



## **REMEDIAL ACTION PRECONSTRUCTION REPORT FOR SITE SOILS**

**FORMER ROBERT BOSCH TOOL CORPORATION  
BOONE DIVISION  
BOONE, NORTH CAROLINA  
NONCD0001139**

**August 2016**

**Prepared For:**

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**Amec Foster Wheeler Project 6251161020.01.02**

**August 18, 2016**

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Ms. Janet MacDonald  
Inactive Hazardous Sites Branch  
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North Carolina Department of Environment and Natural Resources  
217 West Jones Street  
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Subject: **Remedial Action Preconstruction Report for Site Soils  
Robert Bosch Tool Corporation  
NONCD0001139  
Boone, Watauga County, North Carolina  
Amec Foster Wheeler Project 6251121020.01.02**

Dear Ms. MacDonald:

In accordance with III.E of the Administrative Agreement for Registered Environmental Consultant-Directed Assessment and Remediation pursuant to N.C.G.S. 130A-310.9(c) and 15A NCAC 13C .0300, Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) is pleased to submit this Remedial Action Preconstruction Report for Site Soils for the subject site.

Sincerely,

**Amec Foster Wheeler**

  
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## LIST OF ACRONYMS

Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
bgs	below ground surface
Cis-1,2-DCE	cis-1,2-dichloroethene
1,1-DCA	1,1-dichloroethane
DPT	direct push technology
ft <sup>2</sup>	square feet
FID	flame-ionization detector
HASP	Health and Safety Plan
hp	horsepower
IDW	investigative-derived waste
IHSB	Inactive Hazardous Sites Branch
in. H <sub>2</sub> O	inches of water
in. Hg	inches of mercury
ISCO	In Situ Chemical Oxidation
µg/kg	microgram per kilogram
mg/kg	milligram per kilogram
MACTEC	MACTEC Engineering and Consulting, Inc.
NCDEQ	North Carolina Department of Environmental Quality
O&M	operation and maintenance
P&ID	Piping and Instrumentation Diagram
PCE	tetrachloroethene (perchloroethylene)
PCR	Preconstruction Report
PID	photo-ionization detector
POG	Protection of Groundwater
ppm	parts per million
psi	pounds per square inch
PSRG	Preliminary Soil Remediation Goal
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RA	Remedial Action
RAP	Remedial Action Plan
RAPR	Remedial Action Progress Report
RAPCR	Remedial Action Preconstruction Report

### LIST OF ACRONYMS - Continued

RBTC	Robert Bosch Tool Corporation
REC	Registered Environmental Consultant
RI	Remedial Investigation
RSL	Regional Screening Level
SB	soil boring
scfm	standard cubic feet per minute
SVE	Soil Vapor Extraction
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene
UIC	underground injection control
USEPA	United States Environmental Protection Agency
V	Volt
VAC	Vermont American Corporation
VOC	volatile organic compound

## 1.0 INTRODUCTION

This Remedial Action Preconstruction Report (RAPCR) for Site Soils was prepared by Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) on behalf of Robert Bosch Tool Corporation (RBTC) to address soil impacts at the RBTC, Former Boone Division (the “site”) located in Boone, Watauga County, North Carolina (**Figure 1.1**). The purpose of this document is to:

- 1) Present the final soil remediation design including procurement of applicable permits and approvals;
- 2) Provide documentation to the North Carolina Department of Environmental Quality (NCDEQ) in the event of an audit; and
- 3) Document the final design for the public record.

### 1.1 SITE LOCATION AND HISTORY

The subject site is situated on a 6.82-acre tract of land located on the south flank of a hillside. The latitude and longitude for the site are North 36° 12' 22.79" and West 81° 39' 49.04". The property is developed with a one-story brick 96,709-square feet (ft<sup>2</sup>) former tool manufacturing facility and associated driveways and parking areas. Access to the site is from two asphalt drives that extend from State Farm Road. The site is bounded by State Farm Road to the north, by multi-family residential and institutional buildings to the south and east, and undeveloped woodlands to the west. The site layout is depicted on **Figure 1.2**.

Vermont American Corporation (VAC) originally constructed the facility in 1964, and it is currently located in a variable land-use urban area containing industrial/commercial property, residential housing, and undeveloped property. No information is available for the status of the site prior to 1964, but it is assumed that the property was undeveloped. While in operation, the facility primarily manufactured saw blades, lathe turning tools, and cut-off wheels. Tool manufacturing processes included precision machining, degreasing, metal surface preparation, black oxide coating, heat treating, and painting. Chrome plating occurred at the site from 1965 to 1980. Vapor degreasing was reportedly conducted using 1,1,1-trichloroethane (1,1,1-TCA) and trichloroethene (TCE) as the cleaning solvents in one Detrex solvent vapor degreaser unit.

Hazardous waste generated from the tool manufacturing process was accumulated adjacent to the facility at the southeast corner of the building. The hazardous waste accumulation area was under cover in a fenced area and included a secondary containment berm.

The former tool manufacturing facility was in operation from 1965 until May 1991. The site was subsequently sold to Blue Sky Development, Inc. after its closure in 1991 with VAC retaining environmental liability for the site. Currently, the facility is occupied by Blue Skies Storage, which uses it as a transfer and storage warehouse. VAC was acquired by a joint venture between Robert Bosch Corporation (currently Robert Bosch, LLC) and Emerson Electric in December 1989. Effective January 1, 2003, VAC joined with S-B Power Tool Corporation to become RBTC; therefore, the site is currently known as RBTC, Former Boone Division.

RBTC entered into an Administrative Agreement for Registered Environmental Consultant-Directed Assessment and Remedial Action with the North Carolina Department of Environmental Quality (NCDEQ), Division of Waste Management, Inactive Hazardous Sites Branch (IHSB), Registered Environmental Consultant (REC) program, effective September 25, 2008, pursuant to NCGS 130A-310.9(c) and 15A NCAC 13C .0300.

## 1.2 PREVIOUS INVESTIGATION ACTIVITIES SUMMARY

Historical environmental investigations including Phase I, Phase II, and Phase III environmental assessments that were conducted at the site in the early 1990s are summarized in Section 1.2 of the Remedial Investigation (RI) Report (Amec Foster Wheeler, 2011). Also described in Section 1.2 of the RI Report is corrective action for groundwater that was initiated with the completion of a Corrective Action Plan for groundwater in 1993.

For the site RI, Amec Foster Wheeler conducted additional assessment and delineation activities to further evaluate findings from the historical site environmental investigations. The scope of work for the RI included collecting soil, groundwater, sediment, surface water, and indoor air quality samples. The Phase I RI was conducted during July and August 2011 to delineate the vertical and horizontal extent of contamination. During this phase, 49 borings were advanced for soil sampling; eight surface water and sediment samples were collected from the unnamed tributaries to Boone Creek and Winkler Creek; and four new permanent monitoring wells (MW-12D, MW-20, MW-20D, and MW-21) were installed on site. Groundwater samples were collected from 28 on- and off-site monitoring wells. Five indoor air samples were also collected. The results of the Phase I RI were summarized in the *Remedial Investigation Report* that was certified and submitted to the REC Program on September 23, 2011 (Amec Foster Wheeler, 2011). Soil boring and groundwater monitoring well locations are shown on Figure 1.7 in the *Proposed Remedial Action Plan for Site Soils* (Amec Foster Wheeler, 2016).

The results of the Phase I RI indicated that RI activities were essentially complete, with the following exceptions:

- vertical delineation was not complete in the southeastern portion of the site (in the vicinity of monitoring wells MW-12 and MW-12D), and
- lateral and vertical delineation was not complete at off-site locations due to a lack of access provided by off-site property owners.

As a result, Phase II RI activities were conducted incrementally between February 2012 and December 2013 as off-site access was obtained. During February and March 2012, Amec Foster Wheeler advanced eight additional soil borings (SB-50 through SB-57) in the southern and southeastern portion of the site property, installed seven temporary monitoring wells, installed six permanent overburden monitoring wells (MW-22 through MW-27), installed one deeper bedrock monitoring well (MW-12DD), and collected a second round of indoor air quality samples within the on-site building. The results of the Phase II RI activities conducted during February and March 2012 were summarized in the *Additional Remedial Investigation and Quarterly Groundwater Monitoring Report – First Quarter 2012* (Amec Foster Wheeler, 2012) that was certified and submitted to the REC Program on November 6, 2012.

The soil samples collected from the eight additional soil borings were field screened for organic vapors using a photoionization detector (PID); however, the soil samples were not submitted for laboratory analysis. Subsequent to field screening, four of the soil borings were converted to permanent monitoring wells: MW-22 (SB-56), MW-23 (SB-51), MW-24 (SB57), and MW-25 (SB-55). The results of the February and March 2012 investigation activities indicated that the extent of soil contamination was defined to the extent practicable and that no additional indoor air quality sampling was necessary. However, the groundwater contaminant plume was not vertically delineated within the MW-12 well cluster or horizontally delineated on off-site properties south of monitoring wells MW-8/MW-8D and MW-21 or east/southeast of the MW-12 well cluster (due to lack of off-site access).

Following a lengthy process to obtain access to properties owned/operated by Appalachian State University and Ivy Terrace Apartments, additional Phase II RI activities were conducted. Seven overburden wells (MW-28 and MW-30 through MW-35), one additional deeper bedrock well (MW-12D3), and two additional upper bedrock wells (MW-29D and MW32D) were installed between January and June 2013. The results of these activities were certified and submitted to the REC Program on September 24, 2013 in the *Remedial Investigation Addendum #2* (Amec Foster Wheeler, 2013a). Based on the results of these additional Phase II RI activities, and during preparation of the *Proposed Remedial Action Plan for Groundwater* (Amec Foster Wheeler, 2013b), several additional data gaps were identified that warranted further investigation prior to the final completion of site RI activities. These data gaps included:

- Off-site delineation of volatile organic compounds (VOCs) and 1,4-dioxane in groundwater southeast of wells MW-33 and MW-32D,
- On-site evaluation of VOCs in surface soil (0.5 to 5 feet below ground surface [bgs]) east of borings SB-48 and SB-49, and
- On-site evaluation of 1,4-dioxane in soil.

Closure of the aforementioned data gaps was completed via installation of two additional monitoring wells (MW-36 and MW-36D) and the completion of 22 soil borings (SB-50D through SB-71D) in December 2013. Because soil borings completed in February 2012 also used the boring identifications of SB-50 through SB-57, these December 2013 soil borings were given a “D” suffix to distinguish between the two sets of borings and also to denote analysis for 1,4-dioxane using United States Environmental Protection Agency (USEPA) Method 8260 with Selective Ion Monitoring (SIM). The first quarterly post-remediation groundwater monitoring event for the site was also conducted in December 2013 and included 23 monitoring wells. Based on the results of the December 2013 Phase II RI activities, the delineation of site-specific constituents of concern (CoCs) in various media was considered complete.

The RI was subsequently certified and submitted as complete on July 9, 2014 as documented in the *Remedial Investigation Addendum #3 and First Post-Remediation Groundwater Monitoring Event* (Amec Foster Wheeler, 2014). Quarterly monitoring of groundwater quality was recommended to be conducted as described in Section 4.3.1 in the Proposed Remedial Action Plan (RAP) for Groundwater along with the addition of monitoring wells MW-32D and MW-33 to provide enhanced downgradient plume definition in the upper bedrock and overburden aquifers, respectively. In the *Remedial Action Progress Report - 4<sup>th</sup> Quarter 2014* (Amec Foster Wheeler, 2015), semi-annual groundwater monitoring was recommended to be conducted starting in 2015.

### 1.3 REMEDIAL ACTION PLAN

Based on the results of the certified RI, Amec Foster Wheeler submitted a Proposed Remedial Action Plan (RAP) for Site Soils, in accordance with the requirements of the NCDEQ, IHSB, REC Program, on March 17, 2016. Pursuant to REC Program rules, a public notice of the RAP was sent to interested parties via certified mail on March 29, 2016. The public comment period ended on May 5, 2016, and no verbal or written comments were received. On May 5, 2016, Amec Foster Wheeler received notification via electronic mail from the REC Program that no comments had been received and that the Proposed Remedial Action Plan Completion Certification form (WPC-III) could be completed, certified, and submitted to the REC Program. The Proposed Remedial Action Plan Completion Certification as well as the Responsible Party Document Certification Statement (DC-I) and the Registered Site Manager Document Certification Statement (DC-II) were submitted to the REC Program via electronic mail on May 19, 2016. The REC Program staff acknowledged receipt in an email dated May 20, 2016.

Based on the results of the RI, it was determined that soils at the site were impacted by release(s) of VOCs and to a lesser extent by cyanide. Subsequent sampling activities conducted at the site in 2015 as part of the Proposed RAP for Site Soils preparation, sampling activities determined that portions of site soils were also impacted by 1,4-dioxane. Although 1,4-dioxane is a VOC, for the purposes of the Proposed RAP for Site Soils, 1,4-dioxane was discussed separately from the other site-related VOCs because its inherent characteristics including low volatilization (low Henry's constant), high solubility (miscible), and lower affinity for sorption made remediation options considered for this compound different from the other site-related VOCs. The total area of site soils impacted by VOCs, 1,4-dioxane, and cyanide is estimated to be 6,855 ft<sup>2</sup>. The approximate areal extent of cyanide-, VOC-, and 1,4-dioxane-impacted site soils are shown in **Figure 1.3**, **Figure 1.4**, and **Figure 1.5**, respectively.

The objective of the Proposed RAP for Site Soils was to identify, evaluate, and compare remedial alternatives that would cost-effectively reduce the concentrations of site-related CoCs in soils in order to achieve the site remedial action objectives (RAOs). The CoCs identified for site soils are:

- VOCs including 1,1,1-TCA, 1,1-dichloroethane (1,1-DCA), tetrachloroethene (PCE), TCE, cis-1,2-dichloroethene (cis-1,2-DCE), vinyl chloride (VC), ethylbenzene, total xylenes, and naphthalene;
- 1,4-dioxane; and
- Cyanide.

Site-specific RAOs include:

- Protection of human health and the environment through the treatment of soil CoCs that exist above their respective Residential Preliminary Soil Remediation Goals (PSRGs);
- Minimize further degradation of groundwater quality through treatment of soil CoCs that exist above their respective Protection of Groundwater (POG) PSRGs; and
- Implement remedial action in accordance with applicable laws and regulations.

The future use of the site is unknown; however, unrestricted land use standards for soils are being sought at this time. The April 2016 *Inactive Hazardous Sites Branch, Preliminary Soil Remediation Goals (PSRG) Table* (NCDEQ, 2016) provides the final remediation goals for site soils, unless otherwise specified at a later date.

In order to identify the final remediation goals for soil at the site, the site-specific CoCs were listed, along with their respective Residential PSRGs and their respective POG PSRGs as shown below.

Constituent	Adjusted PSRG (mg/kg)	Residential PSRG (µg/kg)	POG PSRG (µg/kg)
1,1,1-TCA	-----	640,000	<b>1,200</b>
1,1-DCA	-----	3,600	<b>30</b>
PCE	-----	16,200	<b>5</b>
TCE	-----	820	<b>18</b>
Cis-1,2-DCE	-----	32,000	<b>360</b>
VC	-----	59	<b>0.19</b>
Ethylbenzene	-----	<b>5,800</b>	8,100
Total Xylenes	-----	116,000	<b>6,000</b>
Naphthalene	-----	3,800	<b>210</b>
1,4-Dioxane	-----	5,300	<b>12</b>
Total Cyanide	<b>2.7</b>	0.54 mg/kg	14 mg/kg

Note: µg/kg = micrograms per kilogram  
mg/kg = milligrams per kilogram  
**Bold** values indicate final remediation goals

As shown above, for nine of the CoCs (1,1,1-TCA, 1,1-DCA, PCE, TCE, cis-1,2-DCE, VC, total xylenes, naphthalene, and 1,4-dioxane), their POG PSRGs are less than their corresponding Residential PSRGs by at least an order of magnitude. Therefore, for these nine constituents, their respective POG PSRGs were identified as the final remediation goals for site soils.

For the remaining two constituents, ethylbenzene and cyanide, their Residential PSRGs are less than their corresponding POG PSRGs as shown in the above table. As a result, their Residential PSRGs were initially identified as the final remediation goals for site soils. However, according to the NCDEQ REC Guidance, Appendix E.2 (NCDEQ, 2015), the Residential PSRGs may be adjusted based on the type of health effects each evaluated constituent has and the number of site constituents that have each type of health effect (i.e., carcinogenic or non-carcinogenic).

In accordance with the NCDEQ REC Guidance, the USEPA Regional Screening Level (RSL) Summary Tables (USEPA, 2015) were reviewed to identify the type of health effects for both ethylbenzene and cyanide. Ethylbenzene has both carcinogenic and non-carcinogenic health effects, however, its Residential PSRG (5.8 mg/kg) is based on its carcinogenic health effects, and this Residential PSRG is several orders of magnitude less than its non-carcinogenic RSL (3,400 mg/kg). Therefore; the Residential PRG of 5.8 mg/kg (5,800 µg/kg) based on carcinogenic health effects was identified as the final remediation goal as shown in the above table. Cyanide has only non-carcinogenic health effects. Because cyanide is the only non-carcinogenic Residential PSRG being used as a soil remediation goal for the Site, it can be adjusted from being

based on a hazard quotient of 0.2 to being based on a hazard quotient of 1. As a result, the Residential PSRG for cyanide (0.54 mg/kg) listed in the April 2016 IHSB PSRG table (NCDEQ, 2016) was multiplied by 5 to derive an Adjusted Residential PSRG for cyanide of 2.7 mg/kg. The Adjusted PSRG of 2.7 mg/kg was identified in the Proposed RAP for Site Soils as the final remediation goal for cyanide in site soils as shown in the foregoing table.

Evaluation of potential remedial alternatives focused on active technologies specifically targeting the VOCs, 1,4-dioxane, and cyanide present in site soils. Three remedial alternatives were subsequently evaluated in the Proposed RAP for Site Soils and included: 1) surface soil excavation, subsurface soil in situ chemical oxidation (ISCO) injection, and soil vapor extraction (SVE); 2) surface soil ISCO blending, subsurface soil ISCO injection, and SVE; and 3) surface and subsurface soil ISCO injection and SVE.

In the Proposed RAP for Site Soils, surface soils were defined from 0 to 5 feet bgs, and subsurface soils were defined as greater than 5 feet bgs. Each alternative was evaluated independently, then compared to each other and preferentially ranked in accordance with the eight criteria outlined in 15A NCAC 13C .0306(l)(3)(A) through (H). Based on the remedial alternatives evaluation, the most cost effective and readily implementable alternative, surface and subsurface soil ISCO injection and SVE, was recommended for implementation.

## 2.0 FINAL ENGINEERING DESIGN REPORT

Amec Foster Wheeler proposes to conduct remediation of impacted site soils in accordance with the requirements specified in 15A NCAC 13C.0306 and the relevant sections and subsections. Amec Foster Wheeler recommends that the scope of work for site soils remain consistent with the scope originally proposed in the Proposed RAP for Site Soils dated March 17, 2016. The primary objective of soil remediation at the site is to reduce the concentrations of VOCs, 1,4-dioxane, and cyanide identified in site soils to concentrations at or below the applicable POG PSRGs and Residential PSRGs and in accordance with all applicable laws and regulations.

**Appendix A** contains the site ISCO design figures including: the ISCO design drawings cover sheet and site location (Figure A-1); general ISCO injection specifications (Figure A-2); geologic cross section A-A' location map (Figure A-3); geologic cross section A-A' (Figure A-4); geologic cross sections B-B' and C-C' (Figure A-5); geologic cross section D-D' (Figure A-6); and temporary well installation and injection details (Figure A-7).

**Appendix B** contains the site SVE system design figures including: the design drawings cover sheet and site location (Figure B-1); general SVE system construction specifications (Figure B-2); SVE system and conveyance piping layout (Figure B-3); SVE system horizontal well HSV-1 details (Figure B-4); SVE system horizontal well HSV-2 details (Figure B-5); SVE system vertical well details (Figure B-6); SVE system trench details (Figure B-7); and an SVE system piping and instrumentation (P&ID) diagram (Figure B-8).

A description of site health and safety; site control measures; utility locating and contractor mobilization; ISCO injection details, SVE system installation details, start-up, and initial operation procedures; and decontamination and investigation-derived waste (IDW) management procedures are described in the following sections.

### 2.1 HEALTH AND SAFETY

A site-specific Health and Safety Plan (HASP) and HASP Modification have been prepared for implementation of the proposed soil remediation activities. The HASP and HASP Modification are intended to meet the requirements of applicable local, state, and federal regulations including Occupational Safety and Health Administration regulations 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response) and 29 CFR 1926 (Safety and Health Regulations for Construction). The HASP and HASP Modification are included as **Appendix C**. The HASP includes the following components:

- Project identification and key personnel responsibilities;
- Site description;
- Hazard evaluation;
- Personnel training requirements;
- Heat/cold stress program requirements;
- Personal protective equipment requirements;
- Respiratory protection program;
- Decontamination procedures and disposal of contaminated materials;
- Emergency equipment;
- Medical surveillance program requirements;

- Site control measures;
- Accident prevention;
- Community health and safety considerations; and,
- Emergency response plan.

The HASP Modification updates the original HASP and includes updated project organization and emergency contact information as well as maps to the local hospital and non-emergency care clinic. Activity Hazard Analysis sheets for soil remediation-related activities are included in the HASP Modification. Chemical exposure/contact will be minimized through the use of proper personal protective equipment (PPE) and safe handling practices in accordance with the chemical manufacturer safety data sheets and material safety data sheets that are contained within the HASP Modification. In addition, the major remedial action contractors that are selected to complete the work will be required to prepare a site-specific HASP for their workers prior to mobilization to the site.

## **2.2 SITE CONTROL MEASURES**

Access to the work area will be controlled and temporary equipment decontamination/staging area(s) will be set up as needed to facilitate soil remedial action operations in accordance with the HASP. It is anticipated that dust control may be necessary during horizontal and vertical SVE well installation and during SVE conveyance piping installation. Dust control may entail using water misting during the drilling and trenching activities. Work area monitoring for organic vapors using a PID or flame ionization detector (FID) will also be performed as part of the HASP requirements.

To mitigate the need for secondary containment, the hydrogen peroxide, 35% solution will be shipped in two 500-gallon, double-walled totes. These totes will be staged on asphalt next to the existing groundwater remediation system within a fenced compound that is locked. Once injection is initiated, one hydrogen peroxide tote will be moved closer to the actual location of the injections while the second tote will remain in the fenced compound until it is needed. The anticipated duration of storage of the hydrogen peroxide is 5 days (1 day – initial delivery, 4 days – injection activities). Following the completion of injection, the totes will be removed from the site by either the injection contractor or the chemical supply company.

## **2.3 UTILITY MARK OUTS AND CONTRACTOR MOBILIZATION**

Prior to field mobilization for ISCO injection and SVE system installation activities, a utility mark out will be performed to identify underground utilities in the vicinity of the proposed ISCO injection locations, SVE well locations, and SVE conveyance piping locations. The utility mark out will be conducted through the North Carolina One Call Center as well as a private utility locator. Using the mark-out process, underground utility locations will be confirmed in the field prior to performing soil disturbance activities. Existing site drawings will also be reviewed to evaluate utilities within or near the work zone.

A direct-push technology (DPT) drill rig, chemical injection trailer, and ISCO chemicals will be mobilized to the site for the planned ISCO injection activities. A designated staging area for these items will be identified upon their arrival at the site. Equipment required for SVE system installation (drill rig, backhoe, SVE trailer, conveyance piping, etc.) will be mobilized to the site to complete the SVE system installation. A designated SVE system equipment staging area will also be

identified upon its arrival at the site. For the SVE well installation activities, a designated area will be identified for decontamination of drilling equipment and the staging of drums for residual waste materials (drill cuttings, etc.).

## 2.4 ISCO INJECTION EVENT DETAILS

Approximately 1,310 ft<sup>2</sup> of the identified impacted site soils will be targeted for treatment via DPT temporary ISCO injection wells. The maximum depth of ISCO injection will be 30 feet bgs. General ISCO specifications are provided in Figure A-2 in **Appendix A**. Figures A-3 through A-6 in **Appendix A** show the locations targeted for ISCO treatment based on the currently understood extent of 1,4-dioxane and cyanide in site soils. A small area of VOC-impacted soils located underneath the facility in the vicinity of investigation soil borings SB-10 and DS-13 (shown on **Figure 1.4**) will also be treated using ISCO. Below-grade features shown on Figure A-3 were imported from existing facility construction drawings and do not necessarily reflect the as-built conditions. Additional utility location as described in Section 2.3 will be employed to locate sub-grade piping, wiring, and other pertinent underground features prior to installation of temporary ISCO injection wells.

The chemical oxidant EN Rx Reagent (hydrogen peroxide catalyzed by Synergist D) will be used to treat soils at the site impacted by VOCs, 1,4-dioxane, and cyanide that exist above their associated POG PSRGs as well as above the health-based alternate PSRG for cyanide. Because of the chemical characteristics associated with the targeted soil CoCs, up to three ISCO injection events may be required to achieve the relevant PSRGs for the impacted site soils.

Up to 12,000 gallons of EN Rx Reagent will be injected into up to 30 DPT temporary ISCO injection wells per each injection event. The rate of injection will be location-specific; however, an injection rate of 3 to 5 gallons per minute is anticipated based on ISCO injection experience at sites with similar soil lithology. Each injection event is anticipated to require five, 10-hour work days or a potential total of fifteen, 10-hour work days if all three ISCO injection events are required to complete soil remediation activities.

For the first ISCO injection event, approximately 5,700 gallons of EN Rx Reagent will be targeted for injection into 30 temporary ISCO injection wells. This equates to a 7% by weight hydrogen peroxide solution. If this solution concentration proves to be too high (i.e., too reactive causing excessive off-gassing), then a more dilute solution of hydrogen peroxide (3 to 3.5% by weight) will be used. This diluted concentration is consistent with a maximum anticipated injection of 12,000 gallons of EN Rx Reagent.

Due to the presence of VOCs detected inside of the building during the RI, two of the 30 temporary ISCO injection wells are proposed to be advanced within the building. For each injection well, compressed air will initially be delivered to the targeted soil interval. The air is introduced at approximately 150 pounds per square inch (psi) in order to create chemical oxidant delivery pathways. Pathway development is confirmed by a subsequent pressure drop in the air being delivered. Immediately following the observed pressure drop, the EN RX Reagent is then injected at low pressure (approximately 15 to 50 psi) into the targeted soil interval.

