, leukocytosis, potential occupational carcinogen	Skin, liver, kidneys, CNS, GI tract	Colorless to pale yellow liquid with pungent chloroform-like odor VP = 5 mmHg IP = 11.10 eV Sp. Gr. = 1.59 Fl. P. = NA LEL/UEL = NA

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Tetraethyl Lead (TEL) 0.1 mg/m^3	78-00-2	0.075mg/m^3 [skin]	0.075mg/m^3 [skin]	NE	NE	Inhalation, skin absorption, ingestion, eye contact	Insomnia, exhaustion, anxiety, tremor, spasticity, hypotension, hypothermia, pallor, nausea, anorexia, confusion, hallucinations, psychosis, mania, convulsions, eye irritation	CNS, cardiovascular system, kidneys, eyes	Colorless liquid often dyed, pleasant sweet odor, VP=0.2mmHg IP=11.10eV Sp.Gr.=1.65 Fl.P.=200°F LEL=1.8% UEL=unknown
Toluene 20	108-88-3	200 ppm	375 100 ppm	300	500 ppm	dermal, inhalation, ingestion, skin absorption	CNS depression, liver damage, kidney damage, defatting of skin	CNS, liver, respiratory system, CVS, blood kidney, skin	Liquid benzene odor BP = 232°F flammable LEL = 1.1% UEL = 7.1%
1,2,4-Trimethylbenzene 25ppm (123 mg/m^3) None	95-63-6	NE	25ppm 125 mg/m^3	NE	NE	Inhalation, ingestion, skin/eye contact	Eye/nose/throat/skin/and respiratory system irritant, bronchitis, anemia, headache, drowsiness, exhaustion, dizziness, nausea, incoordination, vomiting, confusion, chemical pneumonitis	Eyes, skin, CNS, respiratory system, blood	Clear, colorless liquid with distinctive aromatic odor; Sp. Gr 0.88, Fl. P. = 112^{0}F, IP = 8.27eV, VP = 1 mm Hg, LEL = 0.9%, UEL = 6.4%
1,3,5-Trimethylbenzene 25ppm (123 mg/m^3) None	108-68-8	NE	25ppm 125 mg/m^3	NE	NE	Inhalation, ingestion, skin/eye contact	Eye/nose/throat/skin/and respiratory system irritant, bronchitis, anemia, headache, drowsiness, exhaustion, dizziness, nausea, incoordination, vomiting, confusion, chemical pneumonitis	Eyes, skin, CNS, respiratory system, blood	Clear, colorless liquid with distinctive aromatic odor; Sp. Gr 0.86, Fl. P. = 122^{0}F, IP = 8.39eV, VP = 2 mm Hg, LEL = NE, UEL = NE

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Vinyl Chloride	75-01-4	1 ppm C 5 ppm [15 minute]	Ca	NE	Ca [N.D.]	Inhalation, skin/eye contact	Potential occupational carcinogen, exhaustion, abdominal pain, enlarged liver, gastrointestinal bleeding	Liver, CNS, blood, respiratory system, lymphatic system	Colorless gas, pleasant odor, IP=9.99eV, UEL=33%, LEL=3.6%, RGasD=2.21
Xylenes 100 150	1330-20-7	435 100 ppm	435 100 ppm	NE, Carcinogenic	900 ppm	dermal, inhalation, ingestion	sensory irritant, blood dyscrasia, bronchitis, CNS depression	CNS, eyes, skin, GI tract, blood, liver, kidneys	Liquid aromatic odor BP = 138.5° flammable LEL = 1.1% UEL = 7.0%
Zinc $2mg/m^3$ $10mg/m^3$	7440-66-6	NE	NE	NE	NE	Ingestion, inhalation	Lassitude, dermatitis, headache, blurred vision, low back pain, vomiting, malaise, chest tightness, dyspnea, decreased pulmonary function	Respiratory system, skin	White, odorless metal, Sp. Gr. = 5.61

References

U.S. Department of Labor. 1990. OSHA Regulated Hazardous Substances, industrial Exposure and Control Technologies Government Institutes, Inc.

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CVS = Cardiovascular System
IDLH = Immediately Dangerous to Life and Health
UEL = Upper Explosive Limit
LEL = Lower Explosive Limit
REL = Recommended exposure limit.
NIOSH = National Institute for Operational Safety and Health
STEL = Short Term Exposure Limit (15 min)

Table 1. Potential Site-Specific Hazards - Toxicological, Physical and Chemical Properties of Compounds. Indiana Machine Works; 135 E. Harrison St, Mooresville, IN

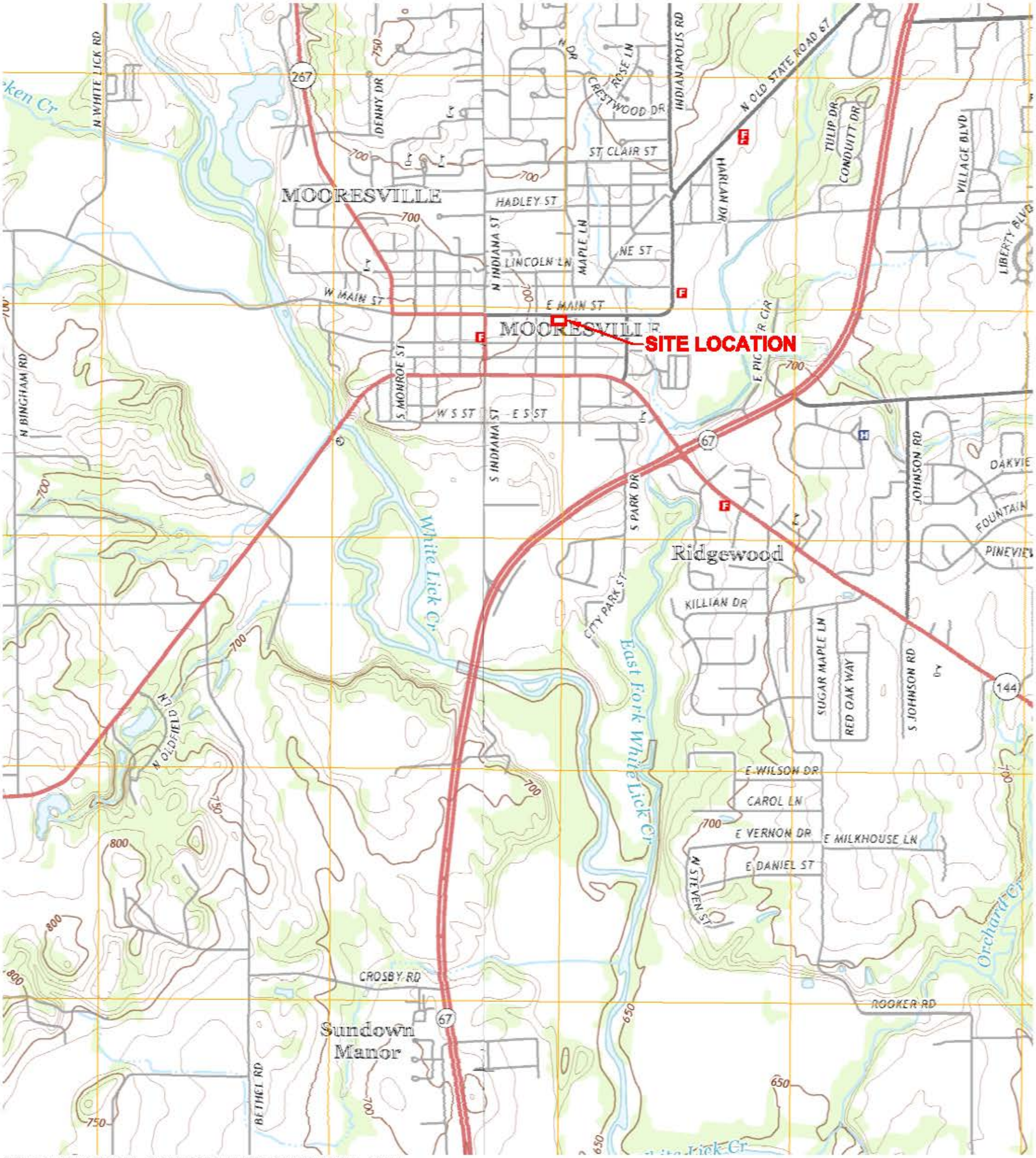
Hawley's Condensed Chemical Dictionary, Sax, N. Van Nostrand and Reinhold Company, 11th Edition, 1987.
Proctor, N.H., J.P. Hughes and M.L. Fischman, 1989. Chemical Hazards of the Workplace. Van Nostrand Reinhold. New York.
Sax, N.I. and R.J. Lewis. 1989. Dangerous Properties of Industrial Materials. 7th Edition. Van Nostrand Reinhold. New York.
2012 TLVs® and BEIs®. American Conference of Governmental Industrial Hygienists.
Pocket Guide to Chemical Hazards, 1997. National Institute for Occupational Safety and Health.

PEL = Permissible Exposure Limit
TWA = Time Weighted Average exposure concentration for a conventional 8-hour (PEL) or up to a 10-hour workday (REL) in a 40-hour work week.
BP = Boiling Point
Fl. P. = Flash Point
NE = Not Established

CNS = Central Nervous System
PNS = Peripheral Nervous System
GI = Gastrointestinal
CVS = Cardiovascular System
IDLH = Immediately Dangerous to Life and Health

UEL = Upper Explosive Limit
LEL = Lower Explosive Limit
REL = Recommended exposure limit.
NIOSH = National Institute for Operational Safety and Health
STEL = Short Term Exposure Limit (15 min)

FIGURES



SOURCE: USGS MAP MOORESVILLE EAST QUADRANGLE; 2013

QUADRANGLE LOCATION

2000' 0 2000'

Title:

SITE LOCATION AND TOPOGRAPHIC MAP

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

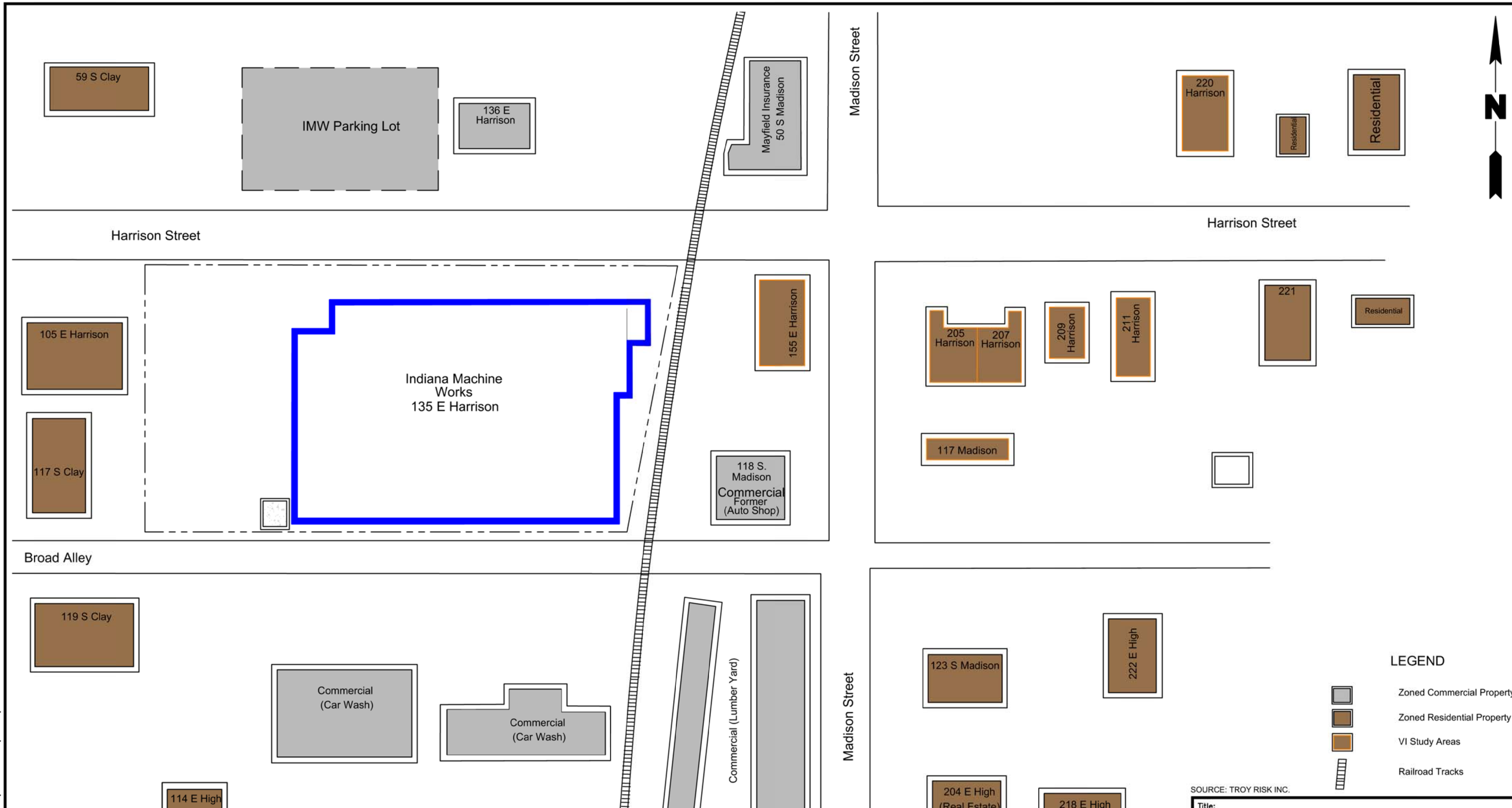
Prepared For:

INDIANA MACHINE WORKS

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/19/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	1
Project Mgr: TA	Project: 1161.0060I000	
File: FIG_01-TOPOMAP.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\HASP\FIG_01-TOPOMAP.DWG



LEGEND

Zoned Commercial Property

Zoned Residential Property

VI Study Areas

Railroad Tracks

60' 0 60'

SOURCE: TROY RISK INC.