**Table 2.1** and Figure A-7 provide final design information for the first ISCO injection event including injection point locations, total number of points per injection location, injection depths,

and quantity of oxidant to inject per injection point. If necessary, details for subsequent ISCO injection events will be provided in future submittals. An underground injection control (UIC) permit has been prepared to encompass all three potential ISCO injection events. The UIC permit is discussed in Section 4.0 of this report.

## 2.5 SVE WELL INSTALLATION DETAILS

Both horizontal and vertical SVE wells will be installed as part of the SVE system design. General SVE system construction specifications are provided in Figure B-2 in **Appendix B**. Figure B-3 in **Appendix B** shows the proposed locations of the horizontal and vertical SVE wells based on the currently understood extent of VOC contamination located outside of the building. The proposed location of the SVE treatment system trailer next to an existing power source and within a fenced compound is also shown. Below-grade features shown on Figure B-3 were imported from existing facility construction drawings and do not necessarily reflect the as-built conditions. Additional utility location as described in Section 2.3 will be employed to locate sub-grade piping, wiring, and other pertinent underground features prior to initiation of horizontal and vertical SVE well drilling.

Due to the presence of a relatively large area of VOC-impacted surface soils in the southeastern portion of the site, two horizontal SVE wells will be installed (see Figure B-3). These two wells will be drilled using horizontal DPT blind drilling methods and will be installed to avoid existing utilities and also to minimize site disruption during installation activities. The well risers, screens, and blanks will be constructed of two-inch diameter Schedule 40 polyvinyl chloride (PVC) directly installed in the native soil. One well, HSV-1, will be installed at a depth of approximately four feet bgs and will contain 100 feet of two-inch diameter, 0.010-inch slotted PVC well screen. The other well, HSV-2, will contain 85 feet of 2-inch diameter, 0.010-inch slotted PVC well screen that will be installed initially at a depth of five feet bgs and will be gradually deepened to 10 feet bgs at the termination of the installation. A grout seal will be installed for both horizontal SVE wells from approximately one to 18 feet from the initial entry into the soil. Figures B-4 and B-5 in **Appendix B** provide the pertinent details for SVE horizontal wells HSV-1 and HSV-2, respectively.

The SVE system will also incorporate 13 vertical SVE wells that are screened at varying depths depending on the depth of the detected VOC contamination. The wells will be installed using a hollow stem auger rig. Each well will be composed of 2-inch diameter Schedule 40 PVC risers connected to 2-inch diameter 0.010-inch slotted Schedule 40 PVC screen. The SVE well screens will be surrounded by sand filter packs and contain bentonite and Portland cement seals above the filter packs to prevent air from short circuiting. All vertical SVE wells will be completed within 12-inch diameter, R-20 traffic-rated, flush-mount well vaults that are surrounded by a three-inch thick layer of concrete to prevent damage from vehicles. Figure B-6 in **Appendix B** provides the details for the 13 vertical SVE wells.

## 2.6 SVE SYSTEM CONVEYANCE PIPING INSTALLATION DETAILS

Trenching will be conducted at the site to accommodate the installation of two-inch diameter Schedule 40 PVC piping within a series of trenches dug between the newly installed SVE wells and the SVE system manifold located on the outside of the SVE treatment system trailer. To install the conveyance piping, trenches will first be saw cut in the existing asphalt. The underlying soil will then be excavated to 24 inches bgs to accommodate conveyance piping installation. A layer of well-graded sand will be placed at the bottom of the trenches followed by the placement of the

conveyance piping. Well-graded sand will then be used to cover the conveyance piping. Native soil will subsequently be used to backfill the trench in loose lifts not to exceed six inches in thickness up to a level even with the bottom of the surrounding asphalt (approximately four to six inches bgs). All backfill will be compacted with a plate-type mechanical compactor or equivalent. Once the native backfill is compacted, additional backfilling and compacting will be conducted until the final compacted trench backfill is level with the bottom of the existing asphalt. Care will be taken not to damage the conveyance piping during compaction. Asphalt will subsequently be placed on top of the compacted backfill to match the pre-existing surface. General SVE system construction specifications are provided in Figure B-2 in **Appendix B**. Figure B-7 in **Appendix B** provides the trench details for the SVE system conveyance piping.

## 2.7 SVE TREATMENT SYSTEM DETAILS

The SVE conveyance system piping will be divided among four manifold branches (Branch 1 through Branch 4) as shown on Figure B-3 in **Appendix B**. The proposed SVE system will utilize a rented mobile, trailer-mounted treatment unit that will be staged next to the existing groundwater remediation system building within a secured area. The SVE unit will be levelled and secured in place. Power to the SVE system will be provided from an existing electrical source (3-phase, 480 Volts [V], 100 amps) with a dedicated electric usage meter. Major SVE system components include the following:

- SVE blower (B-201) capable of providing an inlet vacuum of 135 inches of water (in. H<sub>2</sub>O) vacuum at a flow rate of 115 standard cubic feet per minute (scfm; Elmo Rietschle Model C-VLR-300 or equivalent). While the design operating point is conceptually 135 in. H<sub>2</sub>O vacuum and 102 scfm, the blower is capable of achieving up to 272 in. H<sub>2</sub>O vacuum (20 inches of mercury [in. Hg]) if deemed beneficial to achieve soil remediation objectives during the latter stages of treatment.
- Vapor-liquid separator (VLS-201): aluminum or epoxy-coated steel air water separator, 60 gallon tank, 24 gallon liquid capacity, two-inch Male National Pipe Thread (MNPT) connections, sight glass, and integral low-level (LL), high-level (HL), high-high-level (HHL) float tree with vacuum relief valve and particulate filter. The separator will be used to remove entrained moisture from the extracted soil vapor stream.
- Ambient air dilution valve between vapor-liquid separator (VLS-201) and blower inlet particulate filter (PF-201).
- In-line particulate filter (PF-202) to screen out particulates at the inlet to the blower (B-201).
- In-line discharge silencer to reduce blower noise.
- Condensate transfer pump (TP-201): 1/2-horse power (hp) to 1 hp, centrifugal pump with a totally enclosed, fan-cooled (TEFC) electric motor.
- Condensate tank (T-301): 225-gallon capacity polyethylene tank with drain port and high liquid level switch. T-301 should be located within the trailer, if possible.
- In-line flow totalizer (FT-101) to track the amount condensate collected in T-301.
- Vacuum transmitters (VT-101 and VT-102) on the vapor-liquid separator (VLS-201) inlet and blower inlet.

- Pressure indicator (PI-201) on the blower silencer outlet.
- Pressure transmitter (PT-202) on the outlet of the blower
- Temperature indicator (TI-101) on the blower silencer outlet.
- Temperature transmitter (TT-202) on the outlet of the blower.
- Temperature transmitter (TT-203) inside of the trailer to provide ambient temperature reading within the trailer.
- Air flow indicators (FI-101 through FI-104) and vacuum gauges (VI-101 through VI-104) on each SVE branch inlet.
- Various sampling ports (SP) to confirm SVE system operational efficiency.
- Controls, interlocks, and alarms as follows:
  - Manual and automatic equipment operation modes.
  - Adjustable low inlet vacuum switch on moisture separator inlet to generate alarm.
  - Vapor-liquid separator high liquid level switch to shut off blower and generate alarm.
  - High vacuum switch on blower inlet to shut off blower and generate alarm.
  - Condensate tank high liquid level switch to shut off transfer pump and generate alarm (LSH-301).
  - Blower run time totalizer.
  - Remote telemetry system (EOS Research Ltd. or equivalent) that provides indication of when power is being provided to the trailer, when the blower is running, and when the transfer pump is running; condensate low level indication, condensate high level indication, and high-high level alarm indication; vacuum transmitter readings, temperature transmitter readings, and outlet blower flow (pressure) reading. Telemetry system must also be able to turn the blower on/off and the condensate transfer pump on/off remotely.

Figure B-8 in **Appendix B** provides the piping and instrumentation diagram (P&ID) for the SVE system. The SVE treatment system trailer will be located in an outdoor location next to the existing groundwater remediation system building within a secured area (Figure B-3 in **Appendix B**).

## 2.8 SVE SYSTEM START-UP AND INITIAL OPERATION

SVE system start-up will occur once all system components have been installed and satisfactorily checked and tested. Amec Foster Wheeler previously evaluated the anticipated emissions to be produced by the operation of the SVE system and concluded that the treatment system should be classified as an insignificant source in accordance with 15A NCAC 02Q .0102(d). The NCDEQ, Division of Air Quality, Winston-Salem Division concurred that the SVE treatment system was an insignificant source and that no air permit was required for its operation. This finding is discussed in further detail in Section 4.0 of this report.

The SVE system will initially be started using 100% dilution air. Once the system has stabilized, the manifold valves to the four individual SVE branches will be opened slowly. The pressure/vacuum, system flow rate, condensate production rate, and operating temperature will subsequently be checked. SVE system influent and individual well vapor concentrations will be analyzed using an FID within the first hour of start-up. Start-up activities are anticipated to last for two days. A monitoring schedule for system start-up and initial system operation is provided in **Table 2.2**. Follow-on SVE treatment system sampling and operation and maintenance (O&M) activities will be discussed further in Section 3.0.

The SVE system design assumes a 15-foot area of influence for each vertical SVE well targeting surface soils and a 20-foot area of influence for each vertical SVE well targeting subsurface soils. A horizontal influence of 15 feet is anticipated for the horizontal SVE wells. Amec Foster Wheeler experience with SVE systems in clayey and silty soil similar to that which is present at the site has indicated that air flows from horizontal and vertical extraction wells typically are in the range of 0.1 to 1 scfm per foot of well screen at an applied vacuum of 30 to 100 in. H<sub>2</sub>O or approximately two to seven in. Hg. In tight clays, the measured flow rate can be less. Allowing for additional pressure losses through the manifolds, valves, vapor-liquid separator, and inlet filters, a vacuum blower with a capacity of 115 scfm at 135 inches of water vacuum should be sufficient to treat VOC-impacted soils at the site. If soils prove to be tighter than anticipated, the selected SVE system will be capable of an inlet vacuum up to 272 in. H<sub>2</sub>O.

Initially, SVE treatment system operation will be set to achieve higher air flow at lower vacuum in order to treat the more permeable layers of the impacted site soil first. During later stages of SVE treatment, lower air flow combined with higher vacuum may be employed to treat the less permeable layers of impacted soil. The targeted flow rates for both the vertical and horizontal wells during initial SVE treatment system start-up and operation are shown in the table below.

SVE Well	Screen Interval (feet)	Flow (scfm)
SV-1 and SV-2	5 to 15	2*4
SV-3 and SV-4	16 to 26	2*4
SV-5	20 to 30	4
SV-6 through SV-8	3 to 8	3*2
SV-9 through SV-11	7 to 17	3*4
SV-12	15 to 25	4
SV-13	17 to 27	4
HSV-1	20 to 120	30
HSV-2	20 to 105	26
<b>Total Flow (scfm)</b>		<b>102</b>

## 2.9 DECONTAMINATION AND IDW MANAGEMENT PROCEDURES

Decontamination and IDW management procedures previously established in the *Remedial Investigation Work Plan* that was certified and submitted for the site on July 22, 2011 (MACTEC Engineering and Consulting, Inc., 2011) are incorporated by reference herein.

### 3.0 FINAL ISCO AND SVE SYSTEM ENGINEERING DESIGN DETAILS

This section describes the ISCO injection monitoring plan and ISCO treatment confirmation soil sampling activities. Additionally, ongoing SVE treatment system O&M activities, SVE treatment system performance monitoring, and SVE treatment system confirmation soil sampling activities are described. The associated reporting and an implementation schedule for site soil remediation activities are also presented.

#### 3.1 ISCO INJECTION MONITORING PLAN

Although ISCO injection activities are not anticipated to impact the saturated zone (groundwater underlying the ISCO treatment areas), a monitoring program to confirm this assumption has been developed based on the components of the selected chemical oxidant (EN Rx Reagent). Groundwater samples will be collected from select monitoring wells during a baseline sampling event and submitted to a North Carolina-certified laboratory. Following the first ISCO injection event, groundwater samples will be collected from the same monitoring wells sampled for the baseline sampling event approximately 60 days after the injection event. **Appendix D** contains the ISCO injection Monitoring Plan (Attachment M), which includes the monitoring wells to be sampled and the associated laboratory analytical parameters.

#### 3.2 ISCO TREATMENT CONFIRMATION SOIL SAMPLING

Approximately 60 days following the first ISCO injection event, confirmation soil sampling will be conducted. If the concentrations of the site-related CoCs in each of the confirmation soil samples collected are below their respective POG PSRGs or adjusted Residential PSRGs (cyanide), then the remediation of impacted soils within the ISCO treatment areas will be considered complete. If the concentration of the site-related CoCs remain elevated in any of the confirmation soils samples collected within the ISCO treatment areas, then a second ISCO injection event will occur. Targeted ISCO injection will only occur in those areas where the exceedance(s) occurred. Another round of confirmation soil sampling for the affected area(s) will be conducted after an additional 60 days. Because of the recalcitrance of 1,4-dioxane and cyanide, a third ISCO injection and confirmation soil sampling event may also be conducted, if necessary.

In accordance with Appendix C Part C.2.1 (Post In-Situ Remediation) of the REC Program Implementation Guidance (NCDEQ, 2015), confirmation soil sampling needs to be designed to verify that the entire impacted soil column has been remediated to the site-specific soil RAOs. A soil sampling grid over the area(s) of concern with grid nodes no more than 50 feet apart should be designed with sample locations at each node at 0 to 6 inches bgs, and at a minimum of 5-foot intervals down to the vertical limit of contamination. Because the areas being targeted for ISCO treatment at the site are small, a grid approach is not appropriate to achieve accurate ISCO treatment confirmation soil sampling results. As a result, ISCO confirmation soil sampling locations were selected based on the areal size of each of the areas targeted for ISCO treatment. **Figure 3.1** shows the proposed ISCO treatment confirmation soil sampling locations, and **Table 3.1** provides the proposed ISCO treatment confirmation soil sampling plan.

Note that for each ISCO treatment area, confirmation soil samples will be collected within no more than five-foot intervals, and they will be collected based upon where historical detections of 1,4-dioxane, cyanide, and VOCs above their respective POG PSRGs occurred. Historical results that

previously demonstrated that a particular soil interval did not contain site-related CoCs above their respective POG PSRGs were used to determine the overall targeted length of the ISCO treatment confirmation soil boring.

### **3.3 BASIC ONGOING SVE TREATMENT SYSTEM OPERATION OVERVIEW**

SVE system operation is expected to last from 12 to 24 months. Air will typically flow preferentially through the more permeable sand lenses and less preferentially through the tighter silts and clays present at the site. As such, initial blower operation will target higher air flow rates at lower vacuum. After extraction of soil vapors from the initial pore volumes, contaminant mass removal will occur primarily by desorption from the targeted soil and diffusion from the less permeable soil strata into the preferential pathways. Over time as the concentration of contaminants in the more permeable zones of the targeted soil decreases, the blower operation can be modified to provide higher vacuum at lower flow rates in order to target the soil contaminants located in the tighter silts and clays.

### **3.4 SVE SYSTEM O&M ACTIVITIES**

After completion of the initial SVE system start-up activities described in Section 2.8, routine system O&M will be conducted for the SVE system on a monthly basis unless remote telemetry system monitoring indicates additional O&M trips are required. The following O&M activities will be conducted for the duration of active soil remediation using the SVE treatment system:

- Monitoring and repair of system equipment;
- Monitoring of influent and exhaust gas concentrations;
- System flow adjustment and treatment optimization;
- Recording of system operating parameters; and
- Transfer and disposal of condensate from the vapor-liquid separator.

Gradually over time, influent air concentrations to the SVE system will decline, and contaminant mass removal rates will become asymptotic. As VOC concentrations in each branch of the SVE system approach zero parts per million (ppm) reading on an FID, SVE vacuum to the affected branch or branches will be shut off for a one-month period of soil vapor equilibration. During the next O&M site visit, the affected branch or branches will be re-started, and an FID measurement will be collected within 30 minutes of the restart. If vapor concentrations have rebounded, operation of the affected branch or branches will continue. If no rebound is noted, operation of the branch or branches may be terminated pending confirmatory soil sampling. This procedure will provide increased system capacity for those branch or branches where elevated VOC concentrations remain.

### **3.5 SVE PERFORMANCE MONITORING AND BASIS FOR SHUT DOWN**

**Table 3.2** includes the ongoing SVE system monitoring parameters and schedule. To summarize, SVE influent and effluent VOC concentrations will be measured quarterly using an FID. FID measurements will be taken from the influent port for each of the individual SVE well branches (four total) as well as from the effluent port located after the blower. An effluent air sample will

also be submitted quarterly for laboratory analysis by USEPA Method TO-15. The lab effluent sample will be collected after the air dilution valve has been closed.

For each quarterly monitoring event, SVE contaminant removal will be calculated using the system airflow readings, and the average effluent concentrations (with the air dilution valve closed) from the current and previous events. When VOC removal asymptotically approaches zero ppm, the shutdown of individual SVE well branches or the entire SVE system for a one-month period of soil vapor equilibration will occur. During restart of the SVE system or of the individual well branches, FID measurements of the influent gas concentration will be conducted. Once the measured restart VOC vapor concentrations remain low or non-detect, confirmatory soil sampling for the impacted soils being treated by the SVE system will be conducted.

### **3.6 SVE TREATMENT SYSTEM CONFIRMATION SAMPLING**

As previously described, once VOC removal from the impacted soil being treated by the SVE system becomes asymptotic and FID readings are consistently at or near 0 ppm, a final effluent vapor sample will be collected from the SVE system with the air dilution valve closed. The final vapor sample will be analyzed for select VOCs using USEPA Method TO-15. If the resulting laboratory analysis reveals little or no VOCs, then confirmation sampling of the VOC-impacted soils will commence.

Based on the confirmation soils sampling results, if the concentration of the site-related VOCs remain elevated in any of the soil samples that are collected, then targeted operation of those SVE wells in the vicinity of the exceedance(s) will be conducted. Another round of confirmation soil sampling for the affected area(s) will be conducted after additional FID readings of the influent gas and vapor sample analysis of the effluent gas indicate low or non-detect results. Once the concentrations of the site-related VOCs in each of the confirmation soil samples collected are below their respective POG PSRGs, then the remediation of VOC-impacted soils will be considered complete. The SVE system will subsequently be decommissioned, and all vertical and horizontal SVE wells will be properly abandoned.

Similar to the confirmation soil sampling plan for ISCO treatment, the proposed SVE treatment confirmation soil sampling plan has been developed in accordance with Appendix C Part C.2.1 (Post In-Situ Remediation) of the REC Program Implementation Guidance (NCDEQ, 2015). Because the size of the SVE treatment area is relatively small, a 50-foot sampling grid is inappropriate. **Figure 3.2** shows a potential sampling grid to obtain SVE treatment system confirmation soils samples at 30-foot intervals within the original area of soil VOC contamination. **Table 3.3** provides the proposed confirmation soil sampling plan for the SVE treatment areas.

Because the 30-foot grid nodes fall primarily at the edges of the identified soil VOC contamination, SVE treatment confirmation soil samples have been selected to be collected within the center of each grid. Each confirmation soil sample will be collected within no more than five-foot intervals, and they will be collected based upon where historical detections of VOCs above their respective POG PSRGs occurred. Historical results that previously demonstrated that a particular soil interval did not contain site-related CoCs above their respective POG PSRGs were used to determine the overall targeted length of the SVE treatment confirmation soil boring.

### **3.7 REPORTING**

Design, implementation, and post-treatment monitoring will be documented in accordance with 15A NCAC 13C.0306. The following reports will be prepared and submitted to the NCDEQ, IHSB, REC Program staff for review.

#### **3.7.1 Construction Completion Report**

A Construction Completion Report will be prepared in accordance with 15A NCAC 13C .0306(n) and submitted to the REC Program Manager within 90 days of remedial system construction completion. The Construction Completion Report will include the following information:

- As-built plans and specifications;
- A summary of major variances from the final design plans; and,
- A summary of any problems encountered during construction.

#### **3.7.2 Progress Reports**

Quarterly Remedial Action Progress Reports (RAPRs) will be prepared in accordance with 15A NCAC 13C .0306(o) and submitted to the NCDEQ REC Program Manager. The RAPRs will include the following information:

##### **3.7.2.1 ISCO Soil Remediation Activities and Results**

- A summary of ISCO injection event activities.
- ISCO performance evaluation to include ISCO groundwater sample results and ISCO confirmation soil sample results. A tabulated and graphical presentation of the monitoring data and a comparison of RA performance to design goals.
- Recommendation to conduct an additional ISCO injection event or to conduct no further ISCO injections.

##### **3.7.2.2 SVE Soil Remediation Activities and Results**

- SVE system O&M results including summaries of RA O&M requirements and a discussion of major problems encountered;
- Performance evaluation results including tabulated and graphical presentation of monitoring data and comparison of RA performance to design goals.
- Recommendation to conduct additional SVE treatment or to conduct confirmation soil sampling.

For both the ISCO and SVE soil remediation components, a description of field and laboratory quality control (QC) and quality assurance (QA) procedures followed during any sampling or analysis will be presented. Additionally, a tabulation of analytical results for all sampling and copies of all laboratory reports including QA/QC documentation will also be provided.

Following the first year of active soil remediation, the subsequent progress reporting schedule will be determined based on the most recent ISCO and SVE treatment system sampling results. A recommendation for the schedule of remedial progress reporting following one year of active SVE treatment will be presented in the fourth quarterly RAPR.

### **3.8 IMPLEMENTATION SCHEDULE**

The implementation schedule will be initiated upon certification of this RAPCR. A detailed implementation schedule is provided in **Table 3.4**. Schedule updates will be provided in the quarterly RAPRs.

#### 4.0 PERMITS AND APPROVALS

Amec Foster Wheeler submitted a Notification of Intent to Construct or Operate Injection Wells for a Small-Scale Injection Operation to the NCDEQ on August 15, 2016. The Small-Scale Injection Operation is “permitted by rule” and does not require an individual permit when constructed in accordance with the rules of 15A NCAC 02C .0200. According to correspondence from NCDEQ, construction can begin two weeks following submission of the notice if no comments that require adjustment to the UIC permit are received from NCDEQ. A copy of the UIC Notification and NCDEQ correspondence are included as **Appendix D**.

Amec Foster Wheeler submitted a Request for Air Quality Permitting Applicability Determination for the proposed SVE system to the NCDEQ, Division of Air Quality, Winston-Salem Division via mail on June 15, 2016. In the application, Amec Foster Wheeler evaluated the anticipated operation of the SVE system and concluded that the unit should be classified as an insignificant source in accordance with 15A NCAC 02Q .0102(d). NCDEQ provided a response, Permit Applicability Determination - Applicability Determination Application No. 2865, dated June 21, 2016 and concurred that no permit is required. A copy of the determination request and the NCDEQ correspondence are included as **Appendix E**.

## 5.0 DOCUMENT CERTIFICATION

In accordance with 15A NCAC 13C.0306(b)(1-2), the Responsible Party and Registered Site Manager Document Certification Statements are included in **Appendix F**. In accordance with 15A NCAC 13C.0306(b)(5), the Remedial Design Completion Certification statement is included in **Appendix G**.

## 6.0 REFERENCES

- Amec Foster Wheeler, 2011. Remedial Investigation Report, Former Robert Bosch Tool Corporation Boone Manufacturing Division, Boone, Watauga County, North Carolina, NONCD0001139, September.
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- NCDEQ, 2015. Registered Environmental Consultant Program Implementation Guidance, North Carolina Department of Environmental Quality, Division of Waste Management, Superfund Section, Inactive Hazardous Sites Branch, October.
- NCDEQ, 2016. Inactive Hazardous Sites Branch, Preliminary Soil Remediation Goals (PSRG) Table, April.
- USEPA, 2015. Regional Screening Level Tables, United States United States Environmental Protection Agency, November 2015.

## TABLES

**TABLE 2.1**  
**First ISCO Injection Event Details**  
**Robert Bosch Tool Corporation, Former Boone Division**  
**Boone, North Carolina**  
**Amec Foster Wheeler Project 6251161020.02.01**

General Location	Specific Location	Targeted Injection Depth (feet bgs)	Targeted Injection Point Interval (feet)	Total Depth of Each Injection Point (feet)	Number of Injection Points	Total Drilling per Location (feet)	Total Quantity of Oxidant to Inject per Injection Point (gallons)	Number of Injection Intervals per Injection Point	Total Quantity of Oxidant per Interval (gallons)	Total Quantity of Oxidant to Inject (gallons)
ISCO Injection Area 1 <sup>(1)</sup>	VOC Inside SB-10	9-13	5	13	1	13	294	2	147	294
	VOC Inside DS-13	7-11	5	11	1	11	294	2	147	294
ISCO Injection Area 2 <sup>(2)</sup>	CN SB-42	12-16	4	16	3	48	85	2	43	255
	CN SB-44	16-20	4	20	1	20	85	2	43	85
	CN SB-16	8-12	4	12	1	12	85	2	43	85
	CN SB-17A	3-7	4	7	1	7	85	2	43	85
	CN SB-20	3-8	5	5	8	3	24	3	35	317
	CN SB-48	3-7	4	4	7	1	7	85	2	43
ISCO Injection Area 3 <sup>(3)</sup>	DS-25A	1-5	4	5	1	5	114	2	57	114
	DS-20	5-15	10	15	3	45	197	3	66	591
	DS-19A, DS-20, DS-25, DS-28A	15-30	15	30	14	420	249	4	62	3486

<b>Total Points</b>	<b>30</b>
<b>Total Drilling Feet</b>	<b>612</b>
<b>Total Gallons of Oxidant to Inject</b>	<b>5691</b>

**Notes:**

feet bgs = feet below ground surface

oxidant = EnRx (catalyzed hydrogen peroxide)

<sup>(1)</sup> See Figure No. A-5 in Appendix A for additional information.

<sup>(2)</sup> See Figure Nos. A-5 and A-6 in Appendix A for additional information.

<sup>(3)</sup> See Figure No. A-6 in Appendix A for additional information.

**TABLE 2.2**

**SVE Treatment System Start-Up Monitoring Schedule  
 Robert Bosch Tool Corporation  
 Former Boone Division  
 Boone, North Carolina  
 Amec Foster Wheeler Project 6251161020.01.02**

<b>Category</b>	<b>Monitoring Event</b>	<b>Sampling Locations</b>	<b>Parameters All Samples</b>	
SVE System Start Up	1-hr, 4-hrs, 8-hrs, 24-hrs, and 48-hrs after SVE system start up	SVE system influent at manifold (4 branches total before blower) SVE system effluent (after blower)	Field	FID vapor concentrations
	48-hrs	SVE system effluent <sup>(1)</sup>	Lab	VOCs (EPA Method TO-15) <sup>(2)</sup>

**Notes:**

EPA = Environmental Protection Agency

FID = Flame Ionization Detector

SVE - Soil Vapor Extraction

VOCs = Volatile Organic Compounds

<sup>(1)</sup> Air dilution valve should be closed prior to SVE system effluent sample collection.