Title:

SITE PLAN

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

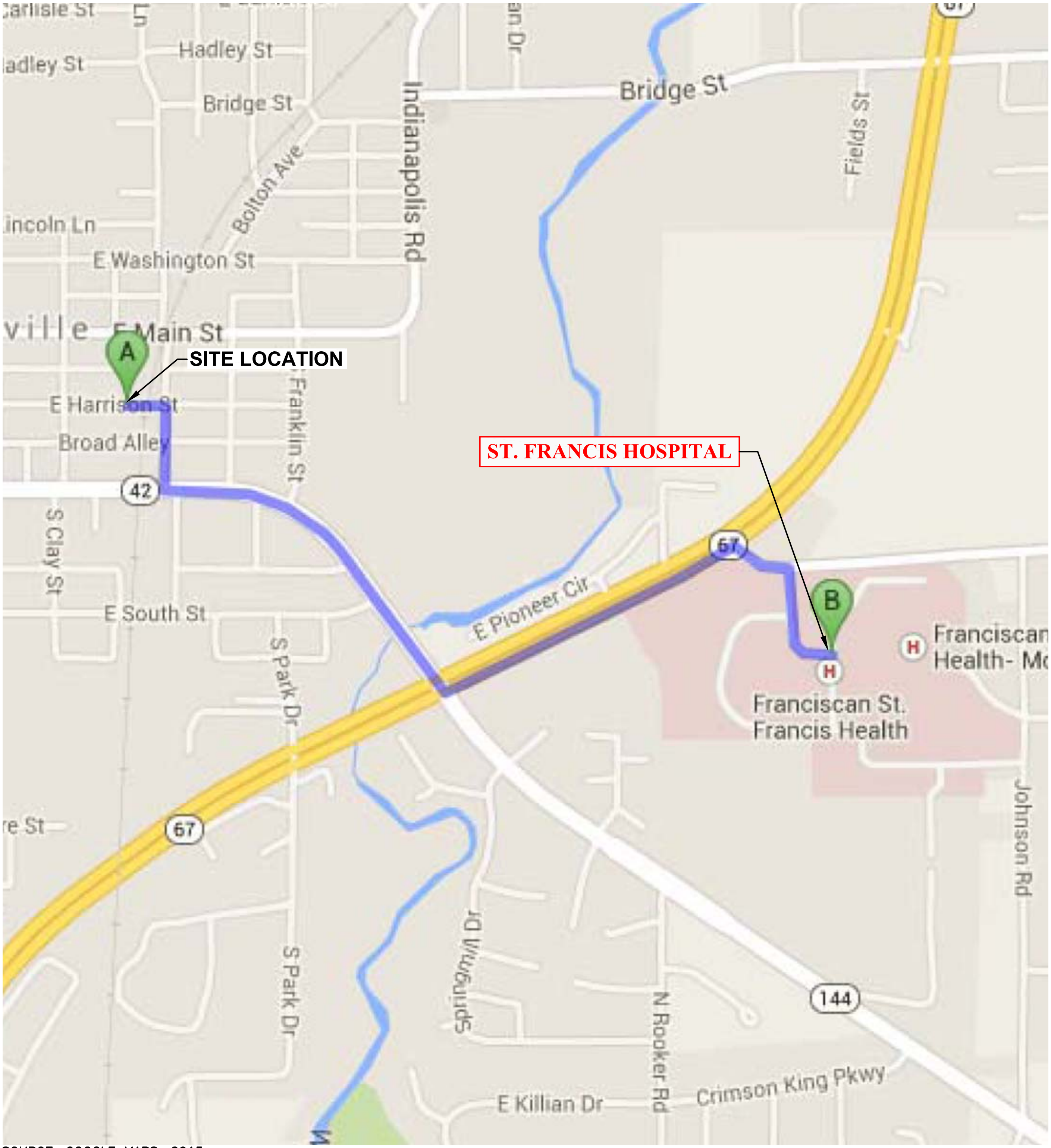
Prepared For:

INDIANA MACHINE WORKS

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/19/2015	FIGURE
Prepared by: JJS	Scale: AS SHOWN	2
Project Mgr: TA	Project: 1181.0060I000	
File: FIG_02-SITE PLAN.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\HASP\FIG_02-SITE PLAN.DWG



SOURCE: GOOGLE MAPS, 2015

DIRECTIONS FROM SITE TO ST. FRANCES HOSPITAL AND HEALTH CENTER:

1. HEAD EAST ON E. HARRISON STR. TOWARD S. MADISON STR.
2. TURN RIGHT AT THE 1ST CROSS STREET ONTO S. MADISON STR.
3. TURN LEFT ONTO IN–42 E./E. HIGH STR.
4. TURN LEFT ONTO IN–67 N.
5. TURN RIGHT ONTO CO. RD. 1250 N/E. HADLEY RD.
6. DESTINATION WILL BE ON THE RIGHT.
   ST. FRANCES HOSPITAL AND HEALTH CENTER
   1201 HADLEY ROAD, MOOREVILLE, IN 46158

Title:

HOSPITAL ROUTE

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

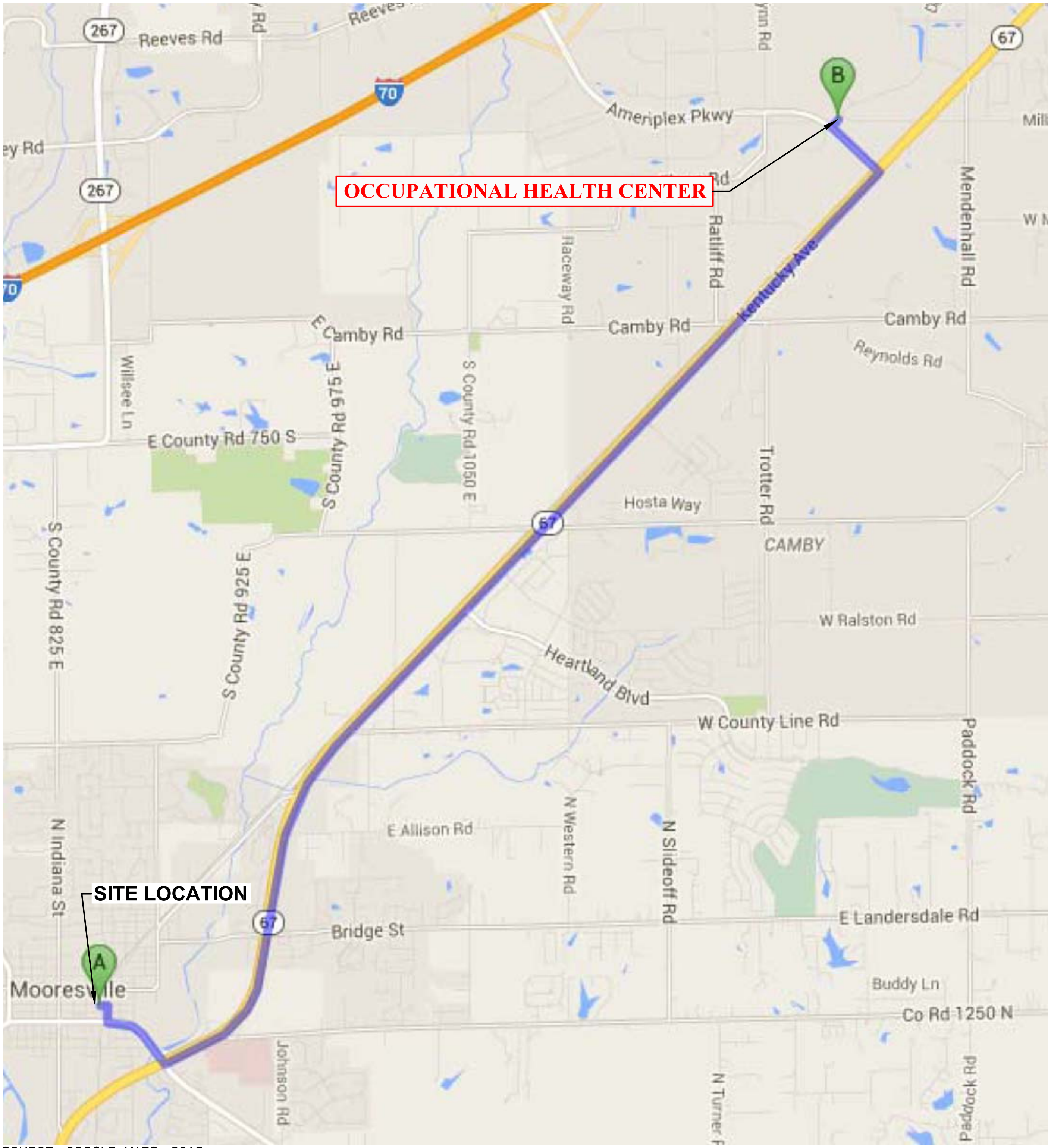
Prepared For:

INDIANA MACHINE WORKS

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: TD	Date: 02/12/2015	FIGURE	
Prepared by: JJS	Scale: AS SHOWN		
Project Mgr: TA	Project: 1181.0060I000	3	
File: FIG_03-04-HOSP.DWG			

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02-\HASP\FIG_03-04-HOSP.DWG



SOURCE: GOOGLE MAPS, 2015

DIRECTIONS FROM SITE TO OCCUPATIONAL HEALTH CLINIC:

1. HEAD EAST ON E. HARRISON STR. TOWARD S. MADISON STR.
2. TURN RIGHT AT THE 1ST CROSS STREET ONTO S. MADISON STR.
3. TURN LEFT ONTO IN–42 E./E. HIGH STR.
4. TURN LEFT ONTO IN–67 N.
5. TURN LEFT ONTO AMERIPLEX PARKWAY
6. TURN RIGHT ON TO DECATUR BLVD.
7. DESTINATION WILL BE ON THE LEFT.
   CONCENTRA URGENT CARE
   5940 DECATUR BLVD., INDIANAPOLIS, IN 46241

Title:

OCCUPATIONAL HEALTH CLINIC ROUTE

135 EAST HARRISON STREET
MOORESVILLE, INDIANA

Prepared For:

INDIANA MACHINE WORKS

ROUX ASSOCIATES, INC. Environmental Consulting & Management	Compiled by: TD	Date: 02/12/2015	FIGURE
	Prepared by: JJS	Scale: AS SHOWN	4
	Project Mgr: TA	Project: 1181.0060I000	
	File: FIG_03–04–HOSP.DWG		

T:\LABORATORY EQUIPMENT\CAD FILES\2015_02–\HASP\FIG_03–04–HOSP.DWG

APPENDICES

APPENDIX A

JOB SAFETY AND HEALTH PROTECTION (OSHA) POSTER

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a compliant with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory civil penalties against employers of up to $7,000 for each serious violation and for optional penalties of up to $7,000 for each nonserious violation. Penalties of up to $7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $70,000 for each such violation. A minimum penalty of $5,000 may be imposed for each willful violation. A violation of posting requirements can bring a penalty of up to $7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to $250,000 (or $500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of $10,000 or up to six months in jail or both.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, GA	(404) 347-3573
Boston, MA	(617) 565-7164
Chicago, IL	(312) 353-2220
Dallas, TX	(214) 767-4731
Denver, CO	(303) 391-5858
Kansas City, MO	(816) 426-5861
New York, NY	(212) 337-2378
Philadelphia, PA	(215) 596-1201
San Francisco, CA	(415) 744-6670
Seattle, WA	(206) 553-5930

Washington, DC
1995 (Reprinted)
OSHA 2203

Robert B. Reich, Secretary of Labor

U.S. Department of Labor

Occupational Safety and Health Administration

Washington, DC 1995 (Reprinted) OSHA 2203

This information will be made available to sensory impaired individuals upon request. Voice phone: (202) 219-8615; TDO message referral phone: 1-800-326-2577

GPO: 1995 0 - 163-097 QL 3

APPENDIX B

FIELD CHANGE REQUEST

Project #: ______________________
Project Name: ______________________
Location: ______________________
Date: ______________________

FIELD CHANGE REQUEST

SITE SAFETY REVIEW - CHANGES AND OVERALL EVALUATION
(To Be Completed For Each Field Change In Plan)

Was the Safety Plan followed as presented? ___ Yes ___ No

Describe, in detail, all changes to the Safety Plan

____

____

____

____

____

Reason for changes ____

____

____

____

Follow-up, Review and Evaluation Prepared by ______________________ Date __________

Discipline ____

Approved by: Project Principal ______________________ Date __________

Site Health and Safety Officer ______________________ Date __________

Approved by: Office Health & Safety Manager ______________________ Date __________

Evaluation of Site Safety Plan

Was the Safety Plan adequate? ___ Yes ___ No

What would you recommend? ____

____

____

____

____

APPENDIX C

HEAT STRESS AND COLD STRESS INFORMATION

Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment (PPE) in hot weather environments.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat cramps are as follows:

- severe muscle cramps, usually in the legs and abdomen;
- exhaustion, often to the point of collapse; and
- dizziness or periods of faintness.