<sup>(2)</sup> VOCs by TO-15 analysis. VOCs include 1,1,1-trichloroethane, 1,1-dichloroethane, tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, vinyl chloride, ethylbenzene, total xylenes, and naphthalene only.

**TABLE 3.1**  
**Proposed ISCO Treatment Confirmation Soil Sampling Plan**  
**Robert Bosch Tool Corporation, Former Boone Division**  
**Boone, North Carolina**  
**Amec Foster Wheeler Project 6251161020.01.02**

Soil Boring Sample ID Number	0-2 (feet bgs)	3-5 (feet bgs)	8-10 (feet bgs)	11-13 (feet bgs)	13-15 (feet bgs)	18-20 (feet bgs)	20-22 (feet bgs)	23-25 (feet bgs)	28-30 (feet bgs)	Intervals to Sample Per Boring Location
ICS-1			W	W						2
ICS-2	X	X	X Y		X Y	Y		Y	Y	7
ICS-3	X Y	X Y	X Y		X Y	Y		Y	Y	7
ICS-4	X	X Y	X Y Z		X Y Z	X Y		X Y	Y	7
ICS-5					Z	Z	Z			3
ICS-6		Z								1
ICS-7		Z	Z							2
ICS-8		Z								1
ICS-9		Z	Z							2
<b>Total Number of Intervals to Sample:</b>										<b>32</b>

**NOTES**

bgs = below ground surface

EPA = Environmental Protection Agency

ICS = ISCO confirmation sample

ISCO = In Situ Chemical Oxidation

SIM = select ion monitoring

VOCs = Volatile Organic Compounds

W = Lab analysis by EPA SW 846 8260 (VOCs; PCE only)

X = Lab analysis by EPA SW 846 8260 (VOCs; 1,1,1-trichloroethane, 1,1-dichloroethane, tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, vinyl chloride, ethylbenzene, total xylenes, and naphthalene only)

Y = Lab analysis by EPA SW 846 8260 SIM (1,4-dioxane)

Z = Lab analysis by EPA SM4500-CN-E (Total Cyanide) and by EPA Method 9014 (Free Cyanide)

All ISCO treatment confirmation soil boring locations need to be measured from previously surveyed points so they can be included on a final confirmation soil sample boring map.

TABLE 3.2

**Ongoing SVE Treatment System Monitoring Plan  
Robert Bosch Tool Corporation  
Former Boone Division  
Boone, North Carolina  
Amec Foster Wheeler Project 6251121001.03.01**

Category	Monitoring Event	Sampling Locations	Parameters All Samples	
SVE System Effectiveness	Quarterly	SVE Influent Ports (4 branches) SVE Effluent Port (after blower)	Field	FID vapor concentration
		SVE Effluent Port <sup>(2)</sup>	Lab	VOCs (EPA Method TO-15 <sup>(3)</sup> )
	SVE Branch Shutdown and Restart <sup>(1)</sup>	Individual SVE Well Branch (influent)	Field	FID vapor concentration

**Notes:**

bgs - below ground surface

EPA - Environmental Protection Agency

FID - Flame Ionization Detector

ft - feet

SVE - Soil Vapor Extraction

VOCs - Volatile Organic Compounds

<sup>(1)</sup> Individual horizontal well branches will be shutdown when FID vapor concentrations approach non-detect. Restart branch(es) at the next monthly monitoring event and perform FID monitoring. Continue SVE treatment system operations if concentrations have rebounded. Repeat process until vapor concentrations are non-detect and then conduct confirmation soil sampling in accordance with **Table 3.3**.

<sup>(2)</sup> Air dilution valve should be closed prior to SVE system effluent sample collection.

<sup>(3)</sup> VOCs by TO-15 analysis. VOCs include 1,1,1,-trichloroethane, 1,1-dichloroethane, tetrachloroethene, trichlorethene, cis-1,2-dichloroethene, vinyl chloride, ethylbenzene, total xylenes, and naphthalene only.

**TABLE 3.3**  
**Proposed SVE Treatment Confirmation Soil Sampling Plan**  
**Robert Bosch Tool Corporation, Former Boone Division**  
**Boone, North Carolina**  
**Amec Foster Wheeler Project 6251121001.03.01**

Soil Boring Sample ID Number	0-2 (feet bgs)	3-5 (feet bgs)	8-10 (feet bgs)	13-15 (feet bgs)	18-20 (feet bgs)	23-25 (feet bgs)	28-30 (feet bgs)	Intervals to Sample Per Location
SCS-1	X	X	X	X	X			5
SCS-2				X	X	X	X	4
SCS-3						X	X	2
SCS-4	X	X	X					3
SCS-5	X	X	X	X	X			5
SCS-6		X	X	X				3
SCS-7				X	X	X		3
SCS-8	X	X	X	X	X	X		6
SCS-9	X	X	X					3
SCS-10	X	X	X	X				4
SCS-11		X	X					2
<b>Total Number of Intervals to Sample:</b>								<b>40</b>

**NOTES:**

bgs = below ground surface

EPA = Environmental Protection Agency

SCS = SVE confirmation sample

SVE = Soil Vapor Extraction

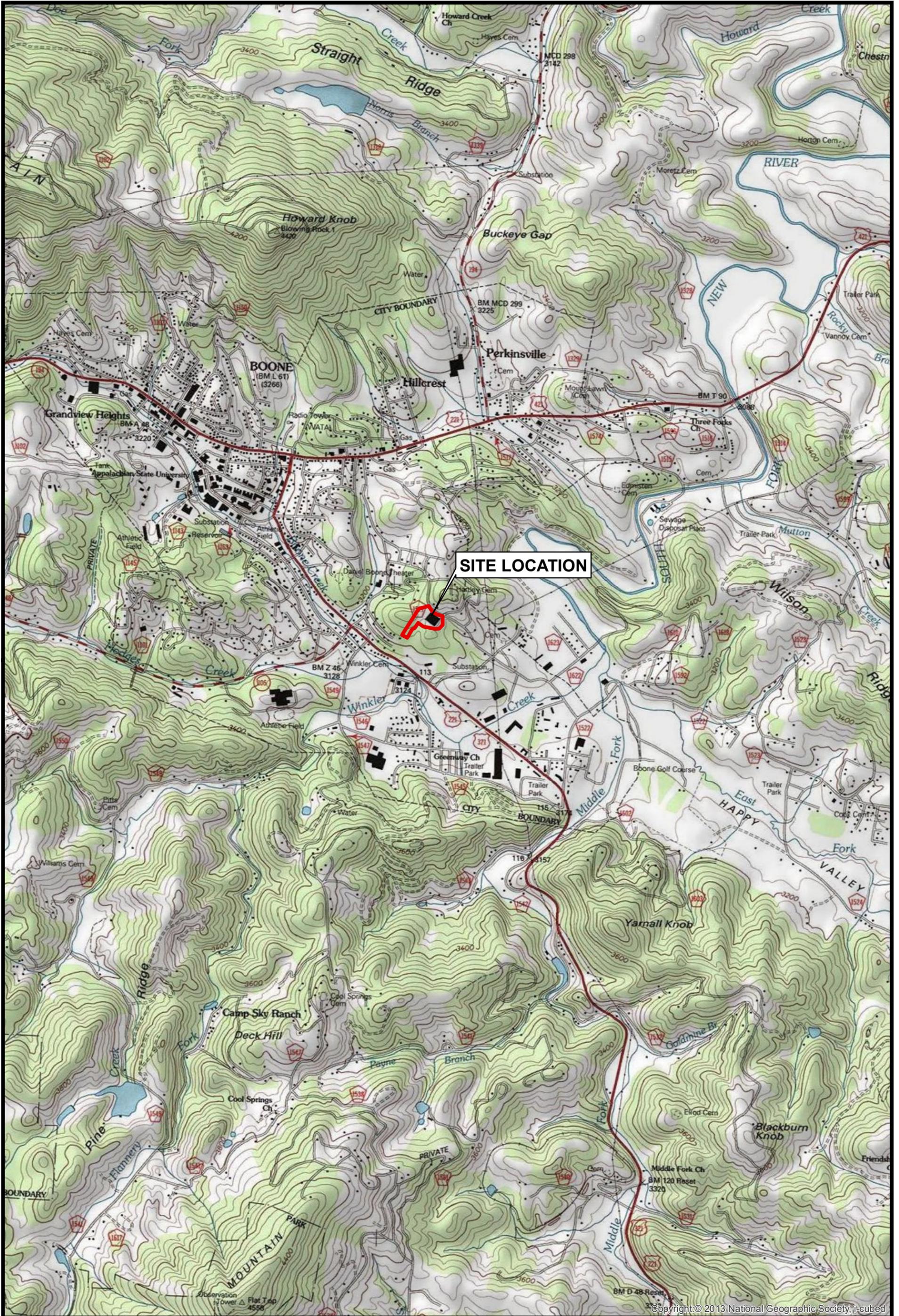
VOCs = Volatile Organic Compounds

X = Lab analysis by EPA SW 846 8260 (VOCs; 1,1,1-trichloroethane, 1,1-dichloroethane, tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, vinyl chloride, ethylbenzene, total xylenes, and naphthalene only)

All SVE treatment confirmation soil boring locations need to be measured from previously surveyed points so they can be included on a final confirmation soil sample boring map.



## FIGURES



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Data Source: 2009 National Geographic Society, [http://goto.arcgisonline.com/maps/USA\\_Topo\\_Maps](http://goto.arcgisonline.com/maps/USA_Topo_Maps).

0 1,000 2,000 4,000 Feet



amec foster wheeler

AmeC Foster Wheeler  
37 VILLA ROAD  
SUITE 201  
GREENVILLE, SC 29615

JOB:	6251-12-1001
DATE:	3/19/15
SCALE:	AS SHOWN
DRAWN:	KEC
REVD:	MJF
CHKD:	TSR
DATE:	3/19/15

### SITE LOCATION MAP

RBTC FORMER BOONE DIVISION  
BOONE, NORTH CAROLINA

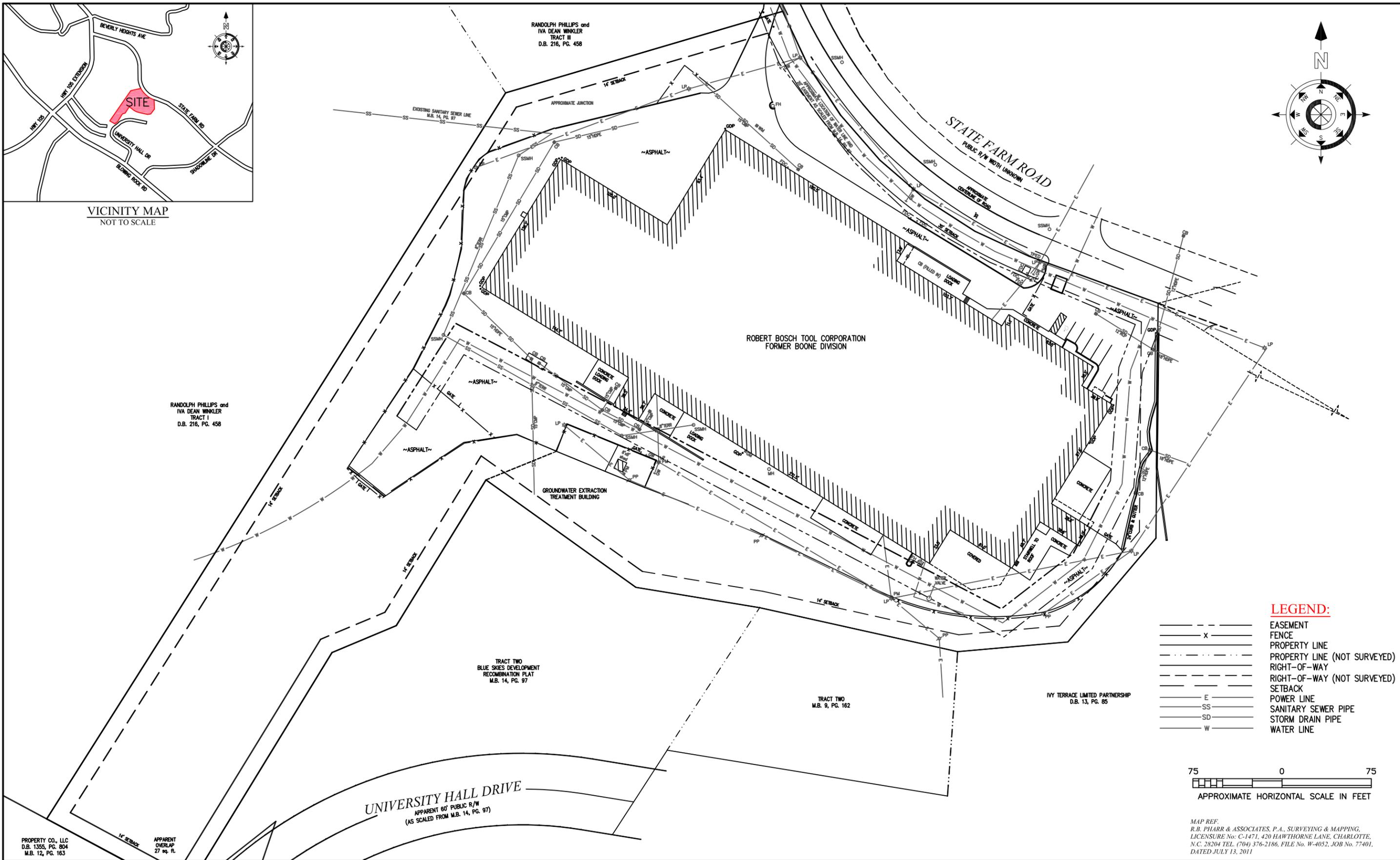
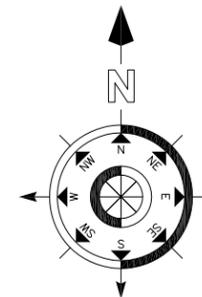
FIGURE NO.

1.1

PROJECT NO.  
6251-12-1001



VICINITY MAP  
NOT TO SCALE



RANDOLPH PHILLIPS and  
IVA DEAN WINKLER  
TRACT I  
D.B. 216, PG. 458

RANDOLPH PHILLIPS and  
IVA DEAN WINKLER  
TRACT III  
D.B. 216, PG. 458

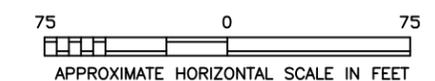
TRACT TWO  
BLUE SKIES DEVELOPMENT  
RECOMBINATION PLAT  
M.B. 14, PG. 97

TRACT TWO  
M.B. 9, PG. 162

IVY TERRACE LIMITED PARTNERSHIP  
D.B. 13, PG. 85

**LEGEND:**

- EASEMENT
- x- FENCE
- PROPERTY LINE
- .-.- PROPERTY LINE (NOT SURVEYED)
- RIGHT-OF-WAY
- .-.- RIGHT-OF-WAY (NOT SURVEYED)
- SETBACK
- E- POWER LINE
- SS- SANITARY SEWER PIPE
- SD- STORM DRAIN PIPE
- W- WATER LINE



MAP REF.  
R.B. PHARR & ASSOCIATES, P.A., SURVEYING & MAPPING.  
LICENSURE No: C-1471, 420 HAWTHORNE LANE, CHARLOTTE,  
N.C. 28204 TEL. (704) 376-2186, FILE No. W-4052, JOB No. 77401,  
DATED JULY 13, 2011

PROPERTY CO., LLC  
D.B. 1355, PG. 804  
M.B. 12, PG. 163

APPARENT  
OVERLAP  
27 sq. ft.

UNIVERSITY HALL DRIVE  
APPARENT 60' PUBLIC R/W  
(AS SCALED FROM M.B. 14, PG. 97)

DRAWN	DDS	DATE	03/16/15
CHECKED	TSR	FILE	Figure 1.2
APPROVED	PSJ	JOB NO:	6251121001.03.01

REVISIONS		
No.	DESCRIPTION	BY

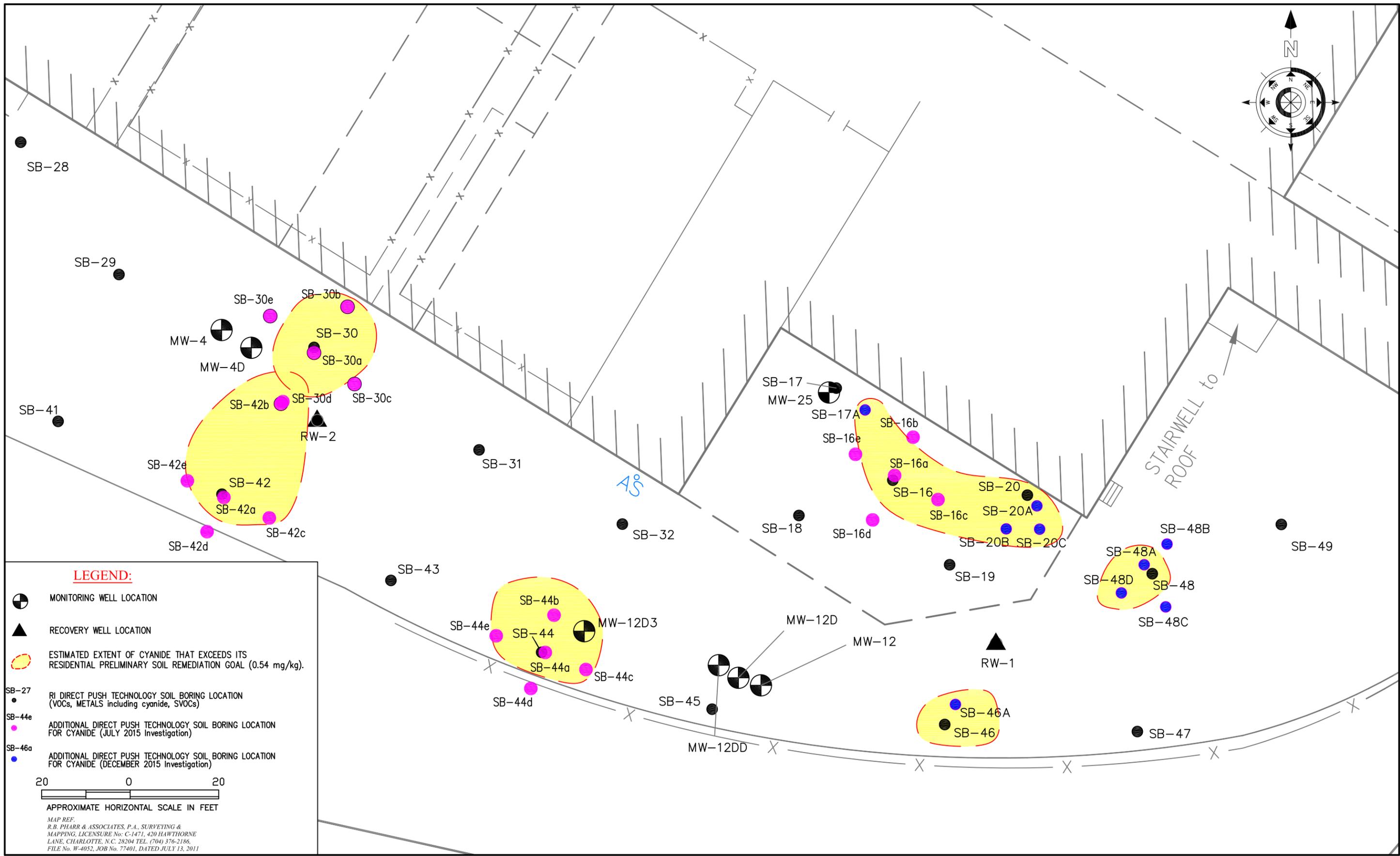
**amec foster wheeler**

37 VILLA ROAD  
SUITE 201  
GREENVILLE, SC 29615  
Phone: (864) 552-9624  
Fax: (864) 552-9699

**SITE LAYOUT MAP**  
**RBTC FORMER BOONE DIVISION**  
BOONE, NORTH CAROLINA

FIGURE  
1.2

Path: P:\Environmental\2012\1001 RBTC Boone\Phase 03 2015 Activities\Task 01 Soil Remediation\SOIL RAP Figures\FIG 1.2 Surveyed Site Layout Plan.dwg [11x17 Site Plan]  
Date: February 25, 2016 - 7:01 am By: pauljohnstone



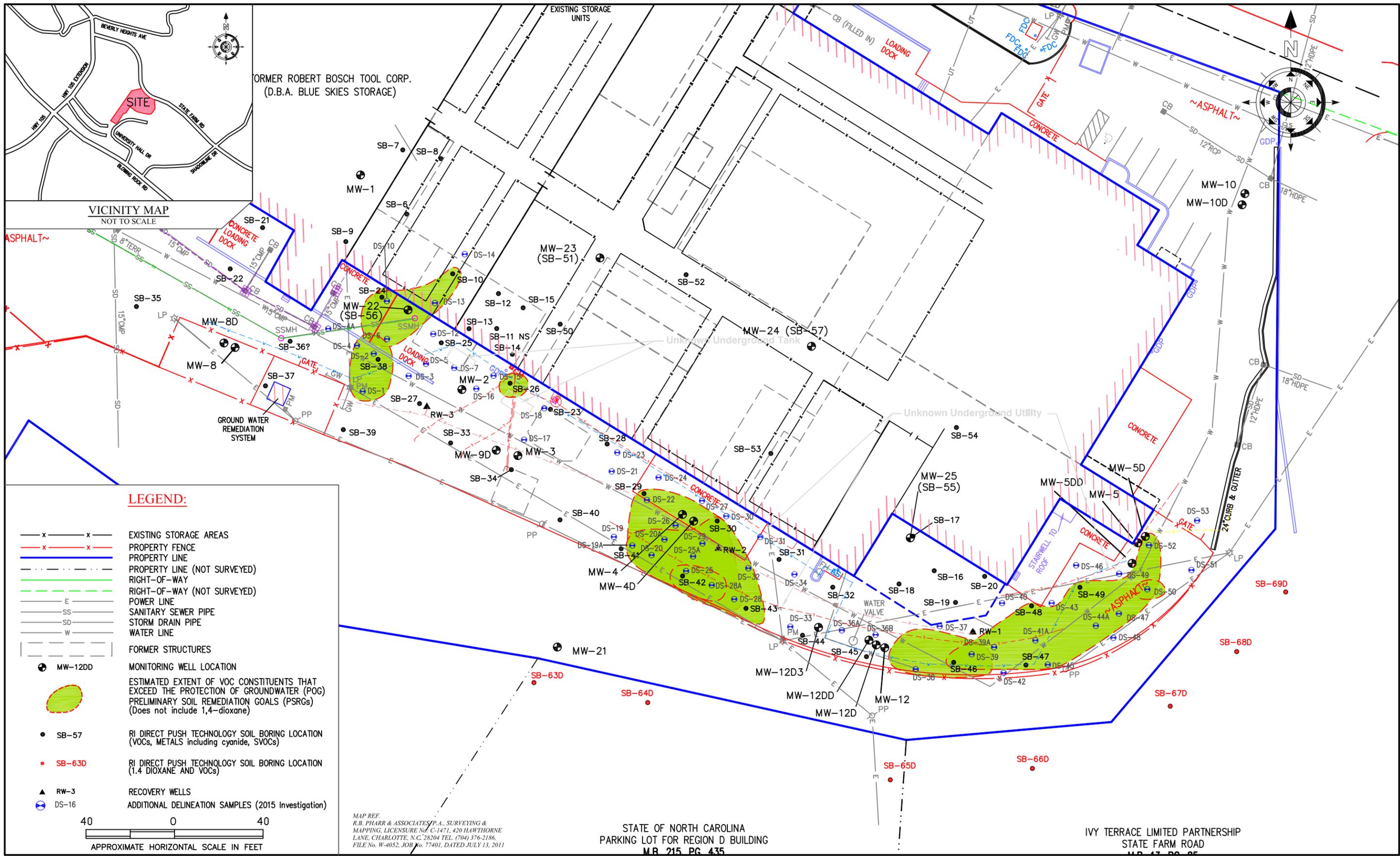
DRAWN	ZJD	DATE	2/3/15
CHECKED	TSR	FILE	Figure 1.3
APPROVED	PSJ	JOB NO:	6251161020.01.02

REVISIONS		
No.	DESCRIPTION	BY



37 VILLA ROAD  
SUITE 201  
GREENVILLE, SC 29615  
Phone: (864) 552-9624  
Fax: (864) 552-9699

**ESTIMATED AREAL EXTENT OF SOILS IMPACTED WITH TOTAL CYANIDE**  
**RBTC FORMER BOONE DIVISION**  
 BOONE, NORTH CAROLINA