First aid treatment includes shade, rest and electrolyte fluid replacement therapy. Normally, the individual should recover within one-half hour. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to a hospital for medical attention.

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working. The circulatory system of the individual fails as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion are as follows:

- rapid and shallow breathing;
- weak pulse;
- cold and clammy skin with heavy perspiration;
- skin appears pale;
- fatigue and weakness;
- dizziness; and
- elevated body temperature.

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids and electrolytes. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to the hospital for medical attention.

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **MEDICAL EMERGENCY,** requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- dry, hot, red skin;
- body temperature approaching or above 105°F;
- large (dilated) pupils; and
- loss of consciousness - the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility.

Heat stress (heat cramps, heat exhaustion, and heat stroke) is a significant hazard if any type of protective equipment (semipermeable or impermeable) which prevents evaporative cooling is worn in hot weather environments. Local weather conditions may require restricted work schedules in order to adequately protect personnel. The use of work/rest cycles (including working in the cooler periods of the day or evening) and training on the signs and symptoms of heat stress should help prevent heat-related illnesses from occurring. Work/rest cycles will depend on the work load required to perform each task, type of protective equipment, temperature, and humidity. In general, when the temperature exceeds 88°F, a 15 minute rest cycle will be initiated once every two hours. In addition, potable water and fluids containing electrolytes (e.g., Gatorade) will be available to replace lost body fluids.

Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 40°F. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. Training on the signs and symptoms of cold stress should prevent cold-related illnesses from occurring. The signs and symptoms of cold stress include the following:

- severe shivering;

- abnormal behavior;
- slowing;
- weakness;
- stumbling or repeated falling;
- inability to walk;
- collapse; and/or
- unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks, and encourage activity, such as walking wrapped in a blanket.

APPENIDX D

INCIDENT REPORT

☐ **Roux Associates, Inc.** ☐ **Remedial Engineering, P.C.**
(Check applicable company name)

ACCIDENT REPORT

Joe Gentile, Corporate Health and Safety Manager
Cell: (610) 844-6911; Office: (856) 423-8800; Office FAX: (856) 423-3220; Home: (484) 373-0953

PART 1: ADMINISTRATIVE INFORMATION

Project #: ______________________________
Project Name: ______________________________
Project Location (street address/city/state)**:**
____
____

Client Corporate Name / Contact / Address / Phone #:
____
____
____
____
____

Immediate Verbal Notifications Given To:

Corporate Health & Safety	☐Yes	☐No
Office Health & Safety	☐Yes	☐No
Office Manager	☐Yes	☐No
Project Principal	☐Yes	☐No
Project Manager	☐Yes	☐No
Client Contact	☐Yes	☐No

REPORT STATUS (time due):
☐ Initial (24 hr) ☐ Final (5-10 days)
Date: __________ Date: __________

Accident Report Delivered To:

Corporate Health & Safety	☐Yes	☐No
Office Health & Safety	☐Yes	☐No
Office Manager	☐Yes	☐No
Project Principal	☐Yes	☐No
Project Manager	☐Yes	☐No

REPORT TYPE: ☐ Loss ☐ Near Loss Estimated Costs: $ _______

OSHA CASE # Assigned by Corporate Health & Safety if Applicable: ______________

Corporate Health & Safety Confirmed Final Accident Report
☐Yes ☐No

DATE OF INCIDENT: ______________

TIME INCIDENT OCCURRED: __________ ☐AM ☐PM

INCIDENT LOCATION – City, State, and Country (If outside U.S.A.)
____

INCIDENT TYPES: (Select most appropriate if Loss occurred.)
From lists below, please select the option that best categories the incident. When selecting an injury or illness, also indicate the severity level.

☐**INJURY** ☐**ILLNESS**

------------------------**Severity Level**---------------------------
☐Fatality ☐First Aid ☐Medical Treatment
☐Restricted Work ☐Lost Time

OTHER INCIDENT TYPES
☐Spill / Release
Material involved: ______________
Quantity (U.S. Gallons): __________
☐Misdirected Waste ☐Consent Order ☐NOV
☐Property Damage ☐Exceedance
☐Motor Vehicle ☐Fine / Penalty

ACTIVITY TYPE (Check most appropriate one.)
☐Decommissioning ☐Geoprobe ☐Sampling
☐Demolition ☐Motor Vehicle ☐System Start-up
☐Dewatering ☐Operations/ Maintenance ☐Trenching
☐Drilling ☐AST/UST Removal
☐Excavation ☐Pump/Pilot Test ☐Other_________
☐Gauging ☐Rigging/Lifting

INJURY TYPE (Check all applicable.)
☐Abrasion ☐Occupational Illness
☐Amputation ☐Puncture
☐Burn ☐Rash
☐Cold/Heat Stress ☐Repetitive Motion
☐Inflammation ☐Sprain/Strain
☐Laceration ☐Other_________

BODY PART AFFECTED (Check all applicable.)
☐Respiratory ☐Shoulder ☐Face
☐Neck ☐Arm ☐Leg
☐Chest ☐Wrist ☐Knee
☐Abdomen ☐Hand/Fingers ☐Ankle
☐Groin ☐Eye ☐Foot/Toes
☐Back ☐Head ☐Other______

I. PERSON(S) DIRECTLY / INDIRECTLY INVOLVED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Directly/Indirectly Involved in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:
1)				
2)				

II. PERSONS INJURED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Injured in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:	Description of Injury:
1)					
2)					

III. PROPERTY DAMAGED IN INCIDENT (Attach additional information as necessary/applicable.)

Property Damaged:	Property Location:	Owner Name, Address & Phone #:	Description of Damage:	Estimated Cost:
1)				$

2)				$

IV. WITNESSES TO INCIDENT (Attach additional information as necessary/applicable.)

Witness Name:	Address:	Phone #:
1)		
2)		

PART 2: WHAT HAPPENED AND INCIDENT DETAILS

PROVIDE FACTUAL DESCRIPTION OF INCIDENT (e.g., describe loss/near loss, injury, response / treatment).

I. AUTHORITIES/GOVERNMENTAL AGENCIES NOTIFIED (Attach additional information as necessary/applicable.)

Authority/Agency Notified:	Name/Phone #/Fax # of Person Notified:	Address of Person Notified:	Date & Time of Notification:	Exact Information Reported/Provided:

II. PUBLIC RESPONSES TO INCIDENT (if applicable)

Response/Inquiry By: (check one)	Entity Name:	Name/Phone # of Respondent/ Inquirer:	Address of Entity/Person:	Date & Time of Response/Inquiry:
☐Newspaper ☐Television ☐Community Group ☐Neighbors ☐Other ____________				

Describe Response/Inquiry:

Roux/Remedial Response:

(Check all that apply.) (Attach photos, drawings, etc. to help illustrate the incident.)

ATTACHED INFORMATION: ☐Photo ☐Sketches ☐Vehicle Acord Form ☐Police Report ☐Other

Name(s) of person(s) who prepared Initial and Final Report:	**Title(s):**	**Phone number(s):**

PART 3: INVESTIGATION TEAM ANALYSIS

CONCLUSION: WHY IT HAPPENED (LIST CAUSAL FACTORS AND CORRESPONDING ROOT CAUSES)

(Root Causes: Lack of knowledge or skill, Doing the task according to procedures or acceptable practices takes more time or effort, Short-cuts or not following acceptable practices is reinforced or tolerated, Not following procedures or acceptable practices did not result in an accident, Lack of or inadequate procedures, Inadequate communications of expectations regarding procedures or acceptable practices, Inadequate tools or equipment, External Factors)

ROOT CAUSE(S) AND SOLUTION(S): HOW TO PREVENT INCIDENT FROM RECURRING

CAUSAL FACTOR	ROOT CAUSE		SOLUTION(S) [Must Match Root Cause(s)]		PERSON RESPONSIBLE	AGREED DUE DATE	ACTUAL COMPLETION DATE
			#	Solution(s)			
			1				
			2				
			3				

INVESTIGATION TEAM:

PRINT NAME	JOB POSITION	DATE	SIGNATURE

No One Gets Hurt!

APPENDIX E

ACORD AUTO INCIDENT FORM

AUTOMOBILE LOSS NOTICE

DATE (MM/DD/YYYY):

AGENCY	INSURED LOCATION CODE	DATE OF LOSS AND TIME	AM / PM
The Treiber Group AJ Gallagher Risk Mgmt Svcs 377 Oak Street Garden City, NY 11530			

CONTACT NAME:	Teresa Garzia
PHONE (A/C, No, Ext):	516.622.2418
FAX (A/C, No):	516.622.2618
E-MAIL ADDRESS:	teresa_garzia@ajg.com
CODE:	SUBCODE:
AGENCY CUSTOMER ID:	ROUXASSO

CARRIER	NAIC CODE
Great Divide Insurance Company	25224
POLICY NUMBER	BAP1549799-11
POLICY TYPE	Commercial Automobile

INSURED

NAME OF INSURED (First, Middle, Last)	INSURED'S MAILING ADDRESS
Roux Associates, Inc.	Susan Sullivan, General Counsel, Roux Associates, Inc. 209 Shafter Street Islandia, NY 11749

DATE OF BIRTH	FEIN (if applicable)	MARITAL STATUS / CIVIL UNION (if applicable)
	11-2579482	

PRIMARY PHONE #: ☐ HOME ☑ BUS ☐ CELL — 631.232.2600

SECONDARY PHONE #: ☐ HOME ☐ BUS ☐ CELL

PRIMARY E-MAIL ADDRESS: LegalDept@rouxinc.com

SECONDARY E-MAIL ADDRESS: Fax Notice of Loss to: 631.232.1525

CONTACT

☐ CONTACT INSURED

NAME OF CONTACT (First, Middle, Last)	CONTACT'S MAILING ADDRESS
Susan Sullivan, General Counsel	Susan Sullivan, General Counsel, Roux Associates, Inc. 209 Shafter Street Islandia, NY 11749

PRIMARY PHONE #: ☐ HOME ☑ BUS ☐ CELL — 631.232.2600

SECONDARY PHONE #: ☐ HOME ☐ BUS ☐ CELL

WHEN TO CONTACT:

PRIMARY E-MAIL ADDRESS: LegalDept@rouxinc.com

SECONDARY E-MAIL ADDRESS: Fax Notice of Loss to: 631.232.1525

LOSS

LOCATION OF LOSS	POLICE OR FIRE DEPARTMENT CONTACTED
STREET:	
CITY, STATE, ZIP:	REPORT NUMBER
COUNTRY:	

DESCRIBE LOCATION OF LOSS IF NOT AT SPECIFIC STREET ADDRESS:

DESCRIPTION OF ACCIDENT (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

INSURED VEHICLE

VEH #	YEAR	MAKE:	BODY TYPE:	PLATE NUMBER	STATE
		MODEL:	V.I.N.:		

OWNER'S NAME AND ADDRESS ☐ (Check if same as insured)

PRIMARY PHONE #: ☐ HOME ☐ BUS ☐ CELL — SECONDARY PHONE #: ☐ HOME ☐ BUS ☐ CELL

PRIMARY E-MAIL ADDRESS:

SECONDARY E-MAIL ADDRESS:

DRIVER'S NAME AND ADDRESS ☐ (Check if same as owner)

PRIMARY PHONE #: ☐ HOME ☐ BUS ☐ CELL — SECONDARY PHONE #: ☐ HOME ☐ BUS ☐ CELL

PRIMARY E-MAIL ADDRESS:

SECONDARY E-MAIL ADDRESS:

RELATION TO INSURED (Employee, family, etc.)	DATE OF BIRTH	DRIVER'S LICENSE NUMBER	STATE	PURPOSE OF USE	USED WITH PERMISSION? (Y/N)

DESCRIBE DAMAGE

1. WAS A STANDARD CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) INSTALLED IN THE VEHICLE AT THE TIME OF THE ACCIDENT?		Y / N
2. WAS THE CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) IN USE BY A CHILD DURING THE TIME OF THE ACCIDENT?		Y / N
3. DID THE CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) SUSTAIN A LOSS AT THE TIME OF THE ACCIDENT?		Y / N

ESTIMATE AMOUNT:	WHERE CAN VEHICLE BE SEEN?:	WHEN CAN VEHICLE BE SEEN?:
OTHER INSURANCE ON VEHICLE - CARRIER:		POLICY NUMBER:

OTHER VEHICLE / PROPERTY DAMAGED **NON - VEHICLE?** ☐ **AGENCY CUSTOMER ID:** ROUXASSO

VEH #	YEAR	MAKE:	BODY TYPE:	PLATE NUMBER	STATE
		MODEL:	V.I.N.:		

DESCRIBE PROPERTY (Other Than Vehicle)	OTHER VEH/PROP INS? (Y/N)
	☐

CARRIER OR AGENCY NAME	NAIC CODE	POLICY NUMBER

OWNER'S NAME AND ADDRESS	PRIMARY PHONE # ☐ HOME ☐ BUS ☐ CELL	SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL
	PRIMARY E-MAIL ADDRESS:	
	SECONDARY E-MAIL ADDRESS:	

DRIVER'S NAME AND ADDRESS ☐ (Check if same as owner)	PRIMARY PHONE # ☐ HOME ☐ BUS ☐ CELL	SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL
	PRIMARY E-MAIL ADDRESS:	
	SECONDARY E-MAIL ADDRESS:	

DESCRIBE DAMAGE

ESTIMATE AMOUNT	WHERE CAN DAMAGE BE SEEN?	

INJURED

NAME & ADDRESS	PHONE (A/C, No)	PED	INS VEH	OTH VEH	AGE	EXTENT OF INJURY
		☐	☐	☐		
		☐	☐	☐		
		☐	☐	☐		
		☐	☐	☐		

WITNESSES OR PASSENGERS

NAME & ADDRESS	PHONE (A/C, No)	INS VEH	OTH VEH	OTHER (Specify)
		☐	☐	
		☐	☐	
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REPORTED BY	REPORTED TO

REMARKS (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

APPLICABLE IN ALASKA

A person who knowingly and with intent to injure, defraud, or deceive an insurance company files a claim containing false, incomplete, or misleading information may be prosecuted under state law.

APPLICABLE IN ARIZONA

For your protection, Arizona law requires the following statement to appear on this form. Any person who knowingly presents a false or fraudulent claim for payment of a loss is subject to criminal and civil penalties.

APPLICABLE IN ARKANSAS, DELAWARE, KENTUCKY, LOUISIANA, MAINE, MICHIGAN, NEW JERSEY, NEW MEXICO, NORTH DAKOTA, PENNSYLVANIA, RHODE ISLAND, SOUTH DAKOTA, TENNESSEE, TEXAS, VIRGINIA, AND WEST VIRGINIA

Any person who knowingly and with intent to defraud any insurance company or another person, files a statement of claim containing any materially false information, or conceals for the purpose of misleading, information concerning any fact, material thereto, commits a fraudulent insurance act, which is a crime, subject to criminal prosecution and civil penalties. In LA, ME, TN, and VA, insurance benefits may also be denied.

APPLICABLE IN CALIFORNIA

For your protection, California law requires the following to appear on this form: Any person who knowingly presents a false or fraudulent claim for payment of a loss is guilty of a crime and may be subject to fines and confinement in state prison.

APPLICABLE IN COLORADO

It is unlawful to knowingly provide false, incomplete, or misleading facts or information to an insurance company for the purpose of defrauding or attempting to defraud the company. Penalties may include imprisonment, fines, denial of insurance, and civil damages. Any insurance company or agent of an insurance company who knowingly provides false, incomplete, or misleading facts or information to a policy holder or claimant for the purpose of defrauding or attempting to defraud the policy holder or claimant with regard to a settlement or award payable from insurance proceeds shall be reported to the Colorado Division of Insurance within the Department of Regulatory Agencies.

APPLICABLE IN THE DISTRICT OF COLUMBIA

Warning: It is a crime to provide false or misleading information to an insurer for the purpose of defrauding the insurer or any other person. Penalties include imprisonment and/or fines. In addition, an insurer may deny insurance benefits, if false information materially related to a claim was provided by the applicant.

APPLICABLE IN FLORIDA

Pursuant to S. 817.234, Florida Statutes, any person who, with the intent to injure, defraud, or deceive any insurer or insured, prepares, presents, or causes to be presented a proof of loss or estimate of cost or repair of damaged property in support of a claim under an insurance policy knowing that the proof of loss or estimate of claim or repairs contains any false, incomplete, or misleading information concerning any fact or thing material to the claim commits a felony of the third degree, punishable as provided in S. 775.082, S. 775.083, or S. 775.084, Florida Statutes.

APPLICABLE IN HAWAII

For your protection, Hawaii law requires you to be informed that presenting a fraudulent claim for payment of a loss or benefit is a crime punishable by fines or imprisonment, or both.

APPLICABLE IN IDAHO

Any person who knowingly and with the intent to injure, defraud, or deceive any insurance company files a statement of claim containing any false, incomplete or misleading information is guilty of a felony.

APPLICABLE IN INDIANA

A person who knowingly and with intent to defraud an insurer files a statement of claim containing any false, incomplete, or misleading information commits a felony.

APPLICABLE IN KANSAS

Any person who, knowingly and with intent to defraud, presents, causes to be presented or prepares with knowledge or belief that it will be presented to or by an insurer, purported insurer, broker or any agent thereof, any written statement as part of, or in support of, an application for the issuance of, or the rating of an insurance policy for personal or commercial insurance, or a claim for payment or other benefit pursuant to an insurance policy for commercial or personal insurance which such person knows to contain materially false information concerning any fact material thereto; or conceals, for the purpose of misleading, information concerning any fact material thereto commits a fraudulent insurance act.

APPLICABLE IN MARYLAND

Any person who knowingly and [or]* willfully presents a false or fraudulent claim for payment of a loss or benefit or who knowingly and [or]* willfully presents false information in an application for insurance is guilty of a crime and may be subject to fines and confinement in prison. * [or] effective 01-01-2013

APPLICABLE IN MINNESOTA

A person who files a claim with intent to defraud or helps commit a fraud against an insurer is guilty of a crime.

APPLICABLE IN NEVADA

Pursuant to NRS 686A.291, any person who knowingly and willfully files a statement of claim that contains any false, incomplete or misleading information concerning a material fact is guilty of a felony.

APPLICABLE IN NEW HAMPSHIRE

Any person who, with purpose to injure, defraud or deceive any insurance company, files a statement of claim containing any false, incomplete or misleading information is subject to prosecution and punishment for insurance fraud, as provided in RSA 638:20.

APPLICABLE IN NEW YORK

Any person who knowingly and with intent to defraud any insurance company or other person files an application for commercial insurance or a statement of claim for any commercial or personal insurance benefits containing any materially false information, or conceals for the purpose of misleading, information concerning any fact material thereto, and any person who in connection with such application or claim knowingly makes or knowingly assists, abets, solicits or conspires with another to make a false report of the theft, destruction, damage or conversion of any motor vehicle to a law enforcement agency, the Department of Motor Vehicles or an insurance company, commits a fraudulent insurance act, which is a crime, and shall also be subject to a civil penalty not to exceed five thousand dollars and the value of the subject motor vehicle or stated claim for each violation.

APPLICABLE IN OHIO

Any person who, with intent to defraud or knowing that he/she is facilitating a fraud against an insurer, submits an application or files a claim containing a false or deceptive statement is guilty of insurance fraud.

APPLICABLE IN OKLAHOMA

WARNING: Any person who knowingly and with intent to injure, defraud or deceive any insurer, makes any claim for the proceeds of an insurance policy containing any false, incomplete or misleading information is guilty of a felony.

APPLICABLE IN WASHINGTON

It is a crime to knowingly provide false, incomplete, or misleading information to an insurance company for the purpose of defrauding the company. Penalties include imprisonment, fines and denial of insurance benefits.

APPENDIX F

JOB SAFETY ANALYSES

JOB SAFETY ANALYSIS	Cntrl. No. GEN-010	DATE: 1/15/2014	☐NEW ☒REVISED	PAGE 1 of 2
JSA TYPE CATEGORY **GENERIC**	WORK TYPE **Site Recon**	WORK ACTIVITY (Description) **Mobilization/Demobilization**		

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Jared Lefkowitz	Staff Assistant Scientist	Leo Kurylo	IL-OHSM
John Williams	OHSM	Mike Ritorto	Project Hydrogeologist
		Joe Gentile	CHSM

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION (as needed) ☒ SAFETY SHOES: Steel Toe or composite toe	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest of high-visibility clothing; long sleeve shirt; long pants	☒ GLOVES: Leather, nitrile, and cut resistant (as needed) ☐ OTHER

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: None

EXCLUSION ZONE: A minimum exclusion zone of 10' will be maintained around moving equipment (if heavy equipment is utilized)

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilize/demobilize and establish work area	**1a. FALL:** Slip/trips/falls from obstructions, uneven terrain, weather conditions, heavy loads, and/or poor housekeeping.	1a. Use 3 points-of-contact/ensure secure footing when entering and exiting vehicle. 1a. Inspect walking path for uneven terrain, steep hills, obstructions, and/or weather-related hazards (i.e., ice, snow, and puddles) prior to mobilizing equipment. Use established pathways. Walk on stable/secure ground. 1a. Do not climb over stored materials/equipment; walk around. Practice good housekeeping; organize and store equipment neatly in one area. 1a. Wear boots with adequate treads. 1a. Delineate unsafe areas with 42" cones, caution tape and/or flagging.
	1b. CONTACT: Personal injury and/or property damage caused by being struck by Site traffic or equipment used in Site activities.	1b. Observe and maintain the posted speed limits. 1b. When first arriving onsite, park vehicles in designated parking space and/or out of the way locations. Use parking brake on all vehicles and tire chocks on work trucks and trailers. 1b. Check in with Site Manager/Supervisor to ensure coordination with other Site activities and to discuss any special hazards. Ensure that short-service employees (SSE) are identified. 1b. Identify potential traffic sources. 1b. Wear PPE including high visibility clothing or reflective vest. 1b. Use a spotter while moving work vehicles; plan ahead to avoid backing whenever possible. 1b. Maintain a minimum 10' exclusion zone when vehicles are in motion. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility. 1b. Delineate work area with 42" cones, flags, caution tape, and/or other barriers. 1b. Position "Work Area" signs at Site entrances, if possible, or at either side of work area. 1b. Position largest vehicle to protect against oncoming traffic. 1b. Face traffic, maintain eye contact with oncoming vehicles, use a spotter, and establish a safe exit route. 1b. Observe potential overhead and ground surface features that may interfere with moving equipment. Clear the path of physical hazards prior initiating mobilization.
	1c. CAUGHT: Personal injury from pinch points and being in line-of-fire of vehicle and/or equipment.	1c. Make sure driver has engaged parking brake and placed wheel chocks in a position to prevent movement. Be sure that vehicle is parked in front/down gradient of work area. 1c. Wear leather gloves when handling any tools or equipment. Wear cut-resistant gloves (Kevlar or similar) when handling sharp objects/cutting tools/glass. 1c. Keep body parts away from line-of-fire of equipment. 1c. Always carry tools by the handles and/or designated carrier. Ensure sharp-edged tools are sheathed/secure.

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2 A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
3 Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift." Avoid general statements such as, "be careful."

		1c. Remove any loose jewelry. Avoid wearing loose clothing and/or ensure loose clothing is secure. 1c. Secure all items on the equipment, tighten up any items or features that have potential to shift or break during mobilization.
	1d. OVEREXERTION: Muscle strains while lifting/carrying equipment. **1e. EXPOSURE:** Personal injury from exposure to biological and environmental hazards. **1f. EXPOSURE:** Heat and cold related injuries. **1g. EXPOSURE:** Personal injury from noise hazards.	1d. Use body positioning and lifting techniques that avoid muscle strain; keep back straight, lift with legs, keep load close to body, and never reach with a load. 1d. Ensure that loads are balanced. Use assistance (mechanical or additional person) to carry equipment that is either unwieldy or over 50 lbs. 1e. Inspect area to avoid contact with biological hazards (i.e. poisonous plants, stinging insects, ticks, etc.). 1e. Wear long sleeved clothes treated with Permethrin, apply insect repellant containing DEET to exposed skin, and inspect clothes and skin for ticks during and after work. 1e. Apply sunscreen (SPF 15+) if exposure to sun for 30 minutes or more is expected. 1f. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 1f. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed. 1f. Wear clothing appropriate for weather and temperature conditions (e.g., rain jackets, snow pants, multiple layers). 1f. If lightning is observed, wait 30 minutes in a sheltered location (car is acceptable) before resuming work. 1g. Wear hearing protection if sound levels exceed 85 dBA (if you must raise your voice for normal conversation).