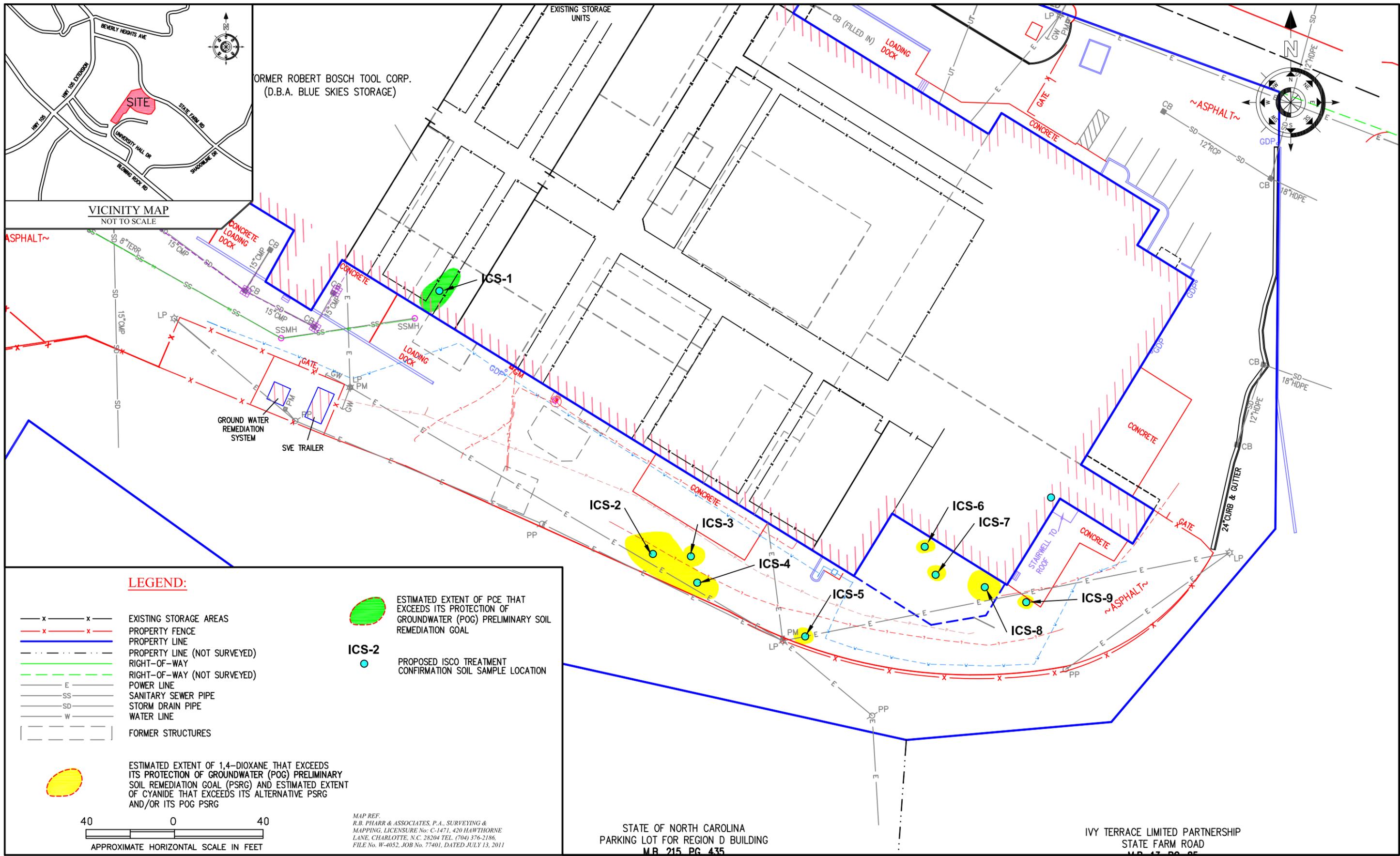
DRAWN	ZJD	DATE	1/08/16
CHECKED	TSR	FILE	Figure 1.4
APPROVED	PSJ	JOB NO:	6251161020.01.02

REVISIONS		
No.	DESCRIPTION	BY



37 VILLA ROAD  
SUITE 201  
GREENVILLE, SC 29615  
Phone: (864) 552-9624  
Fax: (864) 552-9699

**ESTIMATED AREAL EXTENT OF SOILS IMPACTED WITH VOCs**  
**RBTC FORMER BOONE DIVISION**  
 BOONE, NORTH CAROLINA



DRAWN	CHB	DATE	07/27/2016
CHECKED	TSR	FILE	Figure 3.1
APPROVED		JOB NO:	6251161020.01.02

REVISIONS		
No.	DESCRIPTION	BY

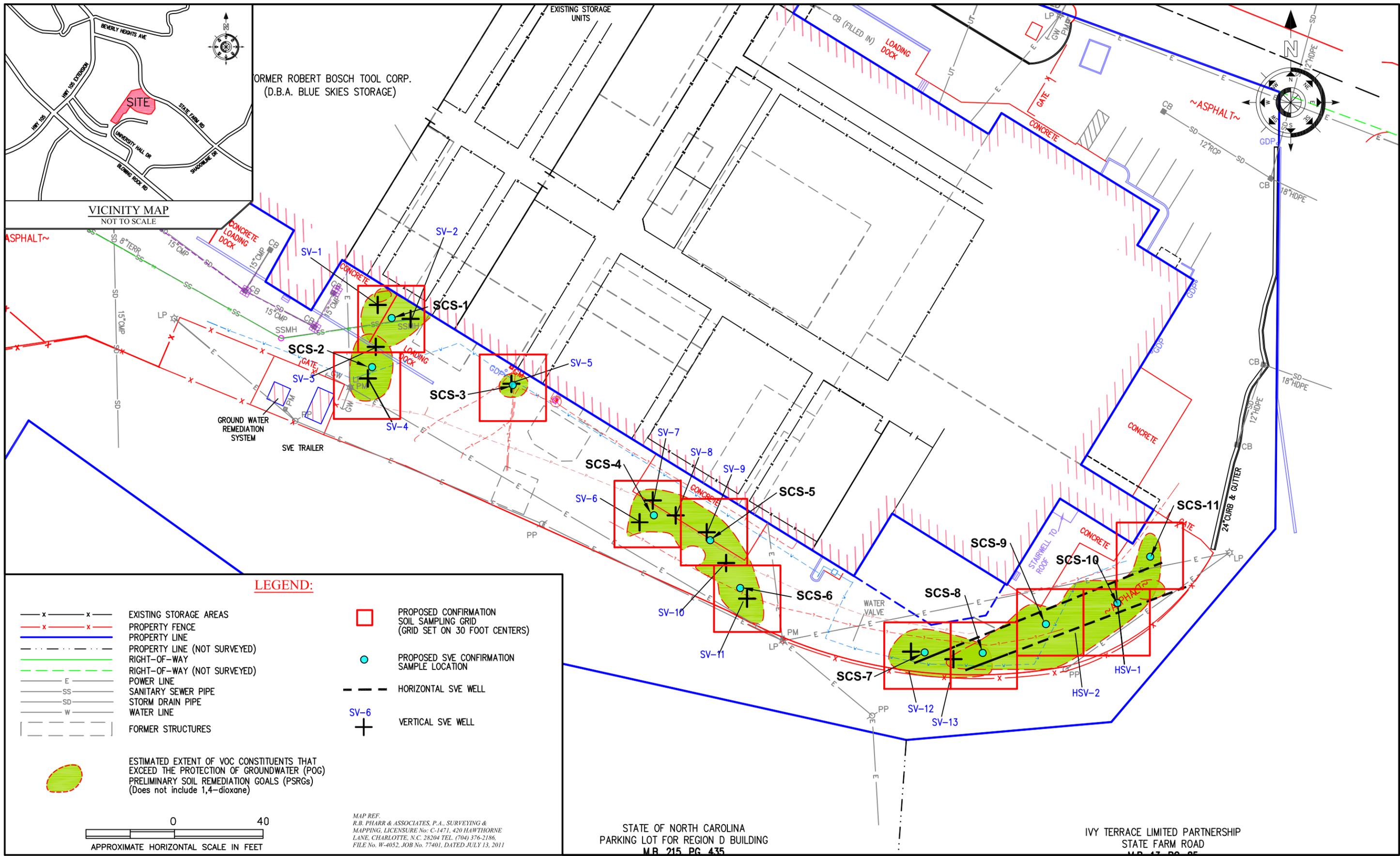
amec foster wheeler

37 VILLA ROAD  
SUITE 201  
GREENVILLE, SC 29615  
Phone: (864) 552-9624  
Fax: (864) 552-9699

**ISCO TREATMENT CONFIRMATION SOIL SAMPLE LOCATIONS**

**RBTC FORMER BOONE DIVISION**  
BOONE, NORTH CAROLINA

FIGURE  
3.1



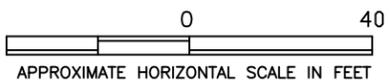
FORMER ROBERT BOSCH TOOL CORP.  
(D.B.A. BLUE SKIES STORAGE)

VICINITY MAP  
NOT TO SCALE

**LEGEND:**

- x - x - EXISTING STORAGE AREAS
- x - x - PROPERTY FENCE
- - - - - PROPERTY LINE
- - - - - PROPERTY LINE (NOT SURVEYED)
- - - - - RIGHT-OF-WAY
- - - - - RIGHT-OF-WAY (NOT SURVEYED)
- E - POWER LINE
- SS - SANITARY SEWER PIPE
- SD - STORM DRAIN PIPE
- W - WATER LINE
- - - - - FORMER STRUCTURES
- [Red Box] PROPOSED CONFIRMATION SOIL SAMPLING GRID (GRID SET ON 30 FOOT CENTERS)
- [Blue Circle] PROPOSED SVE CONFIRMATION SAMPLE LOCATION
- - - - - HORIZONTAL SVE WELL
- SV-6 [Cross] VERTICAL SVE WELL

ESTIMATED EXTENT OF VOC CONSTITUENTS THAT EXCEED THE PROTECTION OF GROUNDWATER (POG) PRELIMINARY SOIL REMEDIATION GOALS (PSRGs) (Does not include 1,4-dioxane)



MAP REF.  
R.B. PHARR & ASSOCIATES, P.A., SURVEYING & MAPPING, LICENSURE No. C-1471, 420 HAWTHORNE LANE, CHARLOTTE, N.C. 28204 TEL. (704) 376-2186, FILE No. W-4052, JOB No. 77401, DATED JULY 13, 2011

STATE OF NORTH CAROLINA  
PARKING LOT FOR REGION D BUILDING  
M.B. 215 PG. 435

IVY TERRACE LIMITED PARTNERSHIP  
STATE FARM ROAD  
M.B. 17 PG. 85

DRAWN	CHB	DATE	07/13/2016
CHECKED	TSR	FILE	Figure 3.2
APPROVED		JOB NO:	6251161020.01.02

REVISIONS		
No.	DESCRIPTION	BY

amec foster wheeler

37 VILLA ROAD  
SUITE 201  
GREENVILLE, SC 29615  
Phone: (864) 552-9624  
Fax: (864) 552-9699

**SVE TREATMENT CONFIRMATION SOIL SAMPLE LOCATIONS**

RBTC FORMER BOONE DIVISION  
BOONE, NORTH CAROLINA

FIGURE  
3.2

## APPENDICES

**APPENDIX A**  
**IN SITU CHEMICAL OXIDATION DESIGN DRAWINGS**

# IN SITU CHEMICAL OXIDATION DESIGN DRAWINGS

## ROBERT BOSCH TOOL CORPORATION - FORMER BOONE DIVISION

482 STATE FARM ROAD  
BOONE, WATAUGA COUNTY, NORTH CAROLINA

FIGURE NO.	DRAWING TITLE
A-1	COVER SHEET/ SITE LOCATION
A-2	GENERAL IN SITU CHEMICAL OXIDATION SPECIFICATIONS
A-3	GEOLOGIC CROSS SECTION A-A' LOCATION MAP
A-4	GEOLOGIC CROSS-SECTION A-A'
A-5	GEOLOGIC CROSS SECTIONS B-B' AND C-C'
A-6	GEOLOGIC CROSS SECTION D-D'
A-7	TEMPORARY WELL INSTALLATION AND INJECTION DETAILS



	<b>COVER SHEET/ SITE LOCATION</b>	
	JOB: 6251-12-1001 LT.LNG: SCALE: DRAWN: Z. Downes CHKD: T. Renn PM: P. Johnstone DATE: 04/04/2016	RBTC FORMER BOONE DIVISION BOONE, NORTH CAROLINA
AMEC Environment & Infrastructure 2801 Yorkmont Road, Suite 100, Charlotte, NC 28208 Phone (704) 357-8600 Fax (704) 357-8638	FIGURE NO. <b>A-1</b>	PROJECT NO. 6251-12-1001

## DEFINITIONS

OWNER/CLIENT: RBTC  
SITE OWNER: BLUE SKIES STORAGE  
ENGINEER: AMEC FOSTER WHEELER E&I

## GENERAL NOTES

- 1) AMEC FOSTER WHEELER WILL ARRANGE FOR A UTILITY MARK-OUT THROUGH THE NORTH CAROLINA ONE CALL CENTER AS WELL AS FOR A PRIVATE UTILITY LOCATOR PRIOR TO THE START OF ANY SOIL DISTURBANCE ACTIVITIES.
- 2) ANY DAMAGE CAUSED BY CONTRACTOR(S) OR ITS SUBCONTRACTOR(S) TO ITEMS PREVIOUSLY IDENTIFIED SHALL BE REPAIRED AND/OR REPLACED WITH NO ADDITIONAL COSTS TO THE ENGINEER, SITE OWNER, AND OWNER/CLIENT. THIS REPAIR AND/OR REPLACEMENT SHALL BE SATISFACTORY TO THE SITE OWNER AND ENGINEER.
- 3) CONTRACTOR(S) SHALL NOTIFY APPROPRIATE AUTHORITIES AND AFFECTED PARTIES AND OBTAIN THEIR PERMISSION PRIOR TO DISCONNECTION OF ANY UTILITIES, IF NECESSARY.
- 4) CONTRACTOR(S) SHALL FIELD VERIFY SITE LAYOUT WITH THE ENGINEER AND SITE OWNER PRIOR TO STARTING ISCO INJECTION ACTIVITIES.
- 5) THE CONTRACTOR(S) SHALL FURNISH ALL LABOR, EQUIPMENT, MATERIAL, AND INCIDENTALS TO CONDUCT THE WORK NECESSARY TO COMPLETE ISCO INJECTION ACTIVITIES.
- 6) ALL WORK TO BE CONDUCTED IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL CODES AND APPLICABLE INJECTION PERMIT.
- 7) CONTRACTOR(S) AND THEIR SUBCONTRACTOR(S) SHALL HAVE ALL REQUIRED HEALTH AND SAFETY TRAINING (29 CFR 1910.120(e)) AND NECESSARY PERSONAL PROTECTIVE EQUIPMENT TO COMPLETE ISCO INJECTION ACTIVITIES.
- 8) CONTRACTOR(S) SHALL PERFORM ALL WORK IN A SAFE MANNER TO THE SATISFACTION OF THE OWNER/CLIENT, SITE OWNER, AND ENGINEER.

## ISCO INJECTION

- 1) THE SCOPE OF WORK INCLUDES INSTALLATION OF 30 TEMPORARY DIRECT PUSH TYPE (DPT) ISCO INJECTION WELLS FOLLOWED BY THE INJECTION OF CATALYZED HYDROGEN PEROXIDE INTO EACH OF THE ISCO INJECTION WELLS.
- 2) ENGINEER SHALL BE RESPONSIBLE FOR DETERMINING THE LOCATION FOR THE 30 ISCO INJECTION WELLS.
- 3) ENGINEER SHALL IDENTIFY THE LOCATION OF WATER SOURCE TO BE USED FOR THE MIXING OF THE SELECTED CHEMICAL REAGENTS.
- 4) THE CONTRACTOR(S) SHALL MAKE EVERY EFFORT TO CAUSE MINIMAL DISRUPTIONS TO FACILITY OPERATIONS DURING PERFORMANCE OF THE SCOPE OF WORK.
- 5) INTERIOR INJECTIONS: DRILLING CONTRACTOR SHALL INSTALL TWO TEMPORARY ISCO INJECTION WELLS. A CONCRETE CORING MACHINE SHALL BE USED TO CUT THROUGH THE EXISTING FLOOR. AN EXHAUST FAN MUST BE USED TO DISPERSE EMISSIONS DURING CORING AND DRILLING ACTIVITIES. ISCO INJECTION CONTRACTOR SHALL PROVIDE AT LEAST 200 FEET OF HOSES TO ACCOMMODATE INJECTION WITHIN THE FACILITY.
- 6) EXTERIOR INJECTIONS: DRILLING CONTRACTOR SHALL INSTALL 28 TEMPORARY ISCO INJECTION WELLS OUTSIDE OF THE EXISTING FACILITY. AN ASPHALT/CONCRETE CUTTING SAW SHALL BE USED TO CUT THROUGH THE EXISTING DRIVEWAY AREA WHERE THE TEMPORARY ISCO INJECTION WELLS ARE TO BE INSTALLED.
- 7) INJECTION SAFETY: THE SELECTED CONTRACTORS SHALL DEVELOP SITE-SPECIFIC HEALTH&SAFETY PLANS (HASPs) PRIOR TO THE START OF ANY PROJECT WORK. THE CONTRACTOR'S HASP SHALL INCLUDE METHODS FOR PROTECTION OF PERSONNEL AND THE ENVIRONMENT FROM ACCIDENTAL RELEASES OF CHEMICAL REAGENTS. THE HASPs SHALL INCLUDE AT A MINIMUM; CHEMICAL HANDLING AND STAGING, SITE CONTROL AND SAFE APPROACH DISTANCES, TEMPORARY CONTAINMENT, AND GENERAL SPILL RESPONSE. THE CONTRACTOR'S HASP SHALL ALSO FULFILL ANY RELATED REQUIREMENTS STIPULATED IN THE ENGINEER'S HASP.

## SITE RESTORATION

- 1) THE SITE SHALL BE RESTORED TO A CONDITION EQUIVALENT TO PRIOR TO INITIATION OF SITE ACTIVITIES INCLUDING TEMPORARY DPT ISCO INJECTION WELLS ABANDONED WITH BENTONITE CHIPS OR PORTLAND CEMENT GROUT (95% CEMENT/ 5% BENTONITE) AND PATCHED TO MATCH THE EXISTING BUILDING FLOOR AND DRIVEWAY SURFACE (I.e., ASPHALT OR CONCRETE).
- 2) ALL WASTE AND DEBRIS GENERATED SHALL BE CONTAINERIZED AND STAGED FOR DISPOSAL IN A LOCATION SPECIFIED BY THE ENGINEER PRIOR TO THE LAST DAY OF WORK.
- 3) SITE CLEAN UP MUST BE TO THE SATISFACTION OF THE ENGINEER, SITE OWNER, AND OWNER/CLIENT.

amec foster wheeler 

AMEC Environment & Infrastructure  
2801 Yorkmont Road, Suite 100, Charlotte, NC 28208  
Phone (704) 357-8600 Fax (704) 357-8638

### GENERAL IN SITU CHEMICAL OXIDATION SPECIFICATIONS

JOB:	6251-12-1001
LT.LNG:	.
SCALE:	AS SHOWN
DRAWN:	T. Renn
CHKD:	G. Wise
PM:	P. Johnstone
DATE:	07/25/2016

RBTC FORMER BOONE  
DIVISION  
BOONE, NORTH CAROLINA

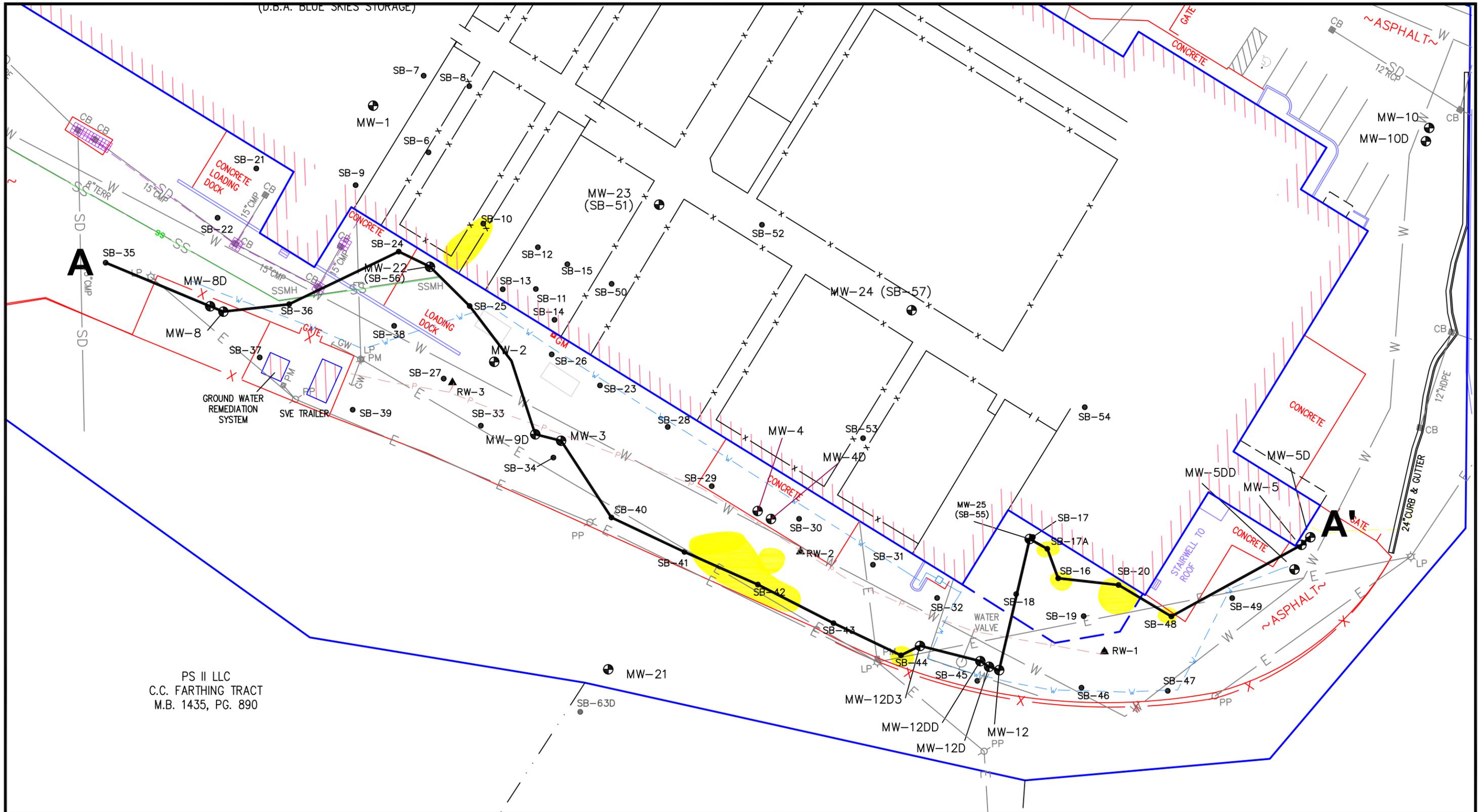
FIGURE NO.

**A-2**

PROJECT NO.

6251-12-1001

Path: P:\Environmental\2016\1020 RBTC Boone\Phase 01 2016 Activities\Task 02 Soil Remediation\Soil RAP\PCR\Appendices\Appendix A - ISCO\A-3 Cross Section A-A' Location Map.dwg [Layout]  
 Date: August 16, 2016 - 8:06am By: paul.johnstone

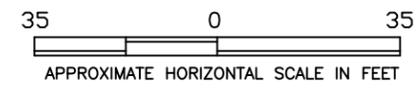


PS II LLC  
 C.C. FARTHING TRACT  
 M.B. 1435, PG. 890

- FENCE
- PROPERTY LINE
- PROPERTY LINE (NOT SURVEYED)
- RIGHT-OF-WAY
- RIGHT-OF-WAY (NOT SURVEYED)
- POWER LINE
- SANITARY SEWER PIPE
- STORM DRAIN PIPE
- WATER LINE

- MW-12DD MONITORING WELL LOCATION
- SB-57 SOIL BORING LOCATION
- RW-3 RECOVERY WELL

- IMPACTED SOIL TO BE TARGETED BY ISCO INJECTION



MAP REF.  
 R.B. PHARR & ASSOCIATES P.A., SURVEYING &  
 MAPPING, LICENSURE No. C-1471, 420 HAWTHORNE  
 LANE, CHARLOTTE, N.C. 28204 TEL. (704) 376-2186.  
 FILE No. W-4052, JOB No. 77401, DATED JULY 13, 2011

**amec foster wheeler**

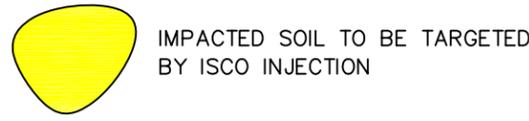
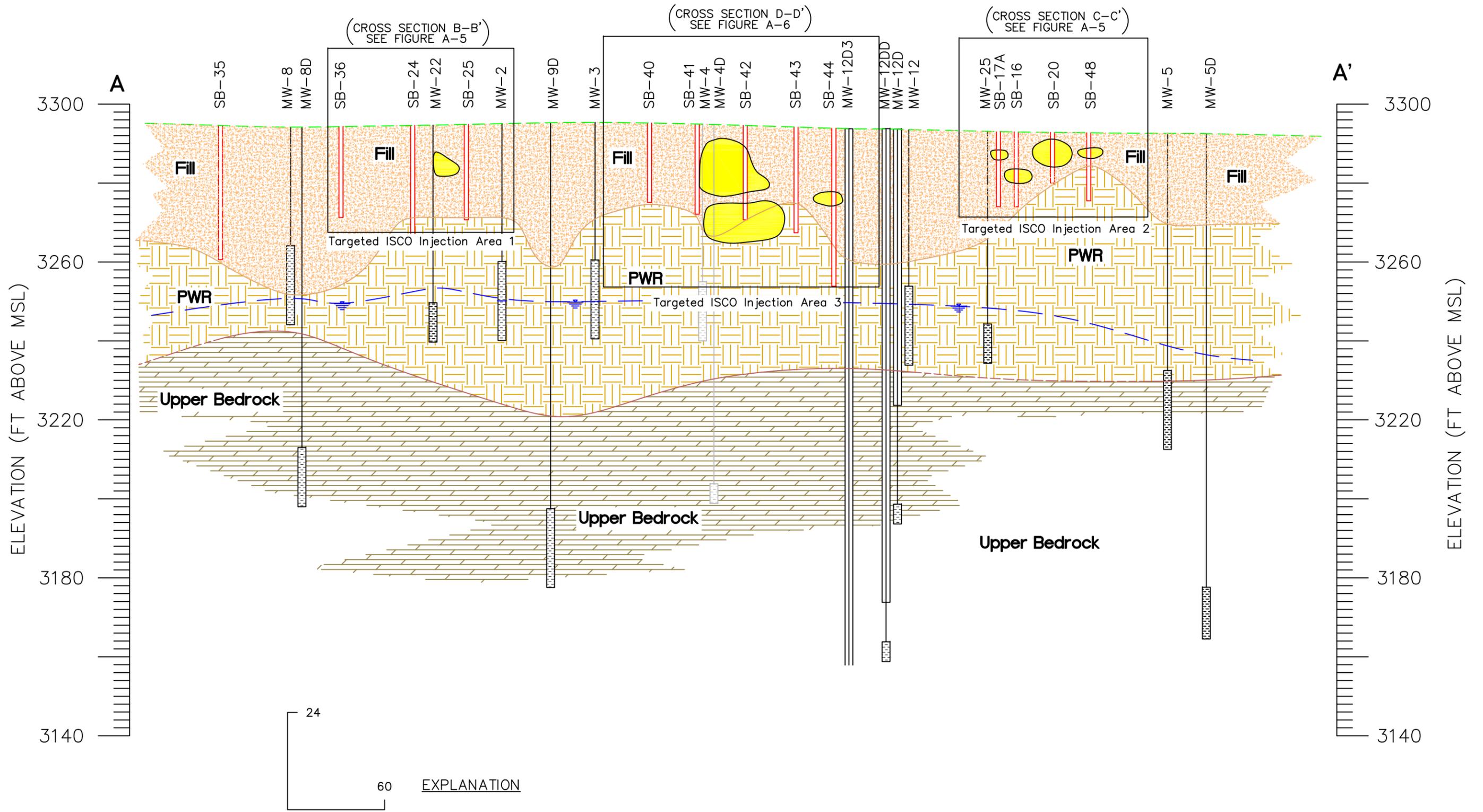
AMEC Environment & Infrastructure  
 2801 Yorkmont Road, Suite 100, Charlotte, NC 28208  
 Phone (704) 357-8600 Fax (704) 357-8638

**GEOLOGIC CROSS SECTION A-A' LOCATION MAP**

JOB:	6251-12-1001
LT, LNG:	
SCALE:	AS SHOWN
DRAWN:	Z. Downes
CHKD:	T. Renn
PM:	P. Johnstone
DATE:	04/04/2016

**RBTC FORMER BOONE  
 DIVISION  
 BOONE, NORTH CAROLINA**

FIGURE NO.  
**A-3**  
 PROJECT NO.  
 6251-12-1001

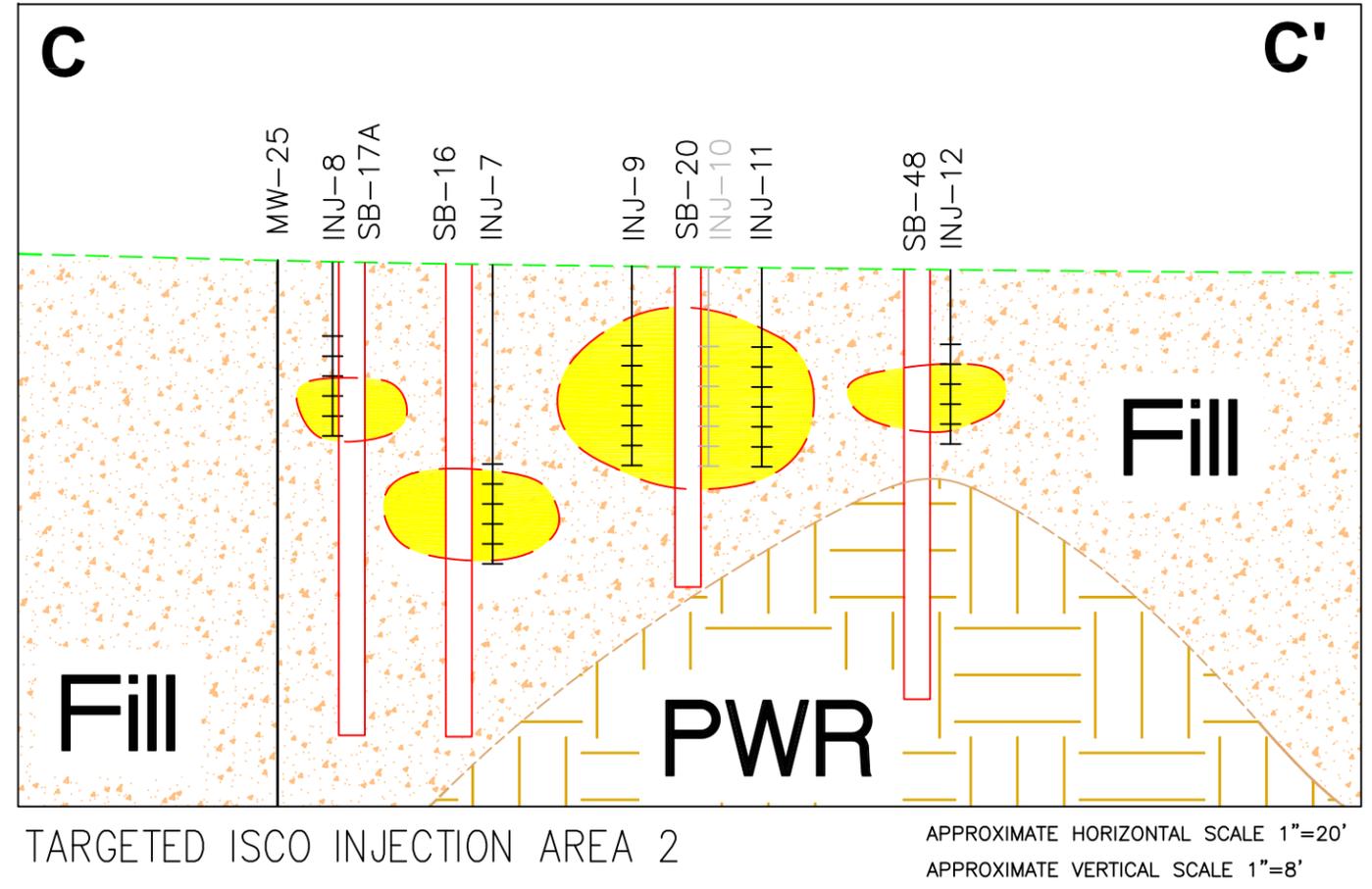
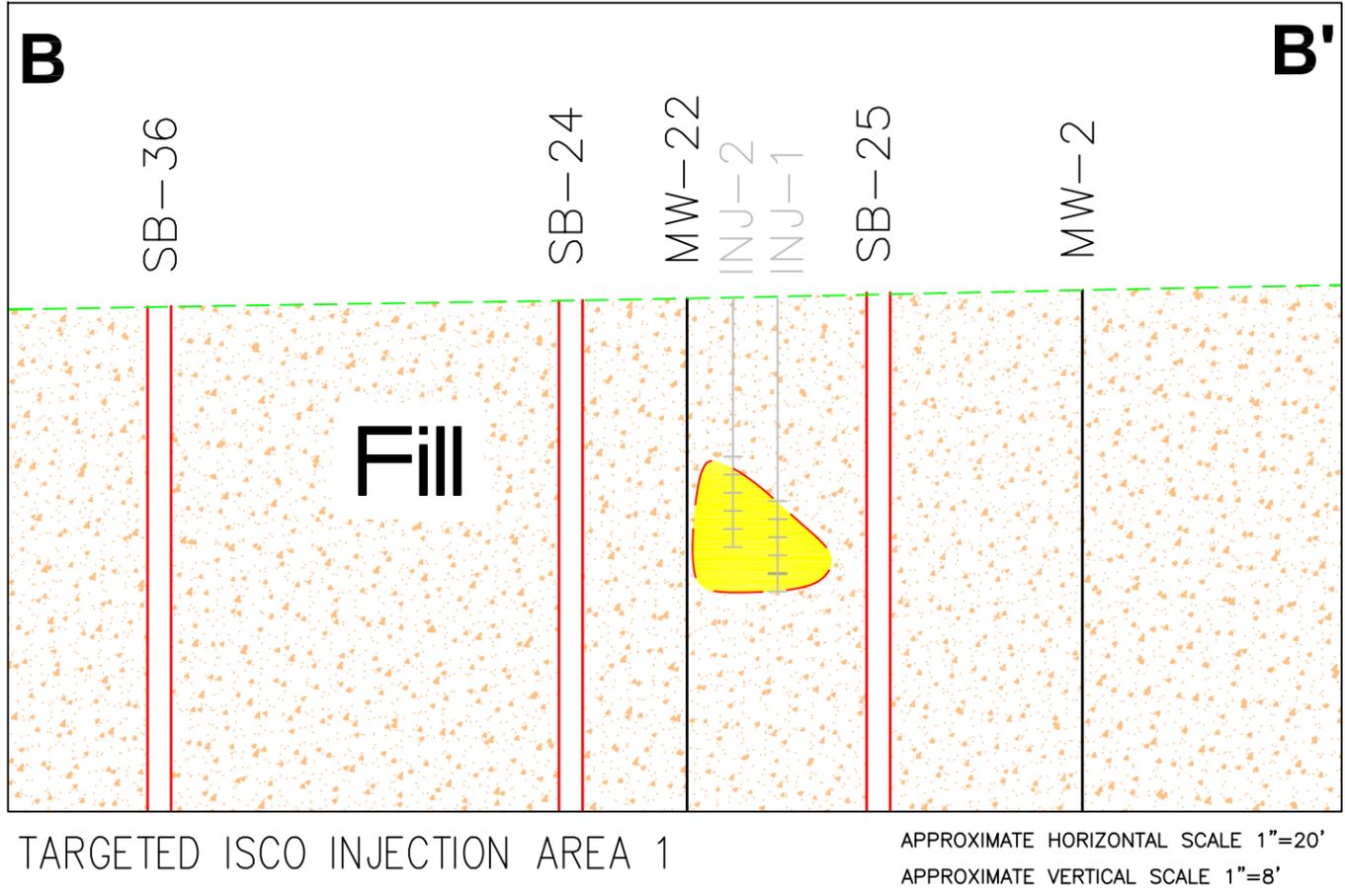
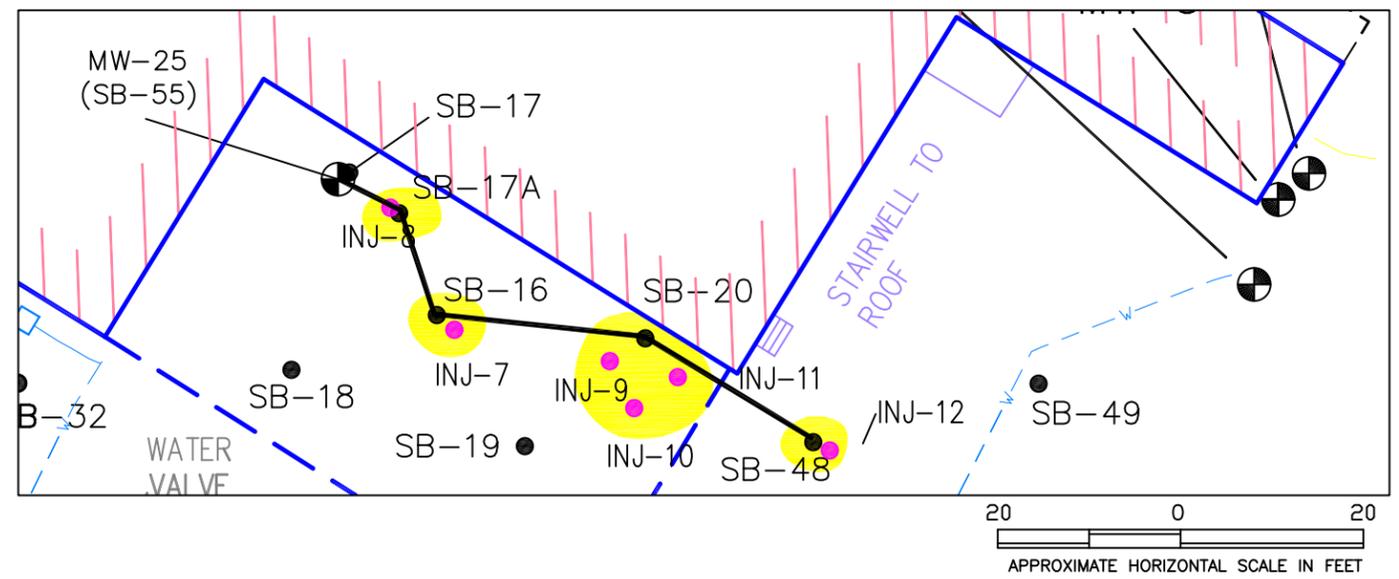
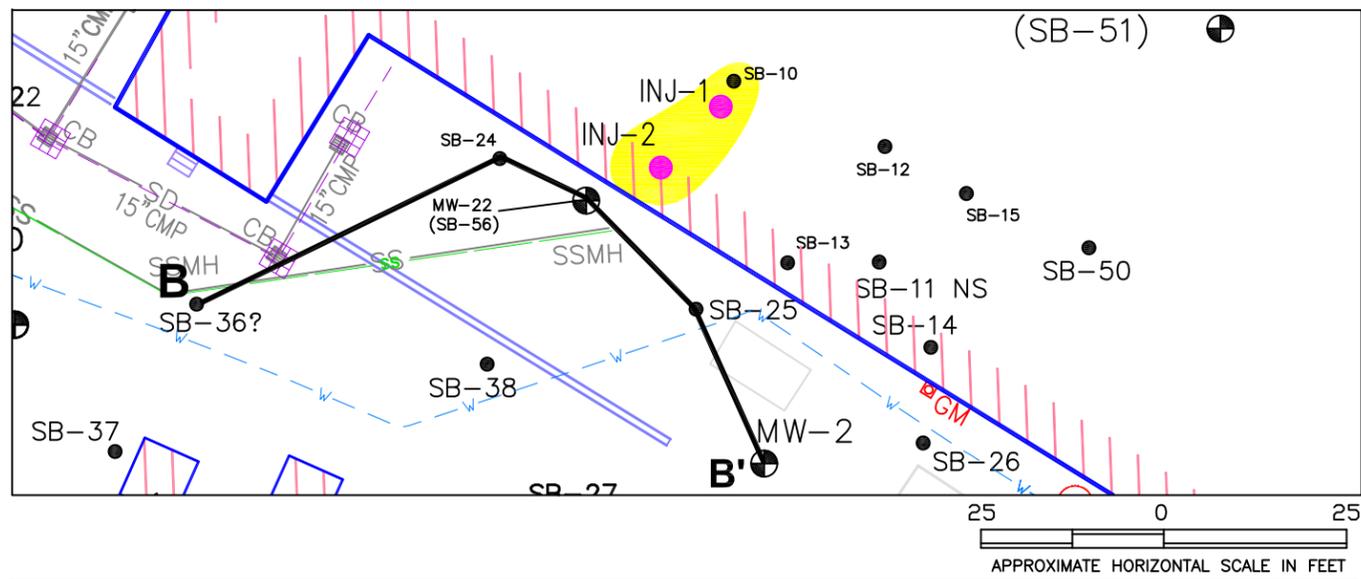


- NOTE:**
1. LOCATION OF A-A' IS REFERENCED ON CROSS SECTION LOCATION MAP (FIGURE H-1)
  2. ISCO = IN SITU CHEMICAL OXIDATION
  3. PWR = PARTIALLY WEATHERED ROCK

- EXPLANATION**
- SCREENED INTERVAL
  - APPROXIMATE GROUNDWATER ELEVATION
  - GROUND-SURFACE
  - INFERRED WATER TABLE SURFACE (MARCH 2016)  
(excludes deep monitoring wells)

	<b>GEOLOGIC CROSS SECTION A-A'</b>	
	JOB: 6251-12-1001 LT, LNG: . SCALE: AS SHOWN DRAWN: Z. Downes CHKD: T. Renn PM: P. Johnstone DATE: 05/26/2016	<b>RBTC FORMER BOONE DIVISION BOONE, NORTH CAROLINA</b>
AMEC Environment & Infrastructure 2801 Yorkmont Road, Suite 100, Charlotte, NC 28208 Phone (704) 357-8600 Fax (704) 357-8638		FIGURE NO. <b>A-4</b> PROJECT NO. 6251-12-1001

Path: P:\Environmental\2016\1020 RBTC Boone\Phase 01 2016 Activities\Task 02 Soil Remediation\Soil RAPCR\Appendices\Appendix A - ISCO\A-5 Geologic Cross Sections B-B' and C-C'.dwg [Layout 3]  
 Date: August 16, 2016 - 8:07am By: paul.johnstone

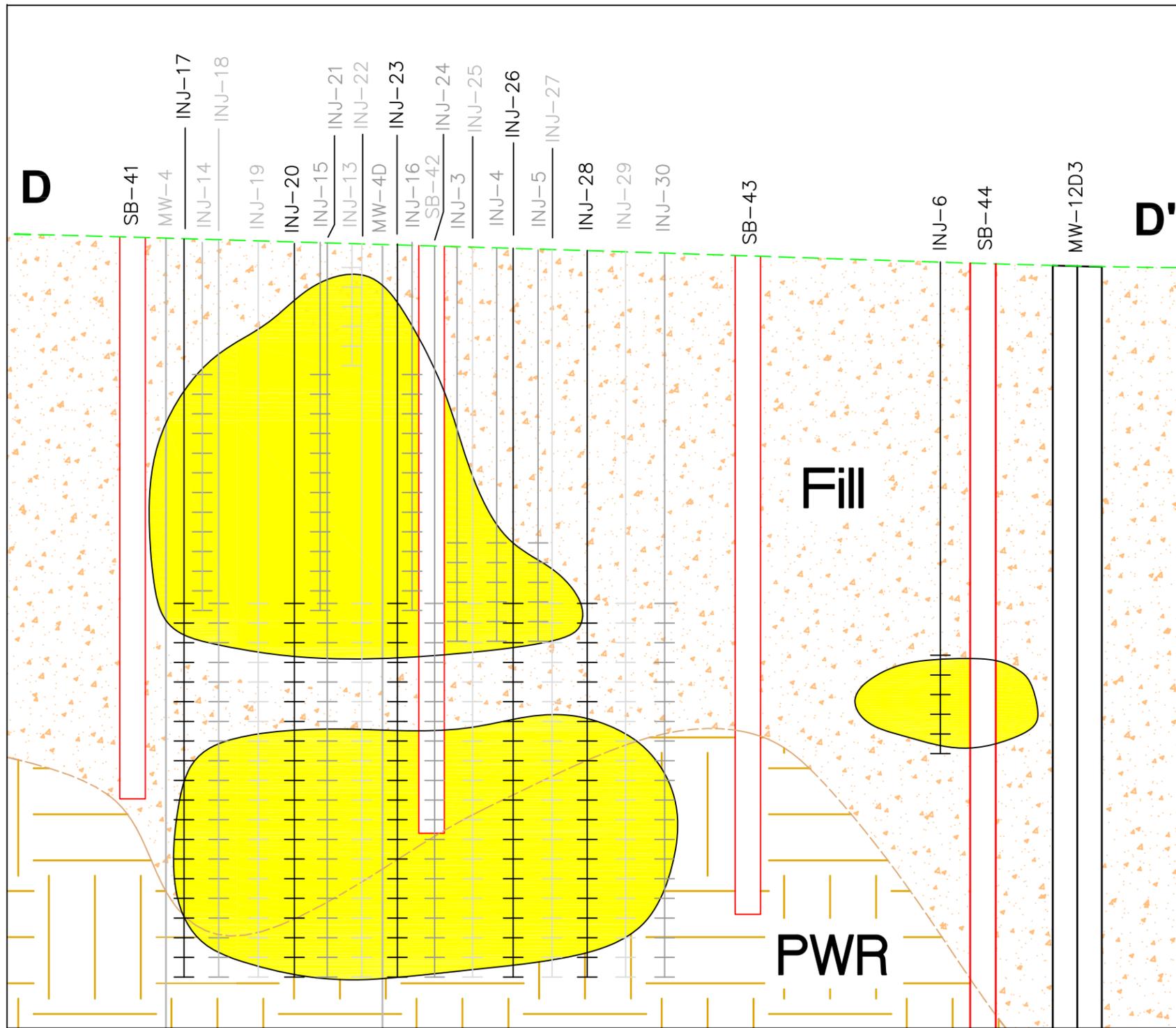


**EXPLANATION**

- GROUND-SURFACE
  - MW-12DD MONITORING WELL
  - INJ-9 ISCO INJECTION POINT
  - SB-57 SOIL BORING
  - TARGETED ISCO INJECTION INTERVAL (PROJECTED ONTO CROSS SECTION B-B' OR C-C')
  - IMPACTED SOIL TO BE TARGETED BY ISCO INJECTION
- NOTE:  
 1. ISCO = IN SITU CHEMICAL OXIDATION  
 2. PWR = PARTIALLY WEATHERED ROCK

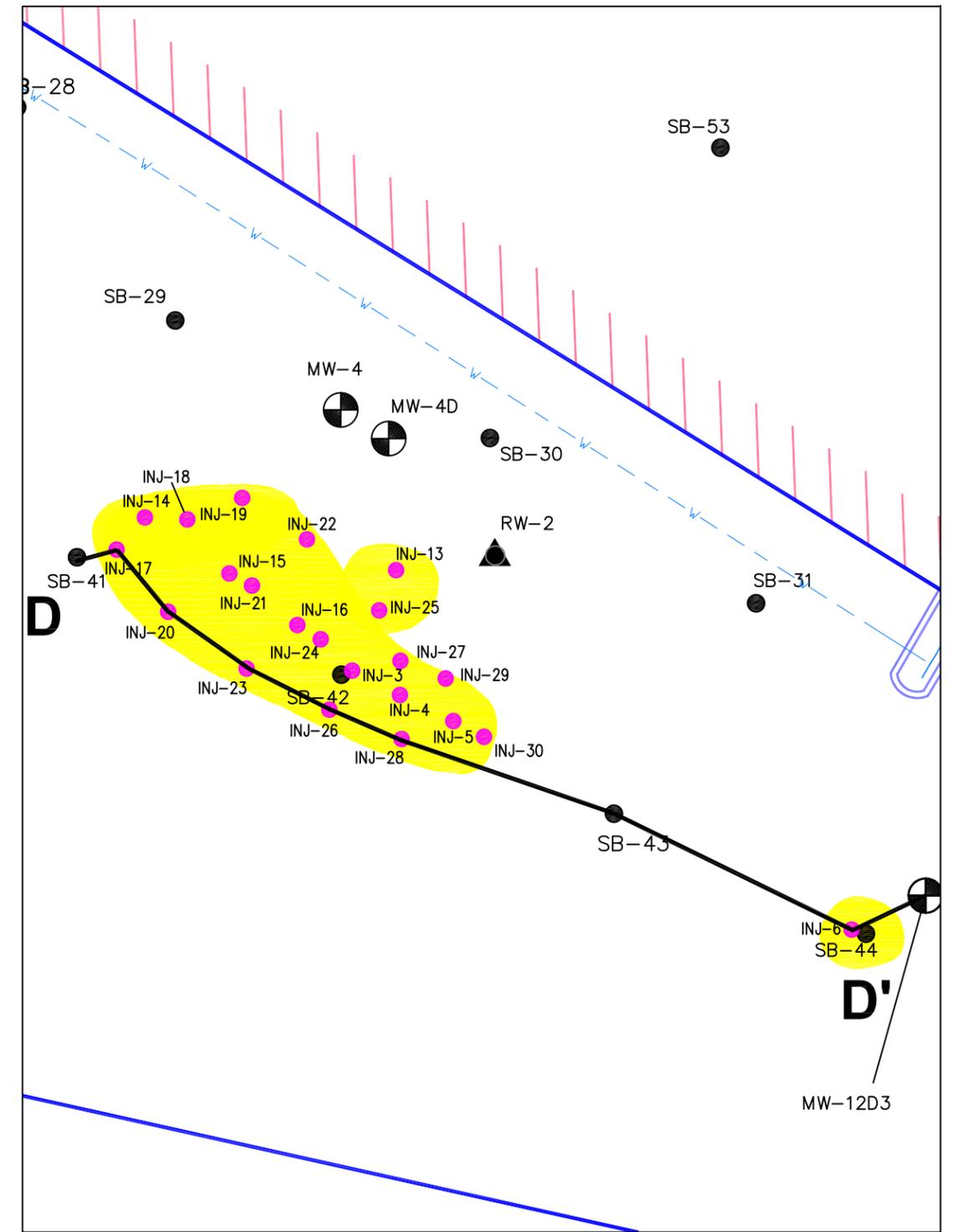
	<b>GEOLOGIC CROSS SECTIONS B-B' AND C-C'</b>		<b>RBTC FORMER BOONE DIVISION</b> BOONE, NORTH CAROLINA	FIGURE NO. <b>A-5</b> PROJECT NO. 6251-12-1001
	JOB: 6251-12-1001 LT, LNG: SCALE: AS SHOWN DRAWN: Z. Downes CHKD: T. Renn PM: P. Johnstone DATE: 05/26/2016			
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Path: P:\Environmental\2016\1020 RBTC Boone\Phase 01 2016 Activities\Task 02 Soil Remediation\Soil RAPCR\Appendices\Appendix A - ISCO\A-6 Geologic Cross Section D-D'.dwg [Layout 4]  
 Date: August 16, 2016 - 8:08am By: paul.johnstone



TARGETED ISCO INJECTION AREA 3

APPROXIMATE HORIZONTAL SCALE 1"=15'  
 APPROXIMATE VERTICAL SCALE 1"=8'



15 0 15  
 APPROXIMATE HORIZONTAL SCALE IN FEET

**EXPLANATION**

- GROUND-SURFACE
- ⊕ MW-12DD MONITORING WELL
- INJ-9 ISCO INJECTION POINT
- SB-57 SOIL BORING

- TARGETED ISCO INJECTION INTERVAL (ON CROSS SECTION D-D')
- TARGETED ISCO INJECTION INTERVAL (PROJECTED ONTO CROSS SECTION D-D')

NOTE:  
 1. ISCO = IN SITU CHEMICAL OXIDATION  
 2. PWR = PARTIALLY WEATHERED ROCK

IMPACTED SOIL TO BE TARGETED BY ISCO INJECTION

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JOB:	6251-12-1001
LT, LNG:	
SCALE:	AS SHOWN
DRAWN:	Z. Downes
CHKD:	T. Renn
PM:	P. Johnstone
DATE:	05/26/2016

**GEOLOGIC CROSS SECTION D-D'**

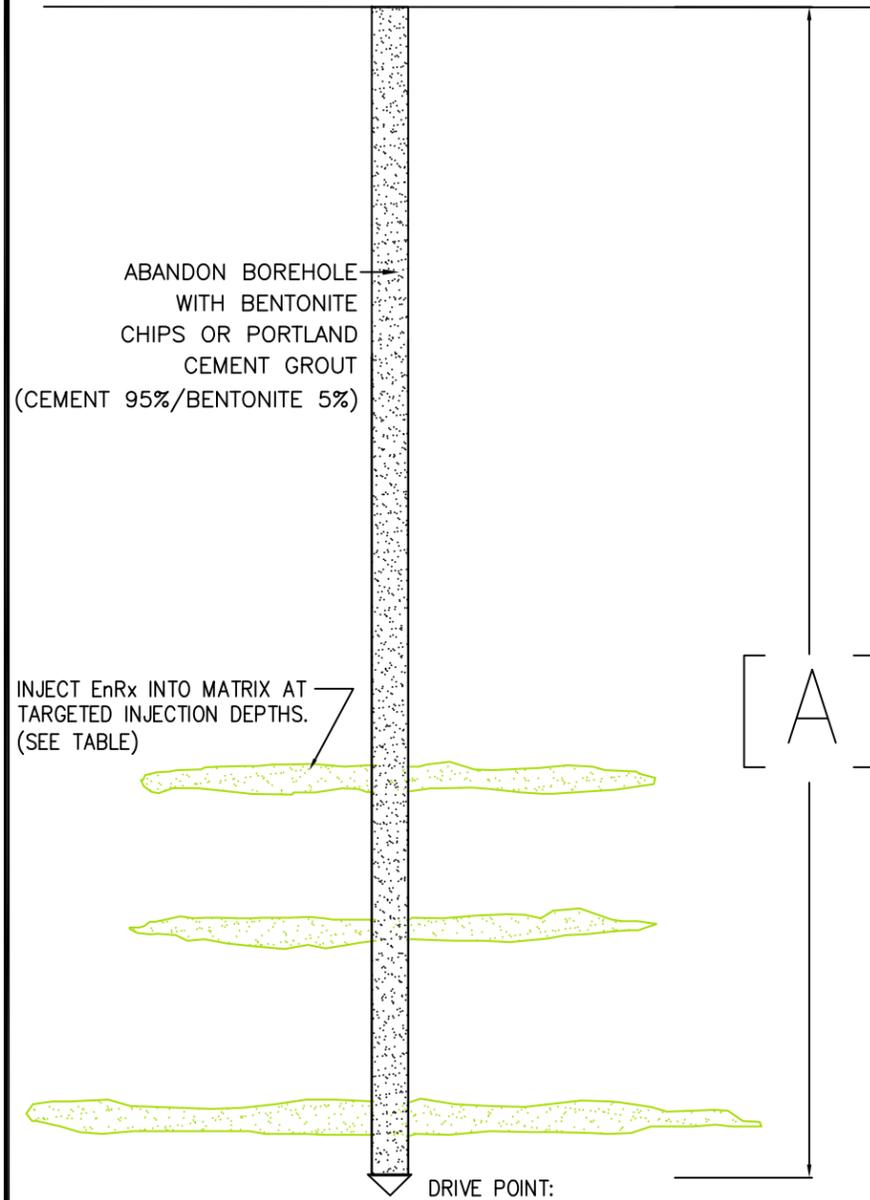
**RBTC FORMER BOONE  
 DIVISION  
 BOONE, NORTH CAROLINA**

FIGURE NO.