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<table>
<tr><td colspan="2">JOB SAFETY ANALYSIS Ctrl. No. GEN-004</td><td>DATE 1/8/2015</td><td>☐ NEW
☒ REVISED</td><td>PAGE 1 of 2</td></tr>
<tr><td>JSA TYPE CATEGORY:
Generic</td><td>WORK TYPE:
Drilling</td><td colspan="3">WORK ACTIVITY (Description):
Direct Push Soil Borings / Well Installation</td></tr>
<tr><td>DEVELOPMENT TEAM</td><td>POSITION / TITLE</td><td colspan="2">REVIEWED BY:</td><td>POSITION / TITLE</td></tr>
<tr><td>Jeffrey Wills</td><td>Project Hydrogeologist</td><td colspan="2">Laura Jensen</td><td>Staff Hydrogeologist</td></tr>
<tr><td></td><td></td><td colspan="2">Leo Kurylo</td><td>IL-OHSM</td></tr>
<tr><td></td><td></td><td colspan="2">Michael Ritorto</td><td>Senior Hydrogeologist</td></tr>
<tr><td colspan="5">REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT</td></tr>
<tr><td>☐ LIFE VEST
☒ HARD HAT
☐ LIFELINE / BODY HARNESS
☒ SAFETY GLASSES</td><td>☐ GOGGLES
☐ FACE SHIELD
☒ HEARING PROTECTION: (as needed)
☒ SAFETY SHOES: <u>Composite-toe or steel toe boots</u></td><td colspan="2">☐ AIR PURIFYING RESPIRATOR
☐ SUPPLIED RESPIRATOR
☒ PPE CLOTHING: <u>Fluorescent reflective vest or high visibility clothing, Long Sleeve Shirt</u></td><td>☒ GLOVES: <u>Leather, Nitrile and cut resistant</u>
☒ OTHER: <u>Insect Repellant, sunscreen (as needed)</u></td></tr>
<tr><td colspan="5">REQUIRED AND / OR RECOMMENDED EQUIPMENT</td></tr>
<tr><td colspan="5">Geoprobe or Truck-Mounted Direct Push Drill Rig, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Macrocore liners, Liner Opening Tool, 20 lb. Fire Extinguisher, 42” Cones & Flags, “Work Area” Signs, Water</td></tr>
<tr><td colspan="5">Exclusion Zone Policy – All non-essential personnel will maintain a distance of 10 feet from drilling equipment while moving/engaged.</td></tr>
<tr><td colspan="5">“SHOW ME YOUR HANDS”
Driller and helper should show that hands are clear from controls and moving parts</td></tr>
</table>

Assess [1]**JOB STEPS**	**Analyze** [2]**POTENTIAL HAZARDS**	**Act** [3]**CRITICAL ACTIONS**
1. Mobilization of drilling rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed)	1a. **CONTACT**: Equipment/property damage. 1b. **FALL**: Slip/trip/fall hazards.	1a. The drill rig's tower/derrick will be lowered and secured prior to mobilization. 1a. A spotter should be utilized while moving the drill rig. If personnel move into the path of the drill rig, the drill rig will be stopped until the path is again clear. Use a spotter for all required backing operations. 1a. Set-up the work area and position equipment in a manner that eliminates or reduces the need for backing of support trucks and trailers. 1a. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility. 1a. Inspect the driving path for uneven terrain. Level or avoid if needed. 1a. Drill rig should have a minimum **exclusion zone of 10 feet** for non-essential personnel (i.e., driller helper, geologist) when the rig is moving/ in operation. 1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 1b. Use established pathways and walk on stable, secure ground.
2. Raising tower/derrick of drill rig	2a. **CONTACT**: Overhead hazards. 2b. **CONTACT**: Pinch Points/Amputation Points when raising the rig and instability of rig	2a. Prior to raising the tower/derrick, the area above the drilling rig will be inspected for wires, tree limbs, piping, or other structures, that could come in contact with the rig's tower and/or drilling rods or tools. 2a. Maintain a safe distance of 10’ from overhead structures. 2b. Inspect the equipment prior to use and avoid pinch/amputation points. 2b. Lower out riggers on rig to ensure stability prior to raising rig tower/derrick. 2b. If the rig needs to be mounted, be sure to use three points of contact.
3. Advancement of drilling equipment and well installation	3a. **CONTACT**: Flying debris	3a. Be aware of and avoid potential lines of fire and wear required PPE such as eye, ear, and hand protection.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess ¹JOB STEPS	Analyze ²POTENTIAL HAZARDS	Act ³CRITICAL ACTIONS
3. Advancement of drilling equipment and well installation (Continued)	3b. **EXPOSURE**: Noise and dust.	3b. Wet borehole area with sprayer to minimize dust. 3b. Stand upwind and keep body away from rig. 3b. Dust mask should be worn if conditions warrant. 3b. Wear hearing protection when the drill rig is in operation.
	3c. **CAUGHT**: Limb/extremity pinching; abrasion/crushing.	3c. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools. 3c. Inspect the equipment prior to use for potential pinch/amputation points. Keep hands away from being between pinch/amputation points and use of tools is preferable compared to fingers and hands. 3c. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt. 3c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3c. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment. 3c. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 3c. Spinning rods/casing have an **exclusion zone of 10 feet** while in operation.
	3d. **CONTACT**: Equipment imbalance during advancement of drill equipment.	3d. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 3d. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred. 3d. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (**minimum exclusion zone of 10 feet**).
	3e. **EXPOSURE**: Inhalation of contamination/vapors.	3e. Air monitoring using a calibrated photoionization detector (PID) will be used to periodically to monitor the breathing zone of the work area. 3e. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux PM of the condition. The Roux PM will then recommend additional precautions in accordance with the site specific health and safety plan.
	3f. **FALL**: Slip/trip/fall hazards.	3f. Contain drill cuttings and drilling water to prevent fall hazards from developing in work area. 3f. See 1b.
	3g. **EXERTION**: Potential for muscle strain/injury while lifting and installing well casings, lifting sand bags, and/or lifting rods.	3g. Keep back straight and bend at the knees. 3g. Utilize team lifting for objects over 50lbs. 3g. Use mechanical lifting device for odd shaped objects.
4. Decontaminate equipment.	4a. **EXPOSURE/CONTACT**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors).	4a. Wear chemical-resistant disposable gloves and safety glasses. 4a. Contain decontamination water so that it does not spill. 4a. Use an absorbent pad to clean spills, if necessary. 4a. See 3b.
	4b. **EXPOSURE:** To chemicals in cleaning solution including ammonia.	4b. See 4a. Review SDS to ensure appropriate precautions are taken and understood.

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JOB SAFETY ANALYSIS Cntrl. No. GEN-012	DATE: 2/3/2015	☐NEW ☒REVISED	PAGE 1 of 2

JSA TYPE CATEGORY: **GENERIC**	WORK TYPE: **Gauging & Sampling**	WORK ACTIVITY (Description): **Soil Sampling**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Michael Hodess	Staff Environmental Scientist	Mike Ritorto	Senior Hydrogeologist
		Leo Kurylo	IL-OHSM

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES ☒ FLAME RESISTANT CLOTHING (as needed)	☐ GOGGLES ☐ FACE SHIELD: ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES: Composite-toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Insect repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Recommended Equipment: 42” traffic cones, caution tape, trowel

EXCLUSION ZONE: A minimum 10’ exclusion zone will be maintained around moving equipment, if present.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Secure location	1a. **CONTACT:** Personnel and vehicular traffic may enter the work area.	1a. If in an area with foot or vehicle traffic, delineate the work area with 42” traffic cones and/or caution tape to prevent exposure to traffic and inform others of work activity. 1a. Wear reflective vest and/or high visibility clothing. 1a. Face the direction of any vehicular traffic. Position vehicle to protect worker from traffic. 1a. Communicate work activity with adjacent work areas.
	1b. **FALL:** Tripping/falling due to uneven terrain or entry/exit from excavations.	1b. Inspect pathways and work area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions. 1b. Use established pathways and walk on stable, secure ground. 1b. Stage equipment and tools in a convenient, stable, and orderlymanner. Store equipment at lowest potential energy. 1b. Roux employees should stay 5 feet from in-progress excavations and trenches. Should entry to an excavation be appropriate (when stabilization is complete), ladders must be employed for steep embankments, excavations, pits, and trenches.
	1c. **EXPOSURE:** Exposure to sun and excessive heat, possibly causing sunburn, heat exhaustion or heat stroke. Exposure to cold temperatures possibly causing cold stress. Skin burn as a result of fire, if applicable. Exposure to explosive vapors due to tank farm operations, Biological hazards - ticks, bees/wasps, poison ivy, thorns, insects, etc.	1c. Wear sunscreen with an SPF 15 or greater whenever 30 minutes or more of exposure is expected. 1c. Use a tent to shade the work area from direct sunlight particularly when warm temperatures are expected. 1c. Be aware of the location of all Site personnel. 1c. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). 1c. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). 1c. Take breaks for rest and water as necessary. Move to an area that is well shaded or a climate controlled area (i.e., car, site trailer, etc.). 1c. No open flames/heat sources. 1c. Flame resistant clothing must be worn when specified by Site policy. 1c. Cell phones should be disabled when specified by Site policy. 1c. Pre-treat field clothing with Permethrin prior to site visit to kill/repel ticks and insects. 1c. Wear long sleeved shirts and tuck in (or tape) pant legs into socks or boots to prevent ticks from reaching skin. 1c. Spray insect repellant containing DEET on exposed skin when working in overgrown areas of the Site. 1c. Inspect area to avoid contact with biological hazards. 1c. Wear cut-resistant gloves when handling branches, shrubs, etc. that may lie within the walking path. 1c. Personnel shall examine themselves and co-worker’s outer clothing for ticks periodically when onsite. 1c. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water. If rash persists after washing, immediately notify your supervisor and the CHSM for possible consultation with a physician at an approved Occupational Health Clinic.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
2. Collect Soil Sample	2a. **CONTACT:** Personal injury from pinch points, cuts, and abrasions from sampling equipment tools, and material within soil sample. Personal injury from contact with moving equipment while sampling. **2b.** **EXPOSURE:** Exposure to contamination (impacted soil) and/or lab preservatives.	2a. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant disposable gloves when handling soil samples and sampling jars. 2a. Where possible, use trowel or equivalent tool to avoid contact with soil. 2a. If sampling from bucket of heavy equipment, ensure all equipment is off and operator utilizes the “show me your hands” policy. 2a. See 1a. 2b. Wear chemical-resistant disposable gloves over cut resistant gloves to protect hands when handling samples; use containment material or plastic sheeting to protect surrounding areas. 2b. When collecting soil sample from hand auger, put large zip lock bag over entire auger to prevent spillage of soil on to the ground. 2b. Open sample jars slowly and fill carefully to avoid contact with preservatives.
3. Decontaminate equipment	3a. **EXPOSURE/CONTACT:** Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated vapors and/or soil). 3b. **EXPOSURE:** Chemicals in cleaning solution including ammonia.	3a. Wear chemical-resistant disposable gloves and safety glasses. 3a. Use an absorbent pad to clean spills. 3a. Properly dispose of used materials/PPE in provided drums in designated drum storage area. 3a. Remain upwind of sample and avoid breathing contaminant vapors, if they are present. 3b. Wear chemical-resistant disposable gloves and safety glasses. 3b. Work on the upwind side of decon. area. 3b. Use an absorbent pad to clean spills. 3b. Properly dispose of used materials/PPE in provided drums in designated drum storage area.

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JOB SAFETY ANALYSIS	Ctrl. No.	DATE 1/23/2015	☐ NEW ☒ REVISED	

JSA TYPE CATEGORY:	WORK TYPE:	WORK ACTIVITY (Description):
Generic	**Drilling**	**Hollow Stem Auger Soil Borings /Well Installation**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Gina Vanderlin	Project Scientist	Joseph Gentile	CSHM
		Leo Kurylo	IL-OHSM

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES steel or composite toe	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: fluorescent long sleeve shirt or long sleeve shirt and reflective safety vest.	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Truck-Mounted Drilling Rig or Track Rig, Saw, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Interface Probe, 20 lb. Fire Extinguisher, 42" Cones & Flags, "Work Area" Signs

EXCLUSION ZONE POLICY – All non-essential personnel shall maintain a **10 foot** exclusion zone while drill rig is engaged

"SHOW ME YOUR HANDS"
Driller and helper should show that hands are clear from controls and moving parts

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization of drilling rig	1a. **CONTACT**: Equipment or property damage. 1b. **FALL**: Slip/trip/fall hazards.	1a. The drill rig's tower/derrick will be lowered and secured prior to mobilization. 1a. A spotter should be utilized while moving or backing the drill rig. If personnel move into the path of the drilling rig, the drilling rig will be stopped until the path is again clear. 1a. Set-up the work area / position equipment in a manner that eliminates or reduces the need for backing of trucks and trailers. 1a. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility. 1a. Inspect the driving path for uneven terrain. Level or avoid if needed. 1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 1b. Use established pathways and walk on stable, secure ground. 1b. Use three points of contact when mounting or dismounting the rig.
2. Raising tower/derrick of drilling rig	2a. **CONTACT**: Overhead hazards. 2b. **CONTACT**: Pinch points when raising the rig; crushing hazard with stability of rig during set-up	2a. Prior to raising the tower/derrick, area above the drilling rig will be inspected for overhead hazards (wires, tree limbs, piping, or other structures) that may be contacted by the rig's tower or drilling rods. 2a. The tower/derrick must not be raised beneath overhead power lines unless approved by both the Roux Project Manager. 2a. Maintain at a minimum 10' from overhead structures. 2a. Do not move the rig while the tower/derrick is raised. 2b. Inspect the equipment prior to use and avoid placing hands near pinch points. 2b. Lower out riggers on rig to ensure stability prior to raising rig tower derrick. 2b. Inspect the set-up location for uneven terrain. Level or avoid area if needed.
3. Advancement of augers for soil borings and well material installation.	3a. **CONTACT:** Flying / spraying debris. 3b. **EXPOSURE:** Noise and dust.	3a. Wear minimum level D PPE 3a. Be aware of and avoid potential lines of fire. 3b. Wet borehole area with sprayer to minimize dust. Stand upwind and keep body positioned away from rig. 3b. Wear hearing protection while drill rig is operating/or the noise levels exceed 85dBA.

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[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
4. Advancement of augers for soil borings, and well material installation (Continued).	4c. **CAUGHT**: Limb/extremity pinching, abrasion, and crushing.	4c. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools. 4c. Test all emergency shutdown devices prior to drilling. 4c. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt. 4c. Inspect augers; do not use if auger flight if damaged or bent. 4c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 4c. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment particularly when installing auger flights. 4c. Drillers and helpers will understand and use the “Show Me Your Hands” Policy. 4c. Spinning augers should have an **exclusion zone of 20 feet** when in operation.
	4d. **CONTACT**: Equipment imbalance during advancement of drill equipment.	4d. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 4d. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred.
	4e. **EXPOSURE**: Inhalation of contamination/vapors.	4e. Air monitoring using a calibrated photoionization detector (PID) will be used to periodically monitor the breathing zone of the work area. 4e. The Action Level for breathing zone air is five parts per million (sustained) as detected by the PID. 4e. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux PM of the condition. The Roux PM will then recommend additional appropriate precautions in accordance with the site specific health and safety plan.
	4f. **FALL**: Slip/trip/fall hazards.	4f. See 1b. 4f. Remove soil cuttings to avoid a tripping hazard from developing near augers.
	4g. **EXERTION**: Installing well casings and lifting augers.	4g. Keep back straight and bend at the knees. 4g. Utilize team lifting for objects over 50lbs. 4g. Use mechanical lifting device for odd shaped objects.
	4h. **CONTACT**: Using hand tools to install well casings and materials	4h. Wear cut resistant and leather gloves. 4h, Secure materials on a level surface before cutting 4h. Place hands out of the line of fire 4h. Inspect all tools prior to use and remove damaged tools from service
5. Cleaning the auger flights	5a. **CONTACT:** Cuts/scrapes or puncture wound from contacting rotating auger.	5a. Follow “No Hands” Procedure and make sure auger is out of gear before contacting auger with hands or tool. 5b. When using a cleaning tool, pull across your body with handle away from body; do not push toward the auger. 5b. Do not clean more than ¾ turn around the auger at a time. 5b. Wear cut resistant and leather gloves. 5b. Always use two hands when operating cleaning tool. 5b. Inspect any tool before use and remove from service if handle or metal are cracked/fatigued. 5b. Stand out of the line of fire.
6. Decontaminate equipment.	6a. **EXPOSURE/CONTACT:** To contamination (e.g., contaminated groundwater, vapors).	6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Contain decontamination water so that it does not spill. 6a. Use an absorbent pad to clean spills, if necessary.
	6b. **EXPOSURE**: To chemicals in cleaning solution (including ammonia)	6b. See 5a.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Job Safety Analysis (JSA)
Hollow-Stem Auger Borings/Well Installation

Location	Date Prepared	Revisions	Prepared By
Laboratory Equipment Site, Mooresville, Indiana	1/26/2005	Rev 1: 2/12/15 Rev 2: 3/28/05 Rev 3: 2/12/15	**Roux Associates:** Joe Perse, Tom Henderson, Larry McTiernan, Leo Kurylo **Geosearch:** Geosearch JSA provided by John Stamas

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Steel Toe Boots / Shoes - Safety Glasses with Side Shields - Hard Hat - Fluorescent Safety Vest or High Visibility Clothing	- Leather/ANSI 2 cut-resistant gloves when working with hand tools and/or equipment - Nitrile gloves when handling/working with liquids (i.e. wash water) - 2 - 20 lb fire extinguishers

Job Step	Potential Hazard	Recommended Actions
1. Mobilize to drilling location	1a. Property damage and personal injury from vehicles	1a. Maintaining established speed limits
		1a. Never move rig with mast in upright position
		1a. Equipment must be stowed and secured
		1a. Avoid backing up; Use a spotter and audible signal (horn/ back-up alarm) when backing up vehicles
		1a. Drive on established roads
		1a. Yield to all pedestrians
	1b. Slip/Trip/Fall from uneven terrain, piping, weather conditions, overloading/awkward load, and/or poor housekeeping	1b. Note surface anomalies caused by traffic, existing structures and vegetation
		1b. Use established path and/or access ways, including catwalks, stairs, roads, etc
		1b. Inspect travel path for weather-related hazards (i.e ice, puddles, high water, snow, etc)
		1b. Use mechanical assistance or take multiple trips to carry equipment
	1c. Personal injury by contact from other vehicles	1c. Always face traffic when walking
		1c. Maintain eye contact with on-coming vehicles
2. Secure work area and drill rig set-up	2a. Personal injury and property damage from site traffic	2a. Place traffic cones to re-direct traffic flow around work area and to alert others as to activity taking place
		2a. Authorized personnel in work area
	2b. Property damage and personal injury from utilities	2b. Ensure >20' from mast to overhead utility
		2b. Confirm utility mark-outs have been completed by all parties
		2b. Subsurface Clearance Protocol completed
	2c. Property damage / personal injury from unstable drill rig	2c. Use blocking and leveling devices to secure rig
	2d. Pinch points from moving equipment and making connections	2d. Always wear leather gloves when making connections and using hand tools
		2d. Keep body parts out of moving objects
3. Drilling	3a. Personal injury from rotating parts, pinch points, abrasions, crushing and entanglement	3a. Test all emergency shutdown devices prior to drilling
		3a. Complete drill rig safety checklists
		3a. See 2d above
		3a. Ensure all loose jewelry is removed; loose clothing is secured; PPE is secured close to the body
		3a. "Cat head" rope, winch cables and hoses must be secured away from rotating parts
		3a. Guide auger flights while connecting together auger flights from the middle of the auger; not the ends.
	3b. Hearing loss from noise exposure	3b . Sound level exceeds 85db, put on hearing protection: Rule of Sound: If you are at a normal conversation distance (3') and need to raise voice, put on hearing protection

Job Safety Analysis (JSA) Hollow-Stem Auger Borings/Well Installation			
Location	**Date Prepared**	**Revisions**	**Prepared By**
Laboratory Equipment Site, Mooresville, Indiana	1/26/2005	Rev 1: 2/12/15 Rev 2: 3/28/05 Rev 3: 2/12/15	**Roux Associates:** Joe Perse, Tom Henderson, Larry McTiernan, Leo Kurylo **Geosearch:** Geosearch JSA provided by John Stamas

Personal Protective Equipment	
Minimum PPE Requirements - Steel Toe Boots / Shoes - Safety Glasses with Side Shields - Hard Hat - Fluorescent Safety Vest or High Visibility Clothing	**Additional PPE Requirements** - Leather/ANSI 2 cut-resistant gloves when working with hand tools and/or equipment - Nitrile gloves when handling/working with liquids (i.e. wash water) - 2 - 20 lb fire extinguishers

Job Step	Potential Hazard	Recommended Actions
3. Drilling (cont.)	3c. Muscle strain from heavy lifting and working with equipment	3c. Proper lifting procedures; keep back straight, lift with legs, keep load close to body; never reach or twist with a load
		3c. Do not lift anything over 50 lbs without assistance
		3c. Use drill rig winch when possible to move heavy objects
	3d. Exposure to contaminants; soil, water and vapor	3d. Monitor breathing zone with PID and upgrade PPE per HASP
		3d. Wear nitrile gloves when handling impacted materials
		3d. Store drilling waste in designated area
	3e. Slip/Trip/Fall from poor housekeeping	3e. Group all equipment and waste in one designated area
		3e. If tools not in use, return to storage
		3e. If augers not in use, place either in racks or decon area
		3e. Hose runs should be as direct and short as possible
	3f. Contact with elevated objects, falling objects	3f. Never walk below an elevated or suspended object
		3f. Only use connections with a positive closure to lift augers or related equipment
		3f. Secure drill rig cables and ropes
	3g. Damage to underground structures from drilling activities.	3g. Review and follow Subsurface Clearance Protocol.
4. Observation well and soil sampling	4a. Personal injury from pinch points and abrasions from sampling equipment	4a. Always use leather gloves/cut-resistant when handling split spoons; must have chemical resistant gloves on also
	4b. Contact with contaminants (impacted ground water, product and/or lab preservatives)	4b. Use of nitrile gloves to protect hands; use containment material to protect surrounding areas.
		4b. Always practice contamination avoidance. Handle sample containers with caution to avoid spilling preservatives. Wash affected area immediately if contaminant contact occurs.
	4c. Muscle strain from heavy objects and repetitive motion	4c. Use proper lifting techniques; keep back straight and lift with arms and legs; keep load near body; avoid reaching or twisting
	4d. Slip/Trip/Fall from poor housekeeping	4d. Group all equipment and waste in one designated area
		4d. If tools not in use, return to storage in one designated area
5. Monitoring Well Installation	5a. Cuts and abrasions from saw	5a. Always wear leather and/or kevlar gloves
		5a. Keep body parts out of cutting path
		5a. Keep pipe secured while cutting
	5b. Pinch points from connecting pipe	5b. Always wear leather/cut-resistant gloves
		5b. Keep hands away from threads of pipe
	5c. Muscular strain from carrying well material	5c. Use proper lifting techniques; keep back straight and lift with arms and legs; keep load near body; avoid reaching
		5c. Use mechanical assistance wherever possible
	5d. Inhalation of dust from well material	5d. Position body upwind of monitoring well, and wear dust masks
		5d. Pour material at a rate that will not create dusts

JOB SAFETY ANALYSIS Ctrl. No. GEN-005	DATE 2/4/2015	☐ NEW ☒ REVISED	

JSA TYPE CATEGORY	WORK TYPE:	WORK ACTIVITY (Description):	
Generic	**Gauging and Sampling**	**Gauging and Sampling**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Gina Masciello	Project Scientist	Joe Gentile	Corp H&S Mgr
Louis Goldstein	Staff Engineer	Michael Ritorto	Project Hydrogeologist
		Leo Kurylo	IL-OHSM

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Composite-toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Knee pads, Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