**A-6**

PROJECT NO.  
 6251-12-1001

TEMPORARY INJECTION WELL DETAIL  
AREA 1, AREA 2, AREA 3



First ISCO Injection Event Details

General Location	Specific Location	Number of Injection Points	Injection Point Number	Targeted Injection Depth (feet bgs)	Total Depth [A] (feet)	Total Quantity of Oxidant to Inject per Injection Point (gallons)	Number of Injection Intervals per Injection Point	Total Quantity of Oxidant per Interval (gallons)	Grout Interval (feet bgs)
ISCO Injection Area 1 <sup>(1)</sup>	SB-10	1	INJ-1	9-13	13	294	3	98	0-13
	DS-13	1	INJ-2	7-11	11	294	3	98	0-11
ISCO Injection Area 2 <sup>(2)</sup>	SB-42	3	INJ-3 thru INJ-5	12-16	16	85	2	42	0-16
	SB-44	1	INJ-6	16-20	20	85	2	43	0-20
	SB-16	1	INJ-7	8-12	12	85	2	43	0-12
	SB-17A	1	INJ-8	3-7	7	85	2	43	0-7
	SB-20	3	INJ-9 thru INJ-11	3-8	8	106	3	35	0-8
	SB-48	1	INJ-12	3-7	7	85	2	43	0-7
ISCO Injection Area 3 <sup>(3)</sup>	DS-25A	1	INJ-13	1-5	5	114	2	57	0-5
	DS-20	3	INJ-14 thru INJ-16	5-15	15	197	3	66	0-15
	DS-19A, DS-20, DS-25, DS28A	14	INJ-17 thru INJ-30	15-30	30	249	4	62	0-30

Notes:

- (1) See Figure No. A-5 for additional information.
  - (2) See Figure Nos. A-5 and A-6 for additional information.
  - (3) See Figure No. A-6 for additional information.
- feet bgs = feet below ground surface  
Oxidant = EnRx (catalyzed hydrogen peroxide)

	<b>TEMPORARY WELL INSTALLATION AND INJECTION DETAILS</b>	
	JOB: 6251-12-1001 LT.LNG: SCALE: AS SHOWN DRAWN: Z. Downes CHKD: T. Renn PM: P. Johnstone DATE: 04/04/2016	RBTC FORMER BOONE DIVISION BOONE, NORTH CAROLINA
37 VILLA ROAD, SUITE 201, GREENVILLE, SC 29615 Phone: (864) 552-9624 Fax: (864) 552-9699	FIGURE NO. <b>A-7</b> PROJECT NO. 6251-12-1001	

**APPENDIX B**

**SOIL VAPOR EXTRACTION TREATMENT SYSTEM DESIGN DRAWINGS**

# SOIL VAPOR EXTRACTION DESIGN DRAWINGS

## ROBERT BOSCH TOOL CORPORATION - FORMER BOONE DIVISION

482 STATE FARM ROAD  
BOONE, WATAUGA COUNTY, NORTH CAROLINA

<u>FIGURE NO.</u>	<u>DRAWING TITLE</u>
B-1	COVER SHEET/ SITE LOCATION
B-2	GENERAL SVE SYSTEM CONSTRUCTION SPECIFICATIONS
B-3	SVE SYSTEM AND CONVEYANCE PIPING LAYOUT
B-4	SVE SYSTEM HORIZONTAL WELL HSV-1 DETAILS
B-5	SVE SYSTEM HORIZONTAL WELL HSV-2 DETAILS
B-6	SVE SYSTEM VERTICAL WELL DETAILS
B-7	SVE SYSTEM TRENCH DETAILS
B-8	SVE SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM



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Phone (704) 357-8600 Fax (704) 357-8638

### COVER SHEET/ SITE LOCATION

JOB: 6251-12-1001  
LT/LNG:  
SCALE:  
DRAWN: Z. Downes  
CHKD: T. Renn  
PM: P. Johnstone  
DATE: 07/01/2016

**RBTC FORMER BOONE  
DIVISION**  
BOONE, NORTH CAROLINA

FIGURE NO.

**B-1**

PROJECT NO.

6251-12-1001

**DEFINITIONS**

OWNER/CLIENT: RBTC  
 SITE OWNER: BLUE SKIES STORAGE  
 ENGINEER: AMEC FOSTER WHEELER E&I

**GENERAL NOTES**

- 1) ALL UTILITIES DEPICTED IN FIGURE B-3 ARE FOR GUIDANCE ONLY. THE ENGINEER WILL ARRANGE FOR A UTILITY MARK-OUT THROUGH THE NORTH CAROLINA ONE CALL CENTER AS WELL AS A PRIVATE UTILITY LOCATOR PRIOR TO THE START OF ANY SOIL DISTURBANCE ACTIVITIES.
- 2) ANY DAMAGE CAUSED BY CONTRACTOR(S) OR ITS SUCONTRACTOR(S) TO ITEMS PREVIOUSLY IDENTIFIED SHALL BE REPAIRED AND/OR REPAIRED WITH NO ADDITIONAL COSTS TO THE ENGINEER, SITE OWNER, AND OWNER/CLIENT. THIS REPAIR AND/OR REPLACEMENT SHALL BE SATISFACTORY TO THE SITE OWNER AND ENGINEER.
- 3) CONTRACTOR(S) SHALL NOTIFY APPROPRIATE AUTHORITIES AND AFFECTED PARTIES AND OBTAIN THEIR PERMISSION PRIOR TO DISCONNECTION OF ANY UTILITIES, IF NECESSARY.
- 4) CONTRACTOR(S) SHALL FIELD VERIFY SITE LAYOUT WITH THE ENGINEER AND SITE OWNER PRIOR TO STARTING SVE SYSTEM CONSTRUCTION ACTIVITIES.
- 5) THE CONTRACTOR(S) SHALL FURNISH ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS NECESSARY TO CONSTRUCT AND INSTALL THE SVE SYSTEM.
- 6) ALL WORK TO BE CONDUCTED IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL CODES.
- 7) CONTRACTOR(S) AND THEIR SUBCONTRACTOR(S) SHALL HAVE ALL REQUIRED HEALTH AND SAFETY TRAINING (29 CFR 1910.120(e)) AND PERSONAL PROTECTIVE EQUIPMENT.
- 8) CONTRACTOR(S) SHALL PERFORM ALL WORK IN A SAFE MANNER TO THE SATISFACTION OF THE OWNER/CLIENT, SITE OWNER, AND ENGINEER. THE CONTRACTOR(S) SHALL DEVELOP A SITE-SPECIFIC HEALTH&SAFETY PLAN (HASP) PRIOR TO THE START OF ANY PROJECT WORK. THE CONTRACTOR'S HASP SHALL FULFILL ALL REQUIREMENTS STIPULATED IN THE ENGINEER'S HASP.

**SVE SYSTEM INSTALLATION**

- 1) THE SCOPE OF WORK INCLUDES INSTALLATION OF TWO HORIZONTAL AND THIRTEEN VERTICAL SVE WELLS AND ASSOCIATED CONVEYANCE PIPING TO AN SVE SYSTEM TRAILER AS DEPICTED IN THESE DRAWINGS.
- 2) THE CONTRACTOR(S) SHALL MAKE EVERY EFFORT TO CAUSE MINIMAL DISRUPTIONS TO FACILITY OPERATIONS DURING PERFORMANCE OF THE SCOPE OF WORK.
- 3) HORIZONTAL AND VERTICAL SVE WELL INSTALLATION SHALL BE AS SPECIFIED ON SUBSEQUENT DRAWINGS.
- 4) ALL SVE WELL AND CONVEYANCE PIPING SHALL BE AS SPECIFIED ON SUBSEQUENT DRAWINGS.
- 5) ALL TRENCHING AND BACKFILLING FOR SVE CONVEYANCE PIPING INSTALLATION SHALL BE AS SPECIFIED ON FIGURE B-7. NATIVE SOIL USED AS BACKFILL SHALL BE FREE OF STONES LARGER THAN 2 INCHES, CONSTRUCTION DEBRIS, SOFT CLAY, AND ANGULAR ROCKS. NATIVE SOIL SHALL BE PLACED IN LOOSE LIFTS NOT TO EXCEED 6 INCHES IN THICKNESS UP TO A LEVEL EVEN WITH THE BOTTOM OF THE EXISTING ASPHALT. ALL BACKFILL SHALL BE COMPACTED WITH A PLATE-TYPE MECHANICAL COMPACTOR OR EQUIVALENT.
- 6) LOCATIONS OF HORIZONTAL AND VERTICAL SVE WELLS AND CONVEYANCE PIPING RUNS MAY BE FIELD ADJUSTED DURING CONSTRUCTION ACTIVITIES TO AVOID UNSPECIFIED OR UNKNOWN OBSTACLES WITH PRIOR APPROVAL FROM THE ENGINEER.
- 7) THE SVE SYSTEM EQUIPMENT TRAILER WILL BE PROCURED DIRECTLY BY THE ENGINEER AND WILL BE TRANSPORTED TO THE SITE BY THE SELECTED SVE SYSTEM VENDOR.
- 8) THE ENGINEER SHALL BE RESPONSIBLE FOR ACCEPTING DELIVERY OF THE SVE SYSTEM EQUIPMENT TRAILER AND FOR ITS APPROPRIATE STAGING AT THE SITE.

**SVE TRAILER**

- 1) EQUIPMENT TRAILER SHALL BE INSTALLED IN A PROFESSIONAL AND WORKMAN LIKE MANNER, WITH ALL COMPONENTS PROPERLY SECURED AND ANCHORED TO RESIST NORMAL FORCES OF THE SYSTEM, WIND, AND PERSONNEL ACTIVITIES. UNLESS OTHERWISE DIRECTED, EQUIPMENT SHALL BE INSTALLED PLUMB, LEVEL AND TRUE TO LINES AND ELEVATIONS. CORROSION RESISTANT FASTENERS AND WIRE/CABLES SUITABLE FOR OUTDOOR USE SHALL BE USED.
- 2) SVE TRAILER VENDOR SHALL PROVIDE ENGINEER WITH ALL EQUIPMENT AND WARRANTY INFORMATION IN AN OPERATIONS AND MAINTENANCE MANUAL.

**ELECTRICAL WORK**

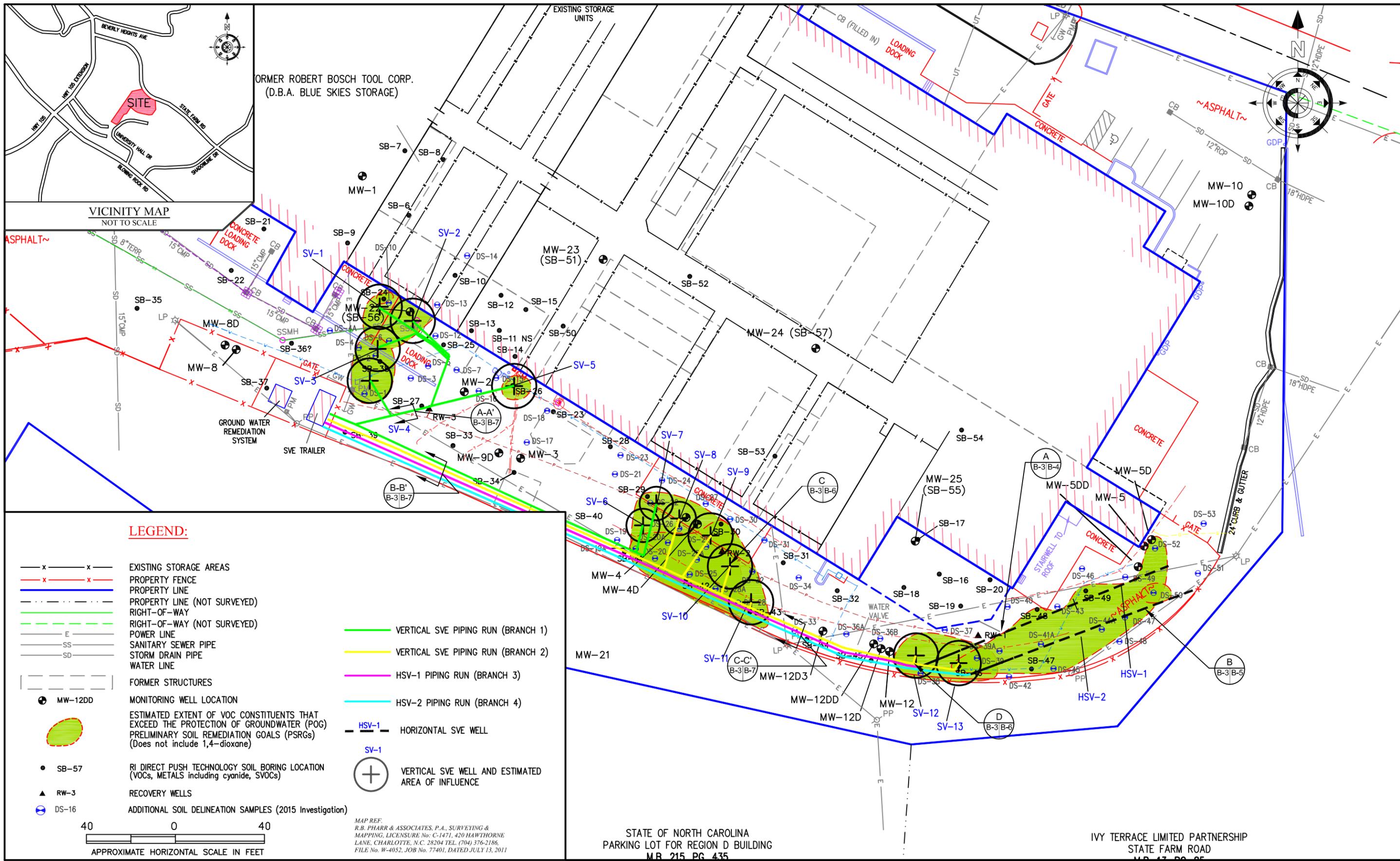
- 1) WORK SCOPE TO INCLUDE ALL MATERIALS AND LABOR NECESSARY TO PROVIDE A POWER CONNECTION TO THE SVE EQUIPMENT SKID OR TRAILER.
- 2) CONTRACTOR SHALL PROVIDE ELECTRICAL WORK TO POWER START UP AND SUBSEQUENT OPERATION OF THE SVE SYSTEM. LOCATION OF POWER SUPPLY WILL BE PROVIDED BY ENGINEER.
- 3) EXISTING POWER SUPPLY IS 3 PHASE, 480 VOLTS. ELECTRICAL SERVICE SHALL BE SUFFICIENT TO OPERATE THE SVE SYSTEM (3 PHASE, 208V, 100 AMP SERVICE).
- 4) THE CONTRACTOR(S) IS REQUIRED TO HAVE A NORTH CAROLINA LICENSED ELECTRICIAN PERFORM ALL ELECTRICAL WORK RELATED TO INSTALLATION OF THE SVE TRAILER SYSTEM.
- 5) THE CONTRACTOR(S) IS REQUIRED TO INSTALL A SEPARATE ELECTRICAL SERVICE OR USE AN EXISTING ELECTRICAL SERVICE TO RECORD POWER USAGE OF THE SVE SYSTEM .
- 6) ALL NECESSARY CONDUIT, PANEL, AND BOX SUPPORTS, IF REQUIRED, SHALL BE FURNISHED AND BE OF UNISTRUT CONSTRUCTION OR EQUIVALENT.
- 7) ALL BOXES, JUNCTIONS, AND PANELS SHALL BE AT LEAST NEMA 3R RATED OR EQUIPPED FOR OUTDOOR WEATHER EXPOSURE WITH APPROPRIATE GASKETS

**SITE RESTORATION**

- 1) THE SITE SHALL BE RESTORED TO A CONDITION EQUIVALENT TO PRIOR TO INITIATION OF SVE SYSTEM INSTALLATION ACTIVITIES.
- 2) ALL WASTE AND DEBRIS SHALL BE CONTAINERIZED AND STAGED FOR DISPOSAL IN A LOCATION SPECIFIED BY THE ENGINEER.
- 3) SITE CLEAN UP MUST BE TO THE SATISFACTION OF THE ENGINEER, SITE OWNER, AND OWNER/CLIENT.

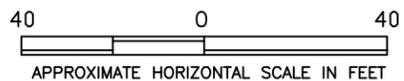
	<b>GENERAL SVE SYSTEM CONSTRUCTION SPECIFICATIONS</b>	
	JOB: 6251-12-1001 LT.LNG: . SCALE: N/A DRAWN: T. Renn CHKD: G. Wise PM: P. Johnstone DATE: 07/25/2016	RBTC FORMER BOONE DIVISION BOONE, NORTH CAROLINA
AMEC Environment & Infrastructure 2801 Yorkmont Road, Suite 100, Charlotte, NC 28208 Phone (704) 357-8600 Fax (704) 357-8638	FIGURE NO. <b>B-2</b>	PROJECT NO. 6251-12-1001

Path: P:\Environmental\2016\1020 RBTC Boone\Phase 01 2016 Activities\Task 02 Soil Remediation\Soil RAPP\CR\Appendices\Appendix B - SVEB2\_SVE System Construction Specifications.dwg [Figure A-2]  
 Date: August 11, 2016 - 10:13am By: timothy.rein



**LEGEND:**

- x-x- EXISTING STORAGE AREAS
- x-x- PROPERTY FENCE
- - - - - PROPERTY LINE
- - - - - PROPERTY LINE (NOT SURVEYED)
- - - - - RIGHT-OF-WAY
- - - - - RIGHT-OF-WAY (NOT SURVEYED)
- E- POWER LINE
- SS- SANITARY SEWER PIPE
- SD- STORM DRAIN PIPE
- - - - - WATER LINE
- - - - - FORMER STRUCTURES
- MW-12DD MONITORING WELL LOCATION
- ESTIMATED EXTENT OF VOC CONSTITUENTS THAT EXCEED THE PROTECTION OF GROUNDWATER (POG) PRELIMINARY SOIL REMEDIATION GOALS (PSRGs) (Does not include 1,4-dioxane)
- SB-57 RI DIRECT PUSH TECHNOLOGY SOIL BORING LOCATION (VOCs, METALS including cyanide, SVOCs)
- RW-3 RECOVERY WELLS
- DS-16 ADDITIONAL SOIL DELINEATION SAMPLES (2015 Investigation)
- VERTICAL SVE PIPING RUN (BRANCH 1)
- VERTICAL SVE PIPING RUN (BRANCH 2)
- HSV-1 PIPING RUN (BRANCH 3)
- HSV-2 PIPING RUN (BRANCH 4)
- HSV-1 HORIZONTAL SVE WELL
- SV-1 VERTICAL SVE WELL AND ESTIMATED AREA OF INFLUENCE



MAP REF:  
R.B. PHARR & ASSOCIATES, P.A., SURVEYING & MAPPING, LICENSE No. C-1471, 420 HAWTHORNE LANE, CHARLOTTE, N.C. 28204 TEL. (704) 376-2186, FILE No. W-4052, JOB No. 77401, DATED JULY 13, 2011

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PARKING LOT FOR REGION D BUILDING  
M.B. 215 PG. 435

IVY TERRACE LIMITED PARTNERSHIP  
STATE FARM ROAD  
M.B. 17 PG. 85

DRAWN	CHB	DATE	06/29/2016
CHECKED	TSR	FILE	Figure B-3
APPROVED		JOB NO:	6251121001.03.01

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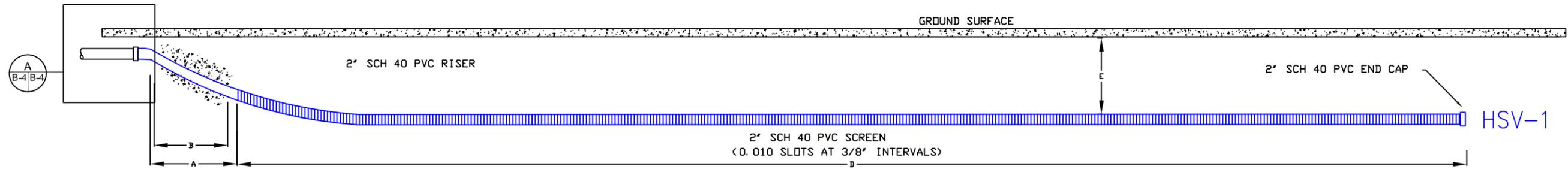
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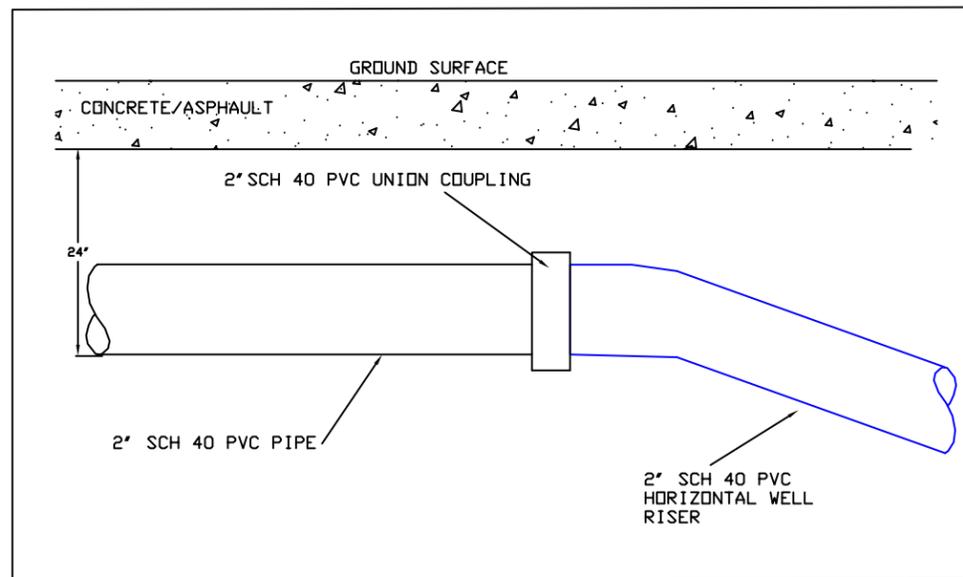
**SVE SYSTEM AND CONVEYANCE PIPING LAYOUT**

**RBTC FORMER BOONE DIVISION**  
BOONE, NORTH CAROLINA

FIGURE  
B-3



A  
B-3/B-4 SVE HORIZONTAL SVE WELL HSV-1 DETAIL  
(NOT TO SCALE)



A  
B-4/B-4 SVE SCREEN DETAIL  
(NOT TO SCALE)

**DIMENSIONS FOR HORIZONTAL SVE WELL HSV-1**

HORIZONTAL VAPOR EXTRACTION WELL NAME	DIMENSIONS (FEET)			
	A	B	C	D
	RISER LENGTH (feet)	HORIZONTAL GROUT INTERVAL (feet)	SCREEN LENGTH (feet)	DEPTH TO TOP-OF-WELL (feet)
HSV-1	20	1-18	100	4
Total Borehole Length (A + C) = 120				

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CHECKED	TSR	FILE	FIGURE B-4	No.	DESCRIPTION	BY
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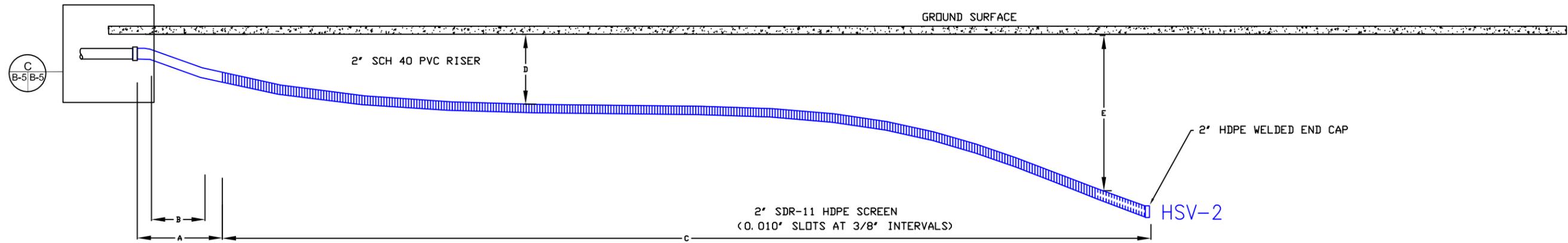
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**SVE HORIZONTAL WELL HSV-1 DETAILS**