42-inch Safety Cones, Caution Tape, Interface Probe and/or Water Level Meter, 20-lb., Type ABC Fire Extinguisher, Buckets. Tools as needed: Socket Wrench, Screw Driver, Crow Bar, Mallet, and Wire Brush.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization to monitoring well(s).	1a. **FALL:** Personal injury from slip/trip/fall due to uneven terrain and/or obstructions. 1b. **CONTACT:** With traffic/third parties. 1c. **EXPOSURE:** To biological hazards.	1a. Inspect pathway and plan for most suitable designated pathway prior to mobilization. 1a. Use established pathways, walk and/or drive on stable, secure ground and avoid steep hills or uneven terrain. 1a. If working near open water with an unguarded edge, wear life vest. 1b. Identify potential traffic sources and delineate work area with 42-inch traffic safety cones. Position vehicle to protect against oncoming traffic. Use caution tape to provide a more visible delineation of the work area if necessary. 1b. Wear appropriate PPE including high visibility clothing or reflective vest. 1b. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route. 1c. Inspect work area for bees and insects. 1c. Use insect/tick repellent as necessary.
2. Open/close well.	2a. **ERGNOMICS:** Muscle strain. 2b. **CAUGHT:** Pinch/crush points associated with removing/replacing manholes and working with hand tools. 2c. **CAUGHT:** Pinch points associated with placing J-plug back onto PVC pipe. 2d. **EXPOSURE:** To potential hazardous vapors.	2a. Use proper lifting techniques; keep back straight, lift with legs and bend knees when reaching to open/close well. 2b. Wear leather gloves or cut resistant gloves when working with well cover and hand tools. 2b. Use proper tools (ratchet and pry bar for well cover) and inspect before use. 2b. Do not put fingers under well cover. 2c. See 2b. 2c. Keep fingers out of line-of-fire when securing cap 2d. No open flames/heat sources. 2d. To minimize exposure to vapors allow well to vent after opening it and before sampling activities begin. 2d. Stand up-wind, if possible, to avoid vapors.
3. Gauge well.	3a. **CONTACT:** With contamination (e.g. contaminated groundwater). 3b. **CONTACT:** With traffic.	3a. Wear chemical-resistant disposable gloves (over cut-resistant gloves) and safety glasses when gauging well. 3a. Insert and remove probe slowly to avoid splashing. 3a. Use an absorbent pad to clean probe. 3b. See 1b.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
4. Purge and sample well.	4a. **EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors) and/or sample preservatives.	4a. Open and fill sample jars slowly to avoid splashing and contact with preservatives. 4a. Wear cut-resistant gloves and chemical-resistant disposable gloves when sampling. 4a. Fill sample containers over purge container to avoid spilling water onto the ground. 4a. Use an absorbent pad to clean spills. 4a. When using a bailer to purge a well, pull the bailer slowly from the well to avoid splash hazards. 4a. When sampling or purging the water using a bailer, pour out water slowly to reduce the potential for splash hazards with groundwater. 4a. When using a tubing valve always remove the valve slowly after sample collection to release any pressure and avoid pressurized splash hazards 4a. When collecting a groundwater sample always point sampling apparatus (tubing, bailer, etc.) away from face and body.
4. Purge and sample well (Continued).	4b. **CONTACT:** Personal injury from cuts, abrasions, or punctures by glassware or sharp objects. 4c. **ERGONOMICS:** Muscle strain while carrying equipment. 4d. **CONTACT:** With traffic. 4e. **CONTACT**: Pinch points with groundwater pump components (i.e. wheel, line, clamps) 4f. **ERGONOMICS**: Muscle strain from repetitive motion of bailing and sampling a well	4b. To avoid spills or breakage, place sample ware on even surface. 4b. Do not over tighten caps on glass sample ware. 4b. Wear chemical-resistant nitrile disposable gloves over cut-resistant (i.e. Kevlar) gloves when sampling and handling glassware (i.e., VOA vials) or when using cutting tools. 4c. Use proper lifting techniques when handling/moving equipment; bend knees and keep back straight. 4c. Use mechanical assistance or team lifting techniques when equipment is 50 lbs. or heavier. 4c. Make multiple trips to carry equipment. 4d. See 1b. 4e. Wear leather gloves when working with groundwater pumps 4e. Never place hands on or near pinch points such as the wheel, clamps or other moving parts during pump operations 4e. Use correct the correct mechanisms, such as a pump reel, to lower pump into well 4e. Never attempt to manually stop any moving part of equipment including hose reels and/or tubing. 4f. See 4c. 4f. Include a stretch break when repetitive motions are part of the task.
5. Management of purge water.	5a. **EXPOSURE/CONTACT:** To contamination (e.g., contaminated groundwater, vapors). 5b. **ERGONOMICS:** Muscle strain from lifting/carrying and moving containers.	5a. Do not overfill container and pour liquids slowly so that they do not splash. 5a. Properly dispose of used materials/PPE in appropriate container in designated storage area. 5b. Use proper lifting techniques when lifting / carrying or moving container(s) (see 4c.). 5b. Do not overfill container(s).
6. Decontaminate equipment.	6a. **EXPOSURE/CONTACT:** To contamination (e.g., contaminated groundwater, vapors). 6b. **CAUGHT:** Pinch points associated with handling hand tools	6a. Work on the upwind side, where possible, of decon area. 6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Use an absorbent pad to clean spills. 6b. See 2b. 6b. Inspect hand tools for sharp edges before decontaminating

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Job Safety Analysis (JSA) Installation and Sampling of Permanent Sub-slab Soil Vapor Points			
Location	**Date Prepared**	**Revisions**	**Prepared By**
135 E. Harrison St. Mooresville, IN	3/31/2006	Rev. 2: 8/14/2007 Rev. 3: 2/12/2015	**Roux:** Therese Pitterle, Indira Rattiram, Christopher Proce, Noelle Clarke, Leo Kurylo

Personal Protective Equipment

Minimum PPE Requirements	**Additional PPE Requirements**
- Hard Hat - Safety Glasses with Side Shields - Hearing Protection - Steel Toe Boots/Shoes or equivalent - High Visibility Clothing	- Leather gloves when working with hand tools/equipment and when removing/replacing manhole covers - Cut-resistant (i.e., Kevlar) gloves when handling cutting tools - Chemical-resistant disposable gloves when handling/working with liquids/soil

Job Steps	Potential Hazards	Recommended Actions
1. Inform site personnel of work scope and location.	1a. Lack of communication with site personnel could result in an accident (e.g. vehicular) or H&S incident.	1a. Inform site personnel of work scope and location.
		1a. Inquire about other activities taking place at the site.
2. Walk to soil vapor point location.	2a. Personal injury from tripping/falling due to weather conditions and materials/equipment stored at portions of the Site.	2a. Inspect walking path for weather-related hazards (i.e., ice, puddles, snow, etc.) and obstructions prior to mobilizing equipment.
		2a. Do not climb over stored materials/equipment; walk around.
	2b. Muscle strain while carrying equipment.	2b. When carrying equipment to/from work area, use proper lifting techniques; keep back straight, lift with legs, keep load close to body, never reach or twist with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment. Two people are required when lifting objects over 50 lbs or when the shape makes the object difficult to lift.
3. Define and secure the work area.	3a. Personal injury or property damage from other vehicles on-site.	3a. Find out expected retail activity/business schedules and plan work around it if possible.
		3a. Face traffic, maintain eye contact with oncoming vehicles and establish a safe exit route.
		3a. Look both ways in high traffic areas.
		3a. Place at least 3 traffic cones around work area when working in areas with traffic. Utilize a spotter in high traffic areas.
	3b. Exposure to noise hazards due to business activities.	3b. Wear hearing protection as needed.
	3c. Potential to contact subsurface utilities.	3c. Review all relevant site plans, electric floor plans, etc.
		3c. Review all utility locations with retail/business personnel with historic site knowledge to confirm findings.
		3c. Ensure drilling location is > 5 ft from potential utilities.
		3c. Ensure Subsurface Clearance Procedure Checklist has been completed.
4. Install boring through subsurface using hammer drill.	4a. Exposure to noise hazards due to hammer drill.	4a. Wear hearing protection.
	4b. Exposure to concrete dust.	4b. Use water spray or vacuum to suppress dust.
	4c. Personal injury/Pinch points associated with handling hammer drill bits.	4c. Wear leather gloves to protect against pinch points.
		4c. Keep body parts clear of moving parts.
		4c. Inspect all equipment/hand tools prior to use.
		4c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body.
5. Place poly tubing down borehole, seal borehole with bentonite or cement, and install small diameter flush mount well cover.	5a. Potential exposure to vapors migrating to land surface.	5a. Use hydrating bentonite or hydraulic cement to seal borehole and prevent vapor migration.
		5a. No open flames/heat sources.
		5a. Turn cell phone off.
	5b. Pinch points associated with well cover and hand tools.	5b.Wear leather gloves when working with hand tools and well cover. Use proper tools (tube cutter, pry bar, ratchet) and inspect before use. Do not put fingers under well cover.

6. Remove/Replace well cover.	6a. Pinch points associated with well cover and hand tools.	6a. See 5b.
	6b. Personal injury from tripping/falling due to equipment.	6b. Keep tools and equipment in a designated area. When not in use, tools and equipment must be returned to their proper storage location. Keep work area clear of obstructions.
		6b. Avoid stepping over equipment.
	6c. Overhead hazards.	6c. Check for overhead hazards before standing, such as shelving, piping, etc.
	6d. Contact with contamination (e.g., contaminated vapors/tubing).	6d. Properly dispose of used materials/PPE in designated waste storage area.

JOB SAFETY ANALYSIS Ctrl. No. GEN-013		DATE: 01/16/2015	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY: **GENERIC**	WORK TYPE **Gauging and Sampling**	WORK ACTIVITY (Description) **Soil Vapor Sampling (Permanent Monitoring Points)**		
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**	
Jeff Wills	Project Hydrogeologist	Daniel Abberton	SHSM	
		Mike Ritorto	Senior Hydrogeologist	
		Leo Kurylo	IL-OHSM	

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Steel-toe boots or equivalent	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Cut-resistant & Nitriles ☒ OTHER: Insect Repellant, Sun Screen, Knee Pads or kneeling pad

REQUIRED AND / OR RECOMMENDED EQUIPMENT

9/16” Socket and Wrench, Non-Toxic Clay/Plumbers Putty, Teflon-Lined Tubing, Masterflex Tubing, 3-Way Stopcock, Air Pump with Low Flow adapter, Dry Cal calibration unit, Enclosure (Bucket with 2 holes and surface seal), Helium Gas Canister, Summa Canisters and Flow Controllers, MultiRae Gas Meters, CO2/O2 Meters, Helium Detector, Tubing Cutter, 42-inch Safety Cones, Caution Tape or Retractable Cone Bars

Exclusion Zone: Maintain a 5-Foot Exclusion Zone for Non-Essential Personnel

ACCESS [1]JOB STEPS	ANALYZE [2]POTENTIAL HAZARDS	ACT [3]CRITICAL ACTIONS
1. Define and secure work area.	1a. **FALL:** Potential tripping hazards. 1b. **CONTACT:** Potential contact with moving vehicles or pedestrians. 1c. **OVEREXERTION:** Muscle strain while lifting and carrying equipment.	1a. Ensure work area is secure and inform others (third party) of work activity. 1a. Remove tripping hazards and inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. If working alongside roads, look both ways before entering roadways, face traffic, and utilize work vehicle to protect employees. 1b. Delineate work area (including vehicles) with traffic safety cones and caution tape or retractable cone bars. 1b. Maintain a 5 foot exclusion zone. 1b. Wear high visibility clothing or reflective safety vest. 1c. When carrying equipment to/from work area, keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced. Use mechanical assistance/make multiple trips to carry equipment.
2. Remove well cover / close well cover.	2a. **CONTACT/CAUGHT:** Pinch points and scrapes associated with hand tools and well covers. 2b. **FALL:** Potential tripping hazards associated with installing bolts. 2c. **OVEREXERTION:** Physical exertion to remove bolts that were over torque or stripped.	2a. Keep hands away from pinch points. 2a. Use hand tools with extensions to remove and replace well covers. 2a. Wear cut-resistant gloves. 2a. Use knee pads or kneeling mat when repetitive kneeling on rough ground is anticipated. 2b. Place security bolts in secure location so not to create tripping hazards. Replace security bolts so that they fit flush with monitoring well covers. 2c. Replace any security bolts that show signs of stripping. Do not over tighten. 2c. Use body positioning and bending techniques that minimize muscle strain; keep back straight, bend at the knees. 2c. See 2a.
3. Remove / replace brass caps at the end of the sample tubing.	3a. **CONTACT:** Pinch points associated with hand tools and brass caps. 3b. **EXPOSURE:** Potential pathway for vapors to migrate to land surface.	3a. Use wrench to remove and replace brass caps. 3a. Wear cut-resistant gloves to protect against pinch points and scrapes. 3b. Replace brass caps immediately upon completion to avoid soil vapors migrating to the surface through sample tubing. 3b. Stand up wind of sample point location.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – Electricity, pressure, tension/compression, torque.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

ACCESS [1]JOB STEPS	ANALYZE [2]POTENTIAL HAZARDS	ACT [3]CRITICAL ACTIONS
4. Set up soil vapor sampling equipment and calibration of meters.	4a. **FALL:** Potential tripping hazards associated with equipment and tubing. 4b. **CONTACT:** Pinch points associated with handling equipment. 4c. **EXPOSURE:** Inhalation of calibration gas and helium.	4a. Place equipment in one area close to the sampling location. 4a. Keep tubing slack to a minimum and locate the summa canister as close to the sampling location as possible. 4a. Avoid stepping over equipment and tubing. 4b. Do not place fingers/hands under sampling equipment. 4b. Make multiple trips when unloading equipment in work area. 4b. Wear cut-resistant gloves to protect against pinch points while handling sampling equipment. 4c. Review SDS for each type of calibration gas used before calibrating. 4c. Calibrate meters in a well vented area and keep air flow regulator away from face. 4c. Close valve on canisters after use to avoid inhalation of excess helium or calibration gas. 4c. Stand up wind of bucket during helium tracer gas test.
5. Screen sample tubing with multiple gas and CO_2/O_2 meters.	5a. **FALL:** Potential tripping hazards associated with equipment. 5b. **EXPOSURE:** Inhalation of soil vapor	5a. See 4a 5a. Identify area where equipment is to be stored within the work area (away from main walking path). 5a. Don’t leave equipment on the ground. Return equipment to storage area between uses. 5b. See 3b. 5b. Use master flex to connect tubing to meter. 5b. Stand on opposite side of meter vent and upwind of soil vapor point during screening activities.
6. Cleaning Work Area.	6a. **FALL:** Potential tripping hazards associated with equipment and tubing. 6b. **CONTACT:** Storing and transport of equipment in car.	6a. See 4a. 6a. See 5a. 6b. Ensure that equipment is placed securely in the vehicle. Do not stack equipment on top of each other. Secure equipment so that it will not slide while being transported. 6b. Wear cut-resistant gloves while handling/loading equipment.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – Electricity, pressure, tension/compression, torque.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