**RBTC FORMER BOONE DIVISION**  
BOONE, NORTH CAROLINA

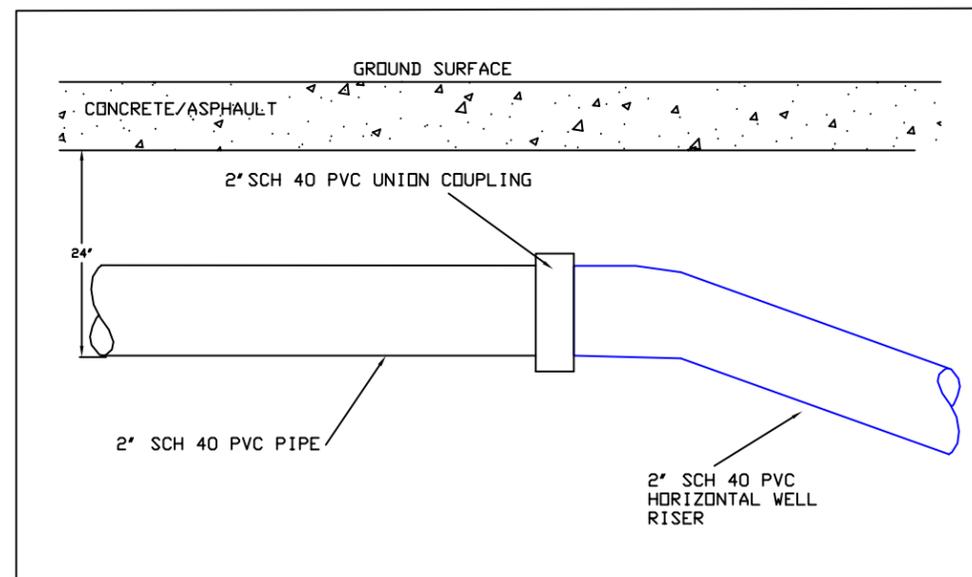
FIGURE

B-4



**B**  
B-3/B-5 SVE HORIZONTAL SVE WELL HSV-2 DETAIL  
(NOT TO SCALE)

DIMENSIONS FOR HORIZONTAL SVE WELL HSV-2					
HORIZONTAL VAPOR EXTRACTION WELL NAME	DIMENSIONS (FEET)				
	A	B	C	D	E
	RISER LENGTH (feet)	HORIZONTAL GROUT INTERVAL (feet)	SCREEN LENGTH (feet)	DEPTH TO TOP-OF-WELL (feet)	DEPTH TO TOP-OF-WELL (feet)
HSV-2	20	1-18	85	5	10
Total Borehole Length (A + C) = 105					



**C**  
B-5/B-5 SVE SCREEN DETAIL

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CHECKED	TSR	FILE	Figure B-5
APPROVED		JOB NO:	6251121001.03.01

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No.	DESCRIPTION	BY

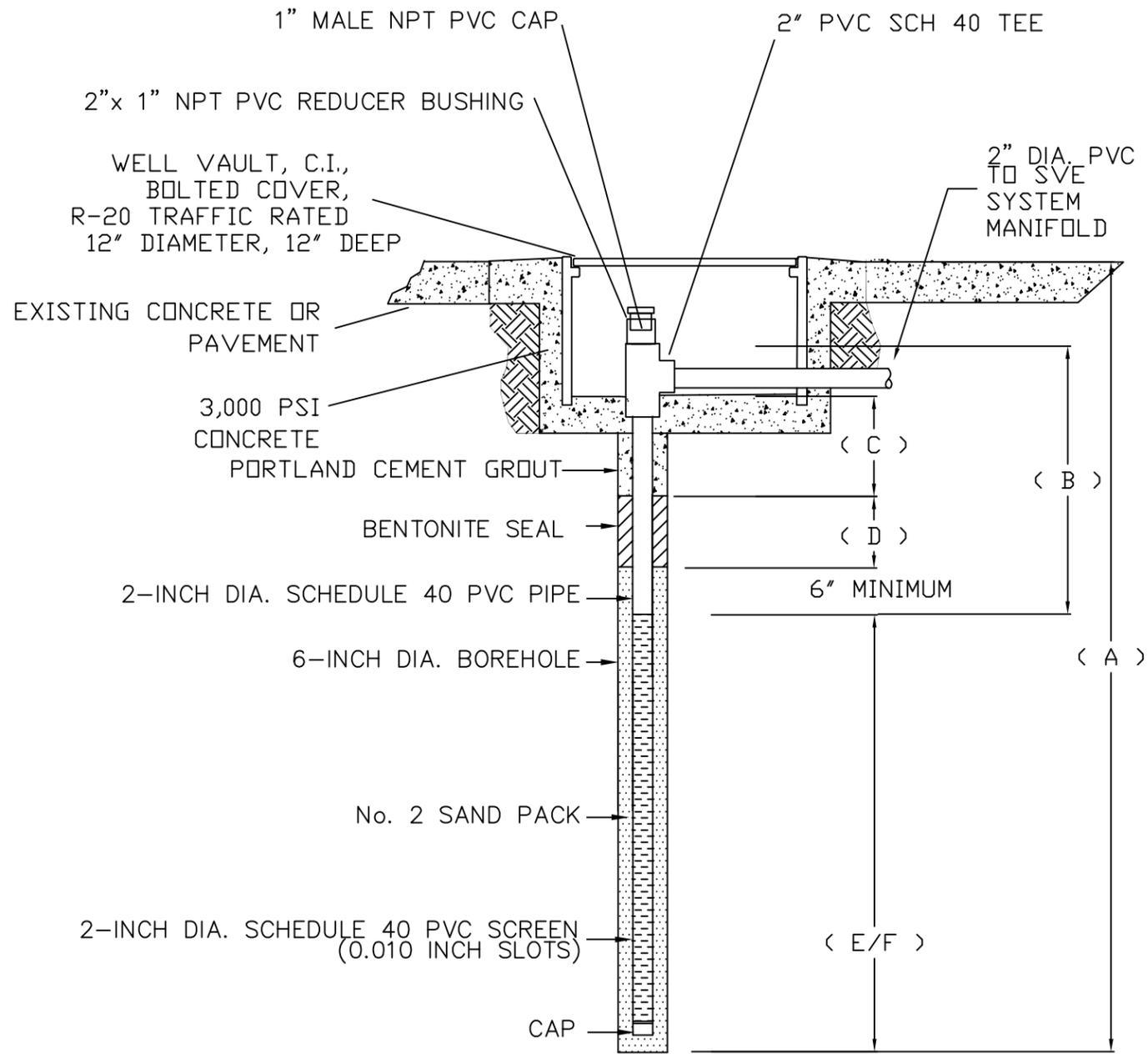
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**SVE SYSTEM HORIZONTAL WELL  
HSV-2 DETAILS**  
RBTC FORMER BOONE DIVISION  
BOONE, NORTH CAROLINA

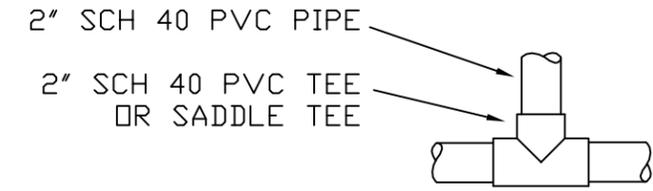
FIGURE  
B-5



DIMENSIONS AS SHOWN ON TABLE

**C**  
B-3 B-6 VERTICAL SVE WELL DETAIL  
INSTALLED IN ASPHALT OR CONCRETE  
(NOT TO SCALE)

VERTICAL SVE WELL DIMENSIONS						
VERTICAL VAPOR EXTRACTION WELL NAME	DIMENSIONS (FEET)					
	A	B	C	D	E	F
	TOTAL DEPTH	RISER LENGTH	GROUT INTERVAL	BENTONITE SEAL	SCREEN LENGTH	SCREEN INTEVAL
SV-1	15	4.5	1 - 2	2 - 4	10	5 - 15
SV-2	15	4.5	1 - 2	2 - 4	10	5 - 15
SV-3	26	15.5	1 - 13	13 - 15	10	16 - 26
SV-4	26	15.5	1 - 13	13 - 15	10	16 - 26
SV-5	30	19.5	1 - 17	17 - 19	10	20 - 30
SV-6	8	2.5	1 - 1.5	1.5 - 2.5	5	3 - 8
SV-7	8	2.5	1 - 1.5	1.5 - 2.5	5	3 - 8
SV-8	8	2.5	1 - 1.5	1.5 - 2.5	5	3 - 8
SV-9	17	6.5	1 - 4	4 - 6	10	7 - 17
SV-10	17	6.5	1 - 4	4 - 6	10	7 - 17
SV-11	17	6.5	1 - 4	4 - 6	10	7 - 17
SV-12	25	14.5	1 - 12	12 - 14	10	15 - 25
SV-13	27	16.5	1 - 14	14 - 16	10	17 - 27
TOTALS	239	117.5	76.5	23	115	----



**D**  
B-3 B-6 SVE WELL CONNECTION DETAIL  
TO BURIED MANIFOLD  
(NOT TO SCALE)

DRAWN	CHB	DATE	6/29/2016
CHECKED	TSR	FILE	Figure B-6
APPROVED		JOB NO:	6251121001.03.01

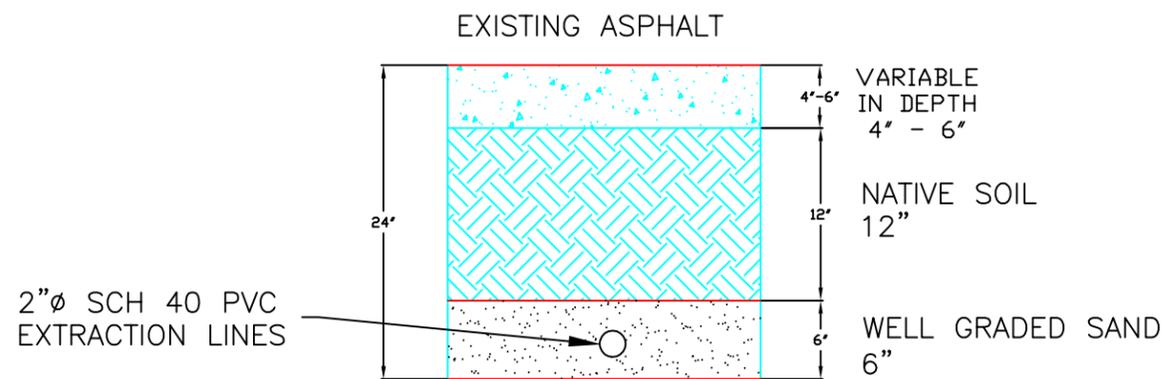
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No.	DESCRIPTION	BY



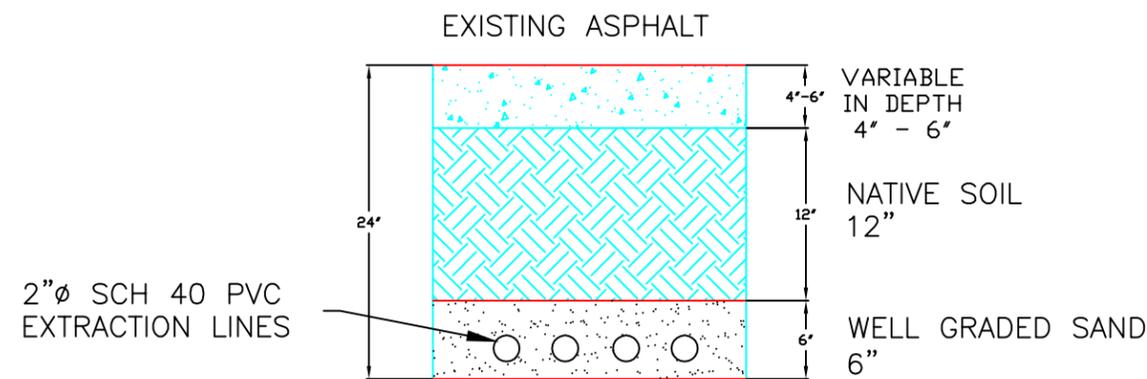
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Fax: (864) 552-9699

**SVE SYSTEM VERTICAL WELL DETAILS**

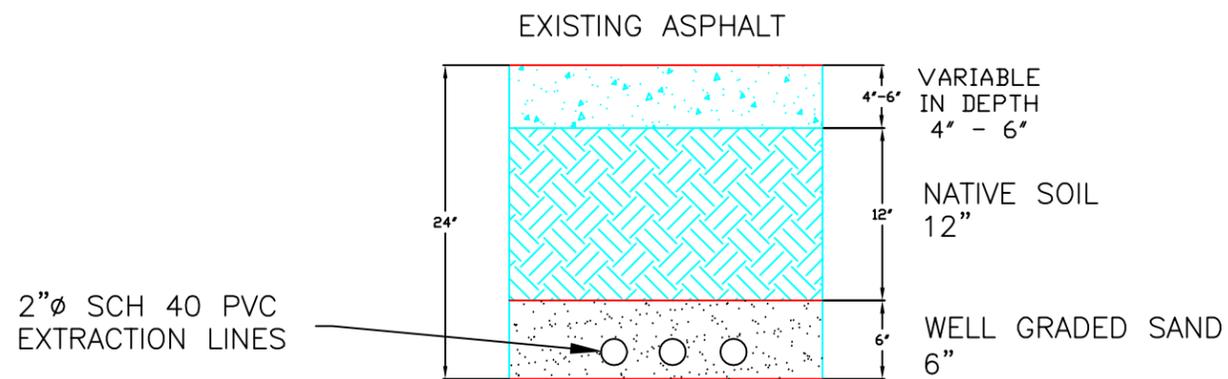
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BOONE, NORTH CAROLINA



TRENCH DETAIL  
(SINGLE PIPE)  
A-A'  
B-3 B-7  
(NOT TO SCALE)



TRENCH DETAIL  
(4 PIPES IN PARALLEL)  
B-B'  
B-3 B-7  
(NOT TO SCALE)



TRENCH DETAIL  
(3 PIPES IN PARALLEL)  
C-C'  
B-3 B-7  
(NOT TO SCALE)

DRAWN	CHB	DATE	6/29/2016
CHECKED	TSR	FILE	Figure B-7
APPROVED		JOB NO:	6251121001.03.01

REVISIONS		
No.	DESCRIPTION	BY



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**SVE SYSTEM TRENCH DETAILS**

**RBTC FORMER BOONE DIVISION**  
BOONE, NORTH CAROLINA

**SVE SCHEDULE OF EQUIPMENT**

SVE BLOWER (B-201): ROTARY CLAW BLOWER, 3-PHASE 7.5 HP, 60 Hz, 3450 RPM WITH CAPACITY OF 200 ACFM AT 135" W.C. VACUUM, 3PH 208VAC, TEFC MOTOR, ELMO RIETSCHLE MODEL C-VLR 300 or equivalent.

VAPOR-LIQUID SEPARATOR (VLS-201): ALUMINUM OR EPOXY-COATED STEEL AIR WATER SEPARATOR, 60 GALLON, 24 GALLON LIQUID CAPACITY OR GREATER, 2" MNPT CONNECTIONS, SIGHT GLASS AND INTEGRAL LL, HL, HHL FLOATS.

CONDENSATE TRANSFER PUMP (TP-201): 1-HP, 208VAC, 1750 RPM MOYNO PROGRESSIVE CAVITY PUMP or equivalent.

CONDENSATE TANK (T-301): 225-GALLON CAPACITY HIGH DENSITY POLYETHYLENE HORIZONTAL TANK WITH HL FLOAT

**CONTROL FUNCTIONS**

LSHH-201	ON	STOP B-201, ALARM
LSH-201	ON	START P-201 TRANSFER PUMP
LSL-201	OFF	STOP TP-201 TRANSFER PUMP
LSH-301	ON	STOP TP-201 TRANSFER PUMP, ALARM

**CONTROL / TELEMETRY**

DIGITAL INPUTS: 8 MINIMUM

- 4 LEVEL SWITCHES
- 2 MOTOR CONTACTORS
- 2 SPARE

ANALOG INPUTS: 6 MINIMUM

- 2 VACUUM TRANSMITTERS
- 2 TEMP TRANSMITTERS
- 1 PRESSURE TRANSMITTER
- 1 SPARE

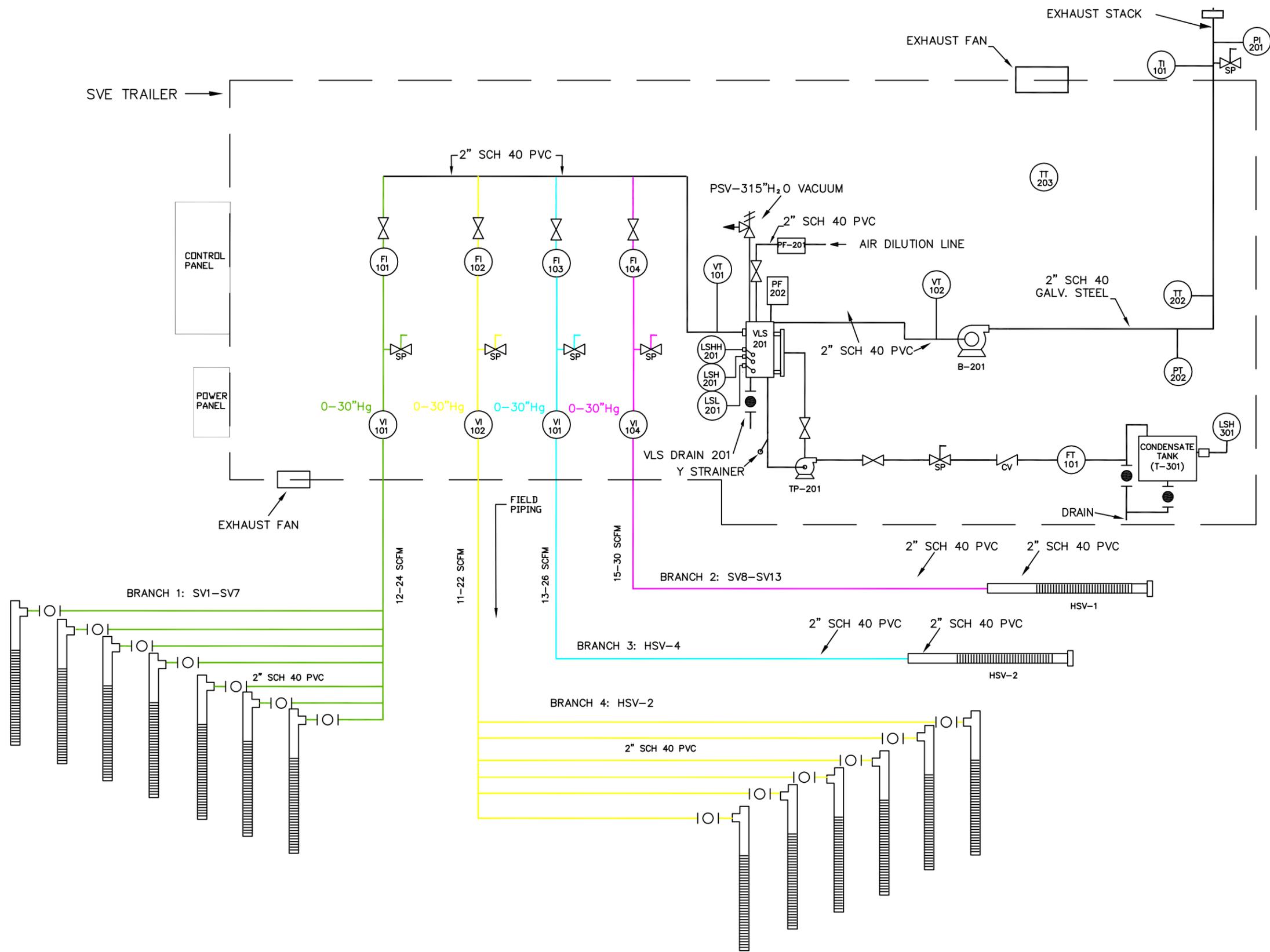
DIGITAL OUTPUTS: 4 MINIMUM

- B-201
- TP-201
- 2 SPARES

INTERNET ACCESS, MONITORING, AND REMOTE OPERATION LOGGING CAPACITY FOR 30 DAYS OF HOURLY RECORDS OF LISTED INPUTS, OUTPUTS, AND ALARM STATUS

**LEGEND**

- GATE VALVE, NORMALLY OPEN
- BALL VALVE, NORMALLY OPEN
- BALL VALVE, NORMALLY CLOSED
- SAMPLING PORT
- VACUUM INDICATOR
- PRESSURE INDICATOR
- TEMPERATURE INDICATOR
- CHECK VALVE
- FLOW INDICATOR
- VACUUM RELIEF VALVE
- PARTICULATE FILTER
- Y STRAINER
- FLOW TOTALIZER
- VACUUM TRANSMITTER
- PRESSURE TRANSMITTER
- TEMPERATURE TRANSMITTER



DRAWN	CHB	DATE	6/30/2016
CHECKED	TSR	FILE	Fig B-8
APPROVED		JOB NO:	6251121001.03.01

REVISIONS		
No.	DESCRIPTION	BY

amec foster wheeler

37 VILLA ROAD  
SUITE 201  
GREENVILLE, SC 29615  
Phone: (864) 552-9624  
Fax: (864) 552-9699

**SVE SYSTEM PROCESS & INSTRUMENT DIAGRAM**

**RBTC FORMER BOONE DIVISION**  
BOONE, NORTH CAROLINA

FIGURE  
B-8

**APPENDIX C**

**HEALTH AND SAFETY PLAN**  
**AND**  
**HEALTH AND SAFETY PLAN MODIFICATION**

# **COMMUNITY AND SITE HEALTH AND SAFETY PLAN**

**ROBERT BOSCH TOOL CORPORATION  
FORMER BOONE DIVISION  
BOONE, NORTH CAROLINA**

**Prepared by:**

**MACTEC Engineering and Consulting, Inc.  
555 N. Pleasantburg Dr., Suite 202  
Greenville, South Carolina**

**MACTEC PROJECT NO. 6680-04-9513**

**JULY 2011**



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Table 2	Summary of Aqueous Contaminants

FIGURES

Figure 1	Site Location Map
Figure 2	Route Map to Nearest Hospital

APPENDICES

Appendix A	Personnel Signoff Sheets
Appendix B	Job Hazard Analysis Forms

**SECTION I**  
**EMERGENCY CONTACTS**

**EMERGENCY TELEPHONE NUMBERS**

<b>Medical</b>	Emergency Assistance/Ambulance	911
	Blowing Rock Hospital 418 Chestnut Drive Boone, North Carolina 28607	(828)295-3136
<b>Police</b>	Emergency Assistance	911
	Boone Police Department 1500 Blowing Rock Road Boone, North Carolina 28607	(828) 268-6900
<b>Fire</b>	Emergency Assistance	911
	Boone Fire Department 729 W. King Street Boone, North Carolina 28607	(828) 268-6180

**Other:**

National Poison Control Center (800) 492-2414  
 Chemical Manufacturing Association – Chemical Referral Center (800) 262-8200

**MACTEC ENGINEERING AND CONSULTING, INC.**

		<b>Telephone</b>	<b>Cell Phone</b>
Office	Greenville, SC	(864) 552-9624	Not applicable
Local Health & Safety Officer	Gary W. Wise	(864) 552-9624	(864) 901-2965
Project Manager	Paul S. Johnstone	(864) 552-9624	(864) 616-4176
Project Principal	Paul S. Johnstone	(864) 552-9624	(864) 616-4176
Site Manager and Site Safety Officer	Mark Filardi	(704) 357-5587	(980) 322-8991

**CLIENT**

Robert Bosch Tool Corporation  
 Contact: David Luepke  
 Director, Environmental, Safety & Facilities Services  
 (224) 232-2201

## SECTION II

### SITE SPECIFIC AND COMMUNITY SAFETY AND HEALTH INFORMATION

#### A. Site Description

MACTEC Project Number: 6680-04-9513

Client: Robert Bosch Tool Corporation

Site Location: See Figure 1

#### B. Scope of Work:

This Health and Safety Plan (HASP) is intended to address the details associated with all phases of site assessment activities. However, in the event that the scope of services goes beyond what is covered under this present HASP, the document will be revised as appropriate prior to mobilization for subject work.

The scope of work to be performed includes conducting direct-push borings, installing monitoring wells, and conducting soil, surface water, sediment, and groundwater sampling.

This HASP has been prepared for the scope of work outlined above. In addition to addressing the health and safety concerns of on-site workers, the plan also addresses monitoring and safety issues related to the adjacent community.

In addition to site safety measures identified in the HASP, MACTEC will employ procedures to protect nearby human populations from exposure to hazardous substances. During times when the site is unoccupied by a MACTEC employee or subcontractor, safety barricades will be used to designate work areas and alert potential visitors to the hazards present. Measures to contain any runoff of hazardous substance will include covering with plastic or containerizing any soil cuttings generated during soil boring and well installation activities, and containerizing liquids generated from decontamination procedures and well development and sampling. If necessary, clean potable water will be sprayed on the surface of the work area to lower dust production, thereby reducing the impact to nearby populations.

## C. Key Personnel

### **MACTEC Personnel:**

Project Manager:	Paul S. Johnstone, L.G.
Project Principal:	Paul S. Johnstone, L.G.
Site Safety Officer:	Mark Filardi
Local Health & Safety Officer:	Mark Filardi

Responsibilities	See Section III, 2.0
Training	See Section III, 3.0

### **Additional Personnel On Site:**

Client representatives:	David Luepke and John Young
Subcontractors:	Priority Underground Locating Service, LLC Geologic Exploration

### **Regulatory Agency:**

North Carolina Department of Environment and Natural Resources  
Division of Waste Management  
Inactive Hazardous Sites Branch  
Registered Environmental Consultant (REC) Program

Project Manager:	Janet Macdonald Raleigh, North Carolina (919) 508-8446
------------------	--

## D. Hazard Evaluation

### **Chemical Hazards**

The hazardous substances of concern at the Site are chlorinated volatile organic compounds (VOCs), and potentially SVOCs, and metals.

### **Groundwater**

Groundwater samples (includes surface water samples) collected during previous assessments revealed concentrations above the laboratory's PQL for:

### **Volatile Organic Compounds**

Chloroform, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, tetrachloroethene, trichloroethene, and vinyl chloride.