JOB SAFETY ANALYSIS
FOR ENHANCED REDUCTIVE DECHLORINATION AMENDMENT INJECTION

By: Steve Markesic/Redox Tech Reviewed by: Leo Kurylo/Roux IL-OHSM (2-12-2015)

Principal Steps	Potential Hazards	Controls/Critical Actions
• Add appropriate amount of water and ZVI to be mixed with ABC • Mix chemicals with water • Attach injection hose to injection point • Inject ERD Amendment • Decontaminate equipment	• Fueling generator (if required) • Compressed air • Hydraulic line breakage • High-speed machinery • Flying debris • Biological hazards • Chemical exposure during leaks or filling system • Exposure to ZVI dust • Slip/trip hazard • Underground utilities • Noise	• Fueling and fuel storage will be in area free of vegetation and debris with proper signage • Properly maintain equipment in working order • Employ the buddy system, look out for co-workers • Keep tools and equipment off the ground, and stored in a designated area • Use of insect repellant as needed • Modified Level D PPE (hearing protection, safety glasses, splash shields, hearing protection, tyvek suit, boot covers) • Use dust masks when handling ZVI • Inspect walking path for uneven terrain, steep hills, obstructions, and/or weather-related hazards (i.e., ice, snow, and puddles) prior to mobilizing equipment. Use established pathways. Walk on stable/secure ground whenever possible. • Utility locates prior to commencing work
Equipment To Be Used	**Inspection Requirements**	**Training Requirements**
• High-pressure injector • Air compressor • Grout Pump	• All safety guards on the equipment will remain in place • Lockout/tag out Standard Operating Procedures will be followed when servicing equipment. • Site inspections will be made to identify and mark slip-trip, biological, and other hazards, which may be found at the site • Site inspection for underground utilities	• Minimum of 40-hour Hazardous Waste Operations and Emergency Response and site-specific hazard communication training • All site personnel will be trained in the safe use of specific equipment and in personal protective equipment required to perform their job • Only trained and qualified personnel will operate the injection or grout unit and handle chemicals

JOB SAFETY ANALYSIS
FOR DIRECT PUSH TECHNOLOGY & AMENDMENT INJECTIONS

By: Steve Markesic/Redox Tech   Reviewed by: Leo Kurylo/Roux IL-OHSM (2-12-2015)

Job Step	Potential Hazard	Controls/Critical Actions
Forms/Permits	Unknown client-specific hazards.	• Well installation or abandonment notification. • Dig/drill clearance obtained. • Class V Injection Permit (if required)
Pre-Work Activities	Striking underground utilities	• Underground utility surveying and marking will be conducted as specified in the Subsurface Clearance Protocol • Daily safety briefing.
Pre-Work Activities	Striking overhead utilities	• Locate and take appropriate precautions with required distances from power lines. • Lower mast and secure during travel.
Site Setup	Physical environmental hazards	• Use of appropriate personal protective equipment where required. Safety boots, hard hats, safety glasses and hearing protection are mandatory. Respirators when chemical hazards exist. No loose-fitting clothing, rings, watches, etc.; long hair to be restrained close to the head.
Site Setup	Dermal or inhalation exposure to contaminants	• Investigate history of area; determine nature and degree of contaminants that could be present. • Conduct air monitoring for potential hazardous atmospheres as described in the project's written safety plan (if required). • Use respirators and other PPE as prescribed in the project's written safety plan.
Site Setup	Fire	• No smoking around the drill rig. • Fire extinguisher will be available on drill rig at all times
Site Setup	Struck by vehicles	• Wear high-visibility/reflective vests as needed.
Site Setup	Drill rig travel	• Ensure stable ground and adequate footing for machinery. Adequate ground preparation to support loads. • Drill rig travel will be conducted with mast secured in its lowered position. • Tools and equipment secured prior to rig movement. • Only personnel seated in cab are to ride on the rig vehicle. • Ensure clearance of overhead power lines. • Use alarm or spotter when reversing rig.
Drilling Activities	Rotating machinery parts of drill rig	• Daily inspection of drill rig & equipment. • Ensure appropriate guards are installed or suitable barriers to forewarn personnel of dangers. • Personnel clear during set up and clear of rotating parts. • Loose clothing, long hair, and jewelry to be safely secured. • Kill switch installed, clearly identified and verified as operational. • Rig placed in neutral when operator not at controls. • Pressurized lines and hoses secured from whipping hazards with whip checks.
Drilling Activities	Falls while performing maintenance on mast	• Use fall protection whenever working over 6 feet. • Only trained workers may use fall protection.
Drilling Activities	Hoisting operations	• Ensure all personnel are clear of operation to a suitable safe distance (minimum 10').
Drilling Activities	Overturning of drill rig	• Establish drill pad if necessary. • Drill rig level and stabilized.
Drilling Activities	Damage underground utilities	• Exposed underground utility lines supported. • Daily briefing.

Job Step	Potential Hazard	Controls/Critical Actions
Drilling Activities	Striking hazardous materials	• Implement suitable safety procedures for the nature of the hazard. • Smoking prohibited around drilling area. • Use of PPE as required. • Daily safety briefing.
Drilling Activities	Failure of drill rig components	• Defective components repaired prior to return to service. • Lockout/tag-out procedures used prior to maintenance. • Good housekeeping on and about the rig.
Drilling Activities	Driving equipment into excavation	• Warning/identification system used to remind equipment operators of injection points.
Drilling Activities	Weather	• Drill rig not to be operated in severe inclement weather such as lightning storms, high winds, or severe rain. Mast to be lowered in these conditions.
Drilling Activities	Exposure to dust	• Fugitive dust will be suppressed as needed, and dust masks will be worn if fugitive dust is present.
Drilling Activities	Exposure to airborne contaminants	• Potential hazardous atmospheres tested prior to entry. • Air monitoring conducted per project's written safety plan for hazardous atmospheres. • Rescue equipment provided where potential for hazardous atmospheres exists. • Ventilation used to control hazardous atmospheres and air tested frequently. • Appropriate respiratory protection used when ventilation does not adequately control hazards.
Drilling Activities	Improper disposal of waste	• Waste disposed of according to project's written safety plan and regulations.

APPENDIX G

Community Relations Plan

Voluntary Remediation Program Community Relations Plan
Indiana Machine Works
135 East Harrison Street, Mooresville, IN
VRP # 6051201

In accordance with VRP guidance (as stated in IC 13-25-5-7) a Community Relations Plan has been prepared for the referenced project. The following summarizes the basic components requested by the IDEM in the non-rule policy document "*Voluntary Remediation Program Community Relations Plan*", adopted April 20, 2001.

I. *Identify all property owners and property occupants, which include property owners or occupants affected or likely to be affected by the contamination that is the subject of the proposed Voluntary Remediation Project and all owners or occupants of adjacent or closely proximate land.*

Address	Property Owner	Identified Occupants
135 East Harrison Street	Indiana Technology Development	Indiana Machine Works, LLC
155 East Harrison Street	Pat Clark	Pat Clark
205 East Harrison Street	Samuel Pugh	Patricia Goss (tenant)
207 East Harrison Street	Samuel Pugh	Janice Jacobs (tenant)
209 East Harrison Street	Sharon Martin	Sandra Eason (tenant)
211 East Harrison Street	Sharon Martin	Jessie Rose (tenant)
50 South Madison Street	Mayfield Insurance	Mayfield Insurance
117 South Madison Street	Samuel Pugh	Steve Russell (tenant)
118 South Madison Street	John Clark	John Clark (business)
124 East High Street	Robert Bingham	Power Wash

II. *Identify all known or registered neighborhood organizations serving the location of the Voluntary Remediation Project, if any.*

Based on personal communications with neighborhood residents and the City of Mooresville Police Department, no neighborhood organizations serving the location were identified.

III. *Identify all known or reasonably apparent sensitive community institutions within two (2) miles, including, but not limited to schools, health care facilities, child care facilities, senior citizen residential or care facilities and the administrative office or owner of parks and playgrounds.*

Community Institution	Mailing Address	Distance from Site
Mooresville High School	550 N. Indiana Street	0.6 miles
Neil Armstrong Elementary School	1000 State Road 144	0.8 miles
Newby Memorial Elementary School	240 N. Monroe Street	0.5 miles
Northwood Elementary School	630 N. Indiana Street	0.7 miles
Paul Hadley Junior High School	200 W. Carlisle Street	0.6 miles
St. Francis Hospital	1201 Harley Road	0.7 miles
A Place to Grow, LLC	350 Southbridge Street	0.7 miles
Children's Park Child Care Center	310 E. South Street	0.3 miles
Christian Children's Playhouse	430 St. Clair Street	0.6 miles
Learn-A-Lot Christian Playschool	12150 N. Rooker Road	0.8 miles
Mooresville Family Resource	6 E. Moore Street	0.5 miles
Mooresville Parks & Recreation	1101 Indianapolis Road	1.2 miles

IV. Include a sample of a written notice to be sent to the property owners and property occupants, neighborhood organizations, and sensitive community institutions.

This notice is being provided to inform you of the presence of a site in your neighborhood that has been accepted into IDEM's Voluntary Remediation Program. This notice is a requirement of a Community Relations Plan, which has been developed by the Applicant and is a component of the Remediation Work Plan that is available for review at the repository listed below. The Community Relations Plan includes provisions for notifying all neighborhood property owners and occupants, neighborhood organizations and other local entities. In addition, the Community Relations Plan may require the applicant to post an informational sign at the subject property. For additional information about the Community Relations Plan and the Remediation Work Plan please review the documents in the repository or contact Mr. Damon Ridley at (317) 234-0972.

Remediation activities to be performed at the site include the excavation and off-site disposal of contaminated soil, and the extraction and treatment of impacted groundwater.

A public comment period concerning site remediation activities is scheduled. Concerned parties are encouraged to contact either Mr. Damon Ridley or Mr. Jeff O'Keefe with comments.

Public Repositories

Mooresville Public Library
220 West Harrison Street
Mooresville, IN 46158

Project Managers

Jefferie O'Keefe, CHMM
Troy Risk, Inc.
7466 Shadeland Station Way
Indianapolis, IN 46256
jokeefe@troyrisk.com
(317) 570-6730

Mr. Damon Ridley
Indiana Department of Environmental Management
Indiana Government Center-North
100 N. Senate Ave.
Indianapolis, IN 46204
(317) 234-0972

V. Provide the name(s) and mailing address(es) of all affected local governmental units with jurisdiction within one (1) mile of the property affected by the proposed Remediation Work Plan.

City of Mooresville – Board of Public Works
4 East Harrison Street
Mooresville, IN
(317) 831-9547

Brown Township Fire Department
53 Indianapolis Road
Mooresville, IN
(317) 831-7443

Morgan County Health Department
180 South Main Street, Suite 252
Martinsville, IN
(765) 342-6621

VI. *Provide the name(s) and mailing address(es) of the newspaper(s) or other appropriate circulars in which notice of the public comment period will be published.*

Mooresville Decatur Times
23 East Main Street
Mooresville, IN

VII. *Identify the location of the public library and other public repositories in which a copy of the proposed Remediation Work Plan will be placed. The proposed Remediation Work Plan must be placed in the public library closest to the site and in the county or counties affected by the project. If more than one repository is selected, the participant shall provide one additional copy of the proposed Voluntary Remediation Work Plan for each additional repository.*

Mooresville Public Library
220 West Harrison Street
Mooresville, IN

VIII. *In, addition, VRP Participants shall post a sign that:*

a. identifies the location as a VRP cleanup site;
b. gives the IDEM VRP site number, the VRP phone number and the VRP web site address;
c. shall meet the following criteria;
  i. be visible/readable from 20 feet;
  ii. be in English and the language predominantly used in the neighborhood if other than English; and
  iii. place one sign per site access point; and
d. shall be posted starting with the end of the public comment period for the Remediation Work Plan, before any work begins and remain posted until the Covenant Not To Sue has been issued.

<u>Signage Text</u>
The property at 135 East Harrison Street is currently undergoing cleanup under the supervision of the IDEM's Voluntary Remediation Program (VRP # 6051201). Information concerning the Voluntary Remediation Program can be obtained at www.in.gov/idem/4127.htm, or by calling (317) 234-0966 or toll free at (800) 451-6027.