**Physical Hazards:**

- Heavy equipment – drill rigs will be present.
- Slippery mud and sloped topography.
- Heat Stress - Field activities in hot climates create a potential for heat stress. The warning symptoms include fatigue; loss of strength; reduced accuracy, comprehension, and retention; and reduced alertness and mental capacity. To prevent heat stress, personnel shall receive adequate water supplies and electrolyte replacement fluids, and maintain scheduled work/rest periods. Pulse rate and body temperature shall also be monitored as appropriate.
- Cold Stress – Field activities during cold weather creates a potential for cold-related illness (chilblains, frostbite, immersion foot, hypothermia, and windchill). The warning signals include heavy shivering, frostnip, excessive fatigue, irritability, or euphoria. To prevent cold stress, personnel will wear protective clothing, consume warm, sweet drinks and/or soup to prevent dehydration, and maintain scheduled work/warming periods. Ambient air temperature and windchill will be monitored and checked every four hours. Work/warm periods will be established when the windchill temperature is below 20° F.
- Biological hazards – Bees, ticks, snakes, poison ivy.

**E. Personal Protective Equipment**

Clothing and Respirators	See Section III, 4.0
Decontamination Procedures	See Section III, 5.0
Medical Surveillance	See Section III, 6.0

Based on the evaluation of potential hazards at the site, the field work will be performed in Level D personal protective equipment (PPE). Level D PPE will consist of the following.

Level-D PPE:	Protective gloves (PVC, Nitrile or Butyl Rubber) Hard Hat (when working near heavy equipment like drill rigs or when other overhead hazards are present). Safety glasses or goggles Steel-toe safety shoes Long pants. Hearing protection if extended exposure to rig noise
--------------	--

## **F. Field Monitoring Procedures**

Monitoring	See Section III, 7.0
Contingency Plan	See Section III, 10.0

VOCs have been identified at the site and are suspected to be present. Therefore, monitoring of the breathing zone is to include monitoring with an organic vapor analyzer, either a flame-ionization detector (FID) or photo-ionization detector (PID), and if appropriate, work will be performed in a higher level of protection (Level C).

## **SECTION III**

### **GENERAL SAFETY, HEALTH, AND EMERGENCY INFORMATION**

#### **1.0 INTRODUCTION**

The health and safety of site workers and the public is a primary concern and goal during project field activities. Thus, a comprehensive, carefully managed, and thoroughly documented site HASP is prepared and implemented as part of project operations.

The following plan describes field implementation of the HASP, specific responsibilities, training requirements, protective equipment, and operating and emergency procedures. Specifically included are procedures for site and personnel monitoring during project field activities. Documentation of these and other site conditions during execution of the project is required. The plan's flexibility allows unanticipated site-specific problems to be addressed while assuring adequate and suitable worker protection. This plan is based on site specific information, actual site inspections, and determination of the potential hazardous conditions which may be encountered.

#### **2.0 RESPONSIBILITIES**

The Project Manager (PM) and Local Health and Safety Representative (LHSR) are responsible for formulating the health and safety requirements and the Site Safety Officer (SSO) is responsible for enforcing health and safety requirements. These responsibilities include:

- assuring that all site team members have received the required health, safety and emergency response training;
- assuring that all site team members have completed the required medical examination and have met the appropriate qualification criteria for site work;
- assuring that all equipment used on site is suitable and adequate; and,
- assuring that site standard operating procedures are followed at all items.

The SSO will have direct responsibility for administering the HASP relative to all site activities, and will be in the field full-time while site activities are in progress. The PM and the LHSR have prepared the HASP based on a format developed by MACTEC and information obtained on site conditions. The SSO has responsibility for reviewing and approving the HASP and responding to any non-routine matters that relate to health, safety, and emergency response during the project life. The PM or LHSR may visit the site at any time to monitor compliance with the provision of the HASP.

#### **3.0 PERSONNEL TRAINING**

All personnel working at the site who potentially may be exposed to toxic substances or hazardous materials will participate in an initial and annual refresher and/or supervisory training (as appropriate), as well as site-specific training before commencement of any on-site assignment. The initial Health and Safety Training Program consists of the 40-hour training program required and designated by Occupational Safety and Health Act (OSHA) standard 29 CFR 1910.120. In

addition, MACTEC uses eight-hour annual refresher and supervisory training elements, which are augmented by site-specific training and briefings. Site-specific training covers hazards and specialized protocols specific to the site. In addition it will cover major elements of the site HASP, as well as health and safety procedures regarding an individual's specific job responsibilities and tasks. Training, such as that defined under MACTEC's Health and Safety Program and 29 CFR 1910.120 is required for all personnel entering work areas at the site. Personnel without the required training will not be permitted in any work area at the site. A thorough understanding of the types of hazards most likely to be encountered at the contaminated work site and the personal protection measures needed to protect personnel from hazards is the first requirement of a complete safety, health and emergency response plan. Each project team member shall have received instruction in health and safety procedures appropriate for conducting and participating in work at contaminated sites. Additional briefings and safety meetings will be held with field personnel before beginning project related work to explain and discuss site-specific health and safety matters. A personnel sign off sheet is included in Appendix A. Job Hazard Analyses (JHAs) for the work to be conducted at the site are included in Appendix B.

A preliminary safety meeting between MACTEC and subcontractor's personnel will be conducted before the initiation of any field activities. The initial briefing will discuss potential hazards which may be encountered, site safety, and the emergency response plan.

Subcontractors will be subject to all applicable health and safety regulations during field operation at the site. The SSO is responsible for briefing the subcontractor's personnel on contamination that may be encountered on the site, site safety, and the emergency response plan. Each of the subcontractors will be under the direct supervision of the SSO or his representative.

#### **4.0 PERSONAL PROTECTIVE EQUIPMENT**

Based on experience at similar sites and the anticipated work, it appears that the primary exposure to contaminants during field activities may occur through skin contact or through inhalation of vapor or dust while sampling and handling potentially contaminated soil or water.

The required personal protective and emergency equipment have been selected based on anticipated site conditions and work.

#### **4.1 PERSONAL PROTECTIVE EQUIPMENT**

The level of protection required is selected based on the anticipated hazards and site activities consistent with USEPA protocols and the provisions of OSHA 29 CFR 1910 and 1926. Anything less than maximum protection (Levels A or B) cannot be specified without (1) carefully defining site conditions, (2) allowing extra safety margins, (3) having higher level equipment readily available, and (4) anticipated worst-case conditions. Because worker efficiency decreases in direct proportion to the amount of protective gear required, it is always desirable to use as little equipment as possible while providing adequate protection.

In the event of conflicting requirements, the most protective level shall apply. The required levels of protection are subject to change at any time by the SSO or the PM based on monitoring, visual observations, or changes in work or site conditions.

## **4.2 CLOTHING**

### **4.2.1 Types of Protective Clothing Materials**

The following materials are generally available for a variety of garments:

- a. Non-elastomers: Tyvek, Nomex.
- b. Elastomers: Polyethylene, Saranex, Polyvinyl Chloride (PVC), Neoprene, Chlorinated Polyethylene (CPE) or Chloropel, Butyl Rubber, Viton, Natural Rubber, Nitrile, Polyvinyl Alcohol (PVA).

### **4.2.2 Essential Considerations when selecting clothing**

- a. Work Mission Duration
  1. Work Rate
  2. Physical Fitness
  3. Body Size
- b. Ensemble Permeation/Penetration by Contaminants
  1. Valves
  2. Fasteners
- c. Ambient Temperature
  1. Valves
  2. Fasteners
  3. Chemical Behavior

### **4.2.3 Clothing Reuse**

- a. Chemicals Can Permeate After Decontamination
- b. Effects of Contaminants on Protective Clothing Must be Known

### **4.2.4 Inspection**

- a. Inspection/Testing of Clothing Received from Factory
- b. Inspection as it is Issued to Workers
- c. Inspection After Use
- d. Periodic Inspection During Storage
- e. Continuous Inspection Prior to, During, and After Use

### **4.2.5 Storage**

- a. Separate from Street Clothes
- b. Segregated by Types and Material

- c. Store According to Manufacturer (Folded, Hung)

#### **4.2.6 Maintenance**

- a. Performed by Qualified Personnel
- b. Authorized by Manufacturer Through Sale of Replacement Parts

#### **4.2.7 Clothing Selection**

- a. Principle Factors
- b. Physical Integrity for Intended Tasks
- c. Ease and Cost of Decontamination
- d. Performance Requirements of Clothing Material

#### **4.2.8 Performance Characteristics of Clothing Material**

- a. Chemical Resistance
  - 1. Degradation: breakdown of the material
  - 2. Penetration: leakage through clothing seams, faults
  - 3. Permeation: breakthrough depending on:
    - a). Material Type
    - b). Degree of Concentration Gradient
    - c). Ambient Temperature/Contaminant Temperature
    - d). Humidity
    - e). Barometric Pressure
- b. Flexibility (often depends on ambient temperatures)
- c. Thermal limits
- d. Durability (ability to resist physical damage)

### **4.3 RESPIRATORS**

Respirators are used to help protect against inhalation hazards. The selection of a respirator usually involves three steps:

- a. Identifying the hazards,
- b. Evaluating the hazards,
- c. Providing proper respiratory protective equipment to suit the conditions and the individual.

There are two general types of respirators: air purifying and supplied air respirators.

#### **4.3.1 Air Purifying Respirators**

- Removes hazardous contaminant from the air before it is inhaled.

- Consists of rubber face piece and replaceable filters or cartridges.
- Can be full faced (covering all face from chin to forehead) or half faced (covering nose and mouth)
- Filters or cartridges must be chosen for specific contaminant. Different types are color coded for use with specific contaminant or group of contaminants.
- Negative pressure devices to insure air enters only through the filters.

#### 4.3.1.1 Powered Air Purifying Respirators (PAPR)

- Positive pressure devices.
- Air is blown by the use of a battery pack through the filter and onto the face.
- Bulkier to wear than the half or full face type air purifying respirator but can be more comfortable in hot working conditions.

#### 4.3.2 **Supplied Air Respirators**

- Air supplied to the respirator from a source independent of the immediate hazardous atmosphere.
- Air supplied through an airline or from compressed air from a tank worn on the back. This second type is known as Self Contained Breathing Apparatus (SCBA).

#### 4.3.3 **Wearing Respirators**

- All respirators should be used in accordance with the OSHA respirator standard 29 CFR 1910.134.
- Individuals must be fit tested before being assigned a respirator.
- No smoking while using a respirator
- No eating or chewing
- Be clean shaven and free of face hair that may interfere with the respirator seal.

#### 4.3.4 **Inspections**

All respirators should be routinely checked for:

- Dirt.
- Cracks, scratches and tears.

- Distortion.
- Broken or missing parts.

#### **4.3.5 Cleaning and Disinfecting**

Whenever possible, respirators should be assigned to one individual. Respirators should be cleaned after each use, rinsed with disinfectant, rinsed with clean water and left to air dry.

#### **4.3.6 Storage**

Respirators should be stored in clean plastic bags and left in a clean, dry area.

### **5.0 DECONTAMINATION PROCEDURES**

Each individual shall conduct proper personal hygiene which may include washing any exposed skin prior to eating or smoking, consistent with site conditions.

A minimum decontamination for the Level D site work will consist of cleaning boots of loose soil or debris and discarding gloves before leaving the site to prevent spreading the contamination that may exist on the site. Decontamination procedures for higher levels of protection (i.e. Level C) are not presented. The HASP will be revised to include a description of these activities in the event that such action is warranted.

### **6.0 MEDICAL SURVEILLANCE**

Symptoms of exposure to hazardous materials and physical stresses (e.g. heat stress or cold stress) will be reviewed with site personnel to indicate the recognized signs of possible exposure or physical stresses. The most likely physical stressor to occur at the site, heat stress, is discussed in the following paragraph.

**Heat Stress:** Field activities in hot climates create a potential for heat stress. The warning symptoms include fatigue; loss of strength; reduced accuracy, comprehension, and retention; and reduced alertness and mental capacity. To prevent heat stress, personnel shall receive adequate water supplies and electrolyte replacement fluids, and maintain scheduled work/rest periods. Pulse rate and body temperature shall also be monitored as appropriate.

**Cold Stress:** Field activities during cold weather creates a potential for cold-related illness (chilblains, frostbite, immersion foot, hypothermia, and windchill). The warning signals include heavy shivering, frostnip, excessive fatigue, irritability, or euphoria. To prevent cold stress, personnel will wear protective clothing, consume warm, sweet drinks and/or soup to prevent dehydration, and maintain scheduled work/warming periods. Ambient air temperature and windchill will be monitored and checked every four hours. Work/warm periods will be established when the windchill temperature is below 20° F.

## **7.0 EMERGENCY EQUIPMENT**

The following emergency equipment will be available on the site during field operations:

### **7.1 FIRE EXTINGUISHERS**

Because of the potential threat of fire at hazardous waste sites, fire extinguishers will be readily available and at hand throughout the investigation. All fire extinguishers will be Class ABC. The fire extinguishers will be kept with the field crew during any field activities.

### **7.2 FIRST AID KITS**

An industrial first aid kit will be kept in the support area.

### **7.3 EYE WASH**

Sufficient potable water for copious flushing will be readily available throughout the project operations.

### **7.4 COMMUNICATIONS**

Emergency telephone numbers are included in the HASP (see Section I), which will be readily available on site. Emergency communication will be discussed in the safety briefings with all work crews prior to initiating the field work. At a minimum, the SSO will have a cellular telephone, which will be available at the work area.

### **7.5 PERSONAL HYGIENE**

A sufficient supply of clean, potable water and hand soap will be provided near the work area for the personal hygiene of field personnel. Personal hygiene primarily entails casual washing during site activities and is not strictly considered decontamination.

## **8.0 SITE CONTROL**

A contaminated waste site may be divided into three specific zones established on the basis of contamination potential:

- Zone 1 - exclusion zone;
- Zone 2 - contamination reduction zone; and
- Zone 3 - support zone.

Given the low-degree of hazards anticipated at the site, work zones will only be established around the drill rig for protection of workers and others from potential mechanical hazards. All public will be kept out of the work zones. If necessary, physical barriers will be erected. Other means of segregating the public can include tape, cones and barriers. Warning signs can be erected.

The exclusion zone is the suspected area of greatest environmental contamination and presents the greatest potential for worker exposure. Personnel entering the area must wear the mandated level of protection. In certain instances, different levels of protection will be required depending on the tasks to be performed within that zone. The support zone serves as a clean, control area, where decontamination facilities are located. The contamination reduction zone serves as a transition area

between the exclusion zone and the support zone. All areas will be defined and marked as appropriate by the Site Manager.

At the site, the establishment of these three specific zones may not be applicable. If hazardous conditions develop during site operations, work will be stopped and the three zones and any necessary additional zones will be developed. The zones will be marked by appropriate flags and stakes, and personnel will be briefed about activities and protective equipment for each zone.

## **9.0 ACCIDENT PREVENTION**

### **9.1 BEFORE LEAVING FOR SITE**

Review Site Information (see SSO).

- a. Expect hazards
- b. Special conditions
- c. Sampling procedures
- d. Location of telephones and emergency equipment
- e. Emergency medical information
- f. Level of personnel protection required

Check safety gear and equipment. The following equipment will be used at the site, or will be available for issue, depending on site-specific conditions. The safety gear and equipment will be available on-site in a support vehicle.

- a. Steel-toe safety boots
- b. Neoprene or Nitrile rubber boots
- c. Coveralls, Tyvek and Saranex coated Tyvek
- d. Hard-hat
- e. Goggles or Safety Glasses
- f. Neoprene gloves
- g. Half-face respirator with cartridges suitable for organic vapor, dusts,
- h. Ziploc® baggies, quart and gallon size to keep equipment clean
- i. Field standard operating procedures

Back-up equipment and spares will be maintained, including:

- a. Gloves
- b. Duct tape
- c. Trash barrel for return transportation of contaminated gear and
- d. Extra respirator cartridges

## 9.2 BEFORE ENTERING SITE

- a. No eating/drinking/smoking except away from the work area. Use good sanitary practices and wash hands and face thoroughly before eating/drinking/smoking.
- b. Drink some salt replacement fluids, especially during hot weather conditions, and carry drinks for use in support area.
- c. Place sample containers in field sample carrier (backpacks or carrier).
- d. Do not place containers or equipment on potentially contaminated surfaces.
- e. Check location of emergency eye wash supply and telephones.
- f. Check alternate safety gear.
  - Respirator (test even if you are not going to wear it immediately)
  - Hard-hat
  - Goggles or safety glasses
  - Check gear for rips/tears/malfunctions.
- g. Set up buddy system prior to proceeding with work.
- h. Make preliminary site survey.
  - Characterize physical conditions of site.
  - Use as much excess caution as possible.
  - Use caution - go slowly.

## 9.3 ON SITE

The following items are requirements to protect the health and safety of field workers and will be discussed in the safety briefing prior to initiation of work on the site.

- A **BUDDY SYSTEM** will be used. Hand signals will be established to maintain communication.
- During site operations, each worker will consider himself as a safety backup to his partner. Off-site personnel will provide emergency assistance. All personnel will be aware of dangerous situations that may develop.
- Visual contact will be maintained between buddies on-site when performing hazardous duties.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of hazardous material is prohibited at the site.

- Prescription drugs will not be taken by personnel where the potential for contact with toxic substances exist, unless specifically approved by a qualified physician. Alcoholic beverage intake is prohibited during the work day.
- No facial hair which interferes with the face-to-face piece seal of the respirator will be permitted on personnel required to wear such equipment. Each staff member will be fit-tested for respirators by the LHSR using an approved technique prior to arriving at the site. If Level D is initially specified at the site, the use of respirators is not required. However, organic vapor respirators will be available on-site in the event that upgrading to Level C is necessary. The respirators and spare cartridges will be available on-site in a support vehicle.
- Work areas for various operational activities (equipment testing, decontamination) will be established if higher levels of protection are implemented at the site.
- Procedures for leaving any contaminated area will be planned and reviewed prior to going on-site.
- Work areas and decontamination procedures have been established based on prevailing site conditions and are subject to change if site conditions change.
- No personnel will be admitted to the site without the proper safety equipment and training.
- Proper decontamination procedures must be followed before leaving the site. Decontamination in the Level D mode of operation will consist of good personal hygiene and cleaning boots and gloves before leaving the site.
- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy, as established by the LHSR or the PM, will be immediately dismissed from the site.
- Any medical emergency supersedes routine safety requirements.
- The SSO will make regular safety inspection of the site to insure that operations are being conducted in accordance with established safety procedures.

#### **9.4 PROCEEDING WITH WORK**

- No eating/drinking/smoking while working in contaminated area.
- Use standard, specified work techniques (see work procedures or discuss with Site Manager).
- Use appropriate care in handling contaminated material. If the work site is not accessible using your gear, do not enter the work site. Confer with buddy and team leader about alternative work locations.
- Wipe off spills, dirt and residue immediately.

- If any gear or equipment damage develops, immediately repair or replace.
- If you experience any physical discomfort, abnormalities, or lightheadedness -stop work, tell your buddy, and go back to designated Support Zone.

## **10.0 CONTINGENCY PLAN**

### **10.1 EMERGENCY ASSISTANCE**

All emergency contacts are listed in Section I of this HASP and should be posted by the nearest telephone.

### **10.2 HOSPITAL**

Hospital emergency room personnel should be contacted and briefed regarding the scope of the work. The emergency route to the hospital shall be discussed with the field personnel prior to beginning any activities. Figure 2 presents a map to the nearest hospital as well as written directions.

### **10.3 ACCIDENTS/INJURIES**

Depending on the severity of the injury, treatment may be given at the site by trained personnel, additional assistance may be required at the site (emergency medical technician), or the victim may have to be transported to the hospital. A first aid kit shall be maintained and readily available on-site.

In life threatening situations, care must begin **WITHOUT** considering decontamination. Outside protective clothing can be removed if it does not cause delays or aggravate the problem. Respirators must always be removed. Normal decontamination procedures should be followed when at all possible.

The SSO shall be immediately notified of any accident/incident. As soon as practical, the SSO shall notify the PM.

It will be the responsibility of the SSO to investigate thoroughly the details of any accident or injury. Based on his findings, he will recommend any corrective action relative to field procedures to prevent recurrence.

### **10.4 FIRE**

The potential for fire is significant at many contaminated waste sites. During subsurface operations, flame-ionization or photo-ionization detectors are to be used to monitor levels of volatile organics. Fire extinguishers (Class ABC) will be kept at the working locations. The local fire department will also be alerted to the nature and location of any field activities.

## **10.5 SITE EVACUATION**

Three stages of site evacuation have been determined:

- a. Withdraw from immediate work area
- b. Withdraw from site
- c. Withdraw from area

### **10.5.1 Withdrawal from Work Area**

Withdrawal to a safe upwind location will be required if any of the following occur:

- Occurrence of a minor accident - Field operations will resume after first aid and/or decontamination procedures have been administered.
- Equipment malfunctions.

### **10.5.2 Evacuation of Site**

The site will be evacuated in the following cases:

- a. A major accident or injury occurs.
- b. Fire and/or explosion occurs.

### **10.5.3 Evacuation of Areas Near the Facility**

The SSO is responsible for determining if circumstances exist for contamination of areas near the facility, and should always assume worst-case conditions until proven otherwise. Fire and police departments must be contacted. A list of their addresses and telephone numbers will be carried by the Site Manager.

## **10.6 SAFETY OF THIRD PARTIES**

Site access will be controlled at the site and only verified team members, and previously approved personnel will be allowed in work areas or areas containing potentially hazardous materials or conditions.

The general public will be kept out of the work zone. If necessary, physical barriers will be erected. Other means of segregating the public will include tape, cones and barriers. Warning signs will be erected, if deemed necessary by the SSO.

The anticipated investigative procedures are not expected to generate hazardous materials to which the public would be exposed through airborne transportation of environmental media. Therefore, physical exclusion of the general public from the work areas at the site will be sufficient to protect the safety of the general public.

**TABLES**

TABLE 1

Summary of Maximum Solid Contaminant Concentrations  
 RBTC Former Boone Division  
 Boone, North Carolina  
 MACTEC Project 6680-04-9513-01

Constituent	Units	EPA Region IX RSL		NCDENR	NCDENR	Maximum Concentration
		Residential	Industrial	IHSB SRGs	IHSB POGs	
Chloromethane	µg/kg	120,000	500,000	24,000	15	76
1,1-Dichloroethane	µg/kg	3,300	17,000	3,300	30	22
cis-1,2-Dichloroethene	µg/kg	700,000	9,200,000	140,000	310	351
Ethylbenzene	µg/kg	5,400	27,000	5,400	8,100	76
Methylene chloride	µg/kg	11,000	53,000	11,000	23	110
Tetrachloroethene	µg/kg	550	2,600	550	5	9
1,1,1-Trichloroethane	µg/kg	8,700,000	38,000,000	640,000	1,200	90
Trichloroethene	µg/kg	2,800	14,000	2,800	18	90
Trichlorofluoromethane	µg/kg	790,000	3,400,000	160,000	24,000	4
Xylenes	µg/kg	590,000	2,500,000	130,000	6,000	510
TPHC	mg/kg	NE	NE	NE	NE	120
Aluminum	mg/kg	77,000	990,000	15,000	NE	<b>19,659</b>
Arsenic	mg/kg	39	1.6	4.4	5.8	<b>4.6</b>
Barium	mg/kg	15,000	190,000	3,000	580	265
Beryllium	mg/kg	160	2,000	32	63	0.54
Boron	mg/kg	16,000	200,000	3,200	45	30.4
Cadmium	mg/kg	70	800	14	3	0.79
Chromium	mg/kg	NE	NE	NE	NE	59
Cobalt	mg/kg	23	300	4.6	0.9	<b>16.1</b>
Copper	mg/kg	3,100	41,000	620	700	11.7
Iron	mg/kg	55,000	720,000	11,000	150	<b>24,343</b>
Lead	mg/kg	400	800	400	270	28.1
Manganese	mg/kg	1,800	23,000	360	65	<b>641</b>
Mercury	mg/kg	10	43	1.1	NE	0.025
Molybdenum	mg/kg	390	5,100	78	NE	12.5
Nickel	mg/kg	1,500	20,000	300	130	11.9
Silica	mg/kg	430,000	18,000,000	860,000	NE	114
Silver	mg/kg	390	5,100	78	3.4	0.98
Thallium	mg/kg	0.78	1	1	0.28	0.37
Vanadium	mg/kg	390	5,200	78	6	44.7
Zinc	mg/kg	23,000	310,000	4,600	1,200	274.6
Cyanide	mg/kg	1,600	20,000	320	0.28	8.53

**Notes:**

TPHC = Total Petroleum Hydrocarbons.

µg/kg = micrograms per kilogram.

mg/kg = milligrams per kilogram.

EPA = United States Environmental Protection Agency.

RSL = Regional Screening Level (milligrams per kilogram).

NCDENR = North Carolina Department of Environment and Natural Resources.

IHSB = Inactive Hazardous Sites Branch.

SRG = Soil Remediation Goal (Health-Based).

POG = Protection of Groundwater SRG.

Sample results reported in micrograms per kilogram.

**Bold** values exceed the IHSB SRG.

TABLE 2

**Summary of Maximum Aqueous Contaminant Concentrations  
RBTC Former Boone Division  
Lincolnton, North Carolina  
MACTEC Project 6680-04-9513-01**

<b>Constituent</b>	<b>NCDENR 2L Standards</b>	<b>Units</b>	<b>Maximum Concentration</b>
Acetone	6000	µg/L	13
Bromodichloromethane	0.6	µg/L	<b>17</b>
Chloroform	70.0	µg/L	19
1,1-Dichloroethane	6	µg/L	<b>1800</b>
1,2-Dichloroethane	0.4	µg/L	<b>6</b>
1,1-Dichloroethene	7	µg/L	<b>410</b>
cis-1,2-Dichloroethene	70	µg/L	<b>5900</b>
trans-1,2-Dichloroethene	100	µg/L	<b>1500</b>
trans-1,2-Dichloropropene	NE	µg/L	6
Methylene chlorride	5	µg/L	5
MTBE	20	µg/L	3.7
Tetrachloroethene	0.7	µg/L	<b>246</b>
1,1,1-Trichloroethane	200	µg/L	<b>3000</b>
1,1,2-Trichloroethane	0.6*	µg/L	<b>17</b>
Trichloroethene	3	µg/L	<b>2,700</b>
Vinyl chloride	0.03	µg/L	<b>76</b>
Barium	0.7	mg/L	0.28
Cadmium	0.002	mg/L	0.0006
Cobalt	NE	mg/L	0.012
Iron	0.3	mg/L	<b>1.92</b>
Manganese	0.05	mg/L	<b>2.49</b>
Nickel	0.1	mg/L	0.015
Zinc	1	mg/L	0.02

**Notes:**

NCDENR = North Carolina Department of Environment and Natural Resources.

2L Standards = NCAC 15A 02L.0202 Groundwater Quality Standards.

\* = Interim Maximum Allowable Concentration.

NE = Not established.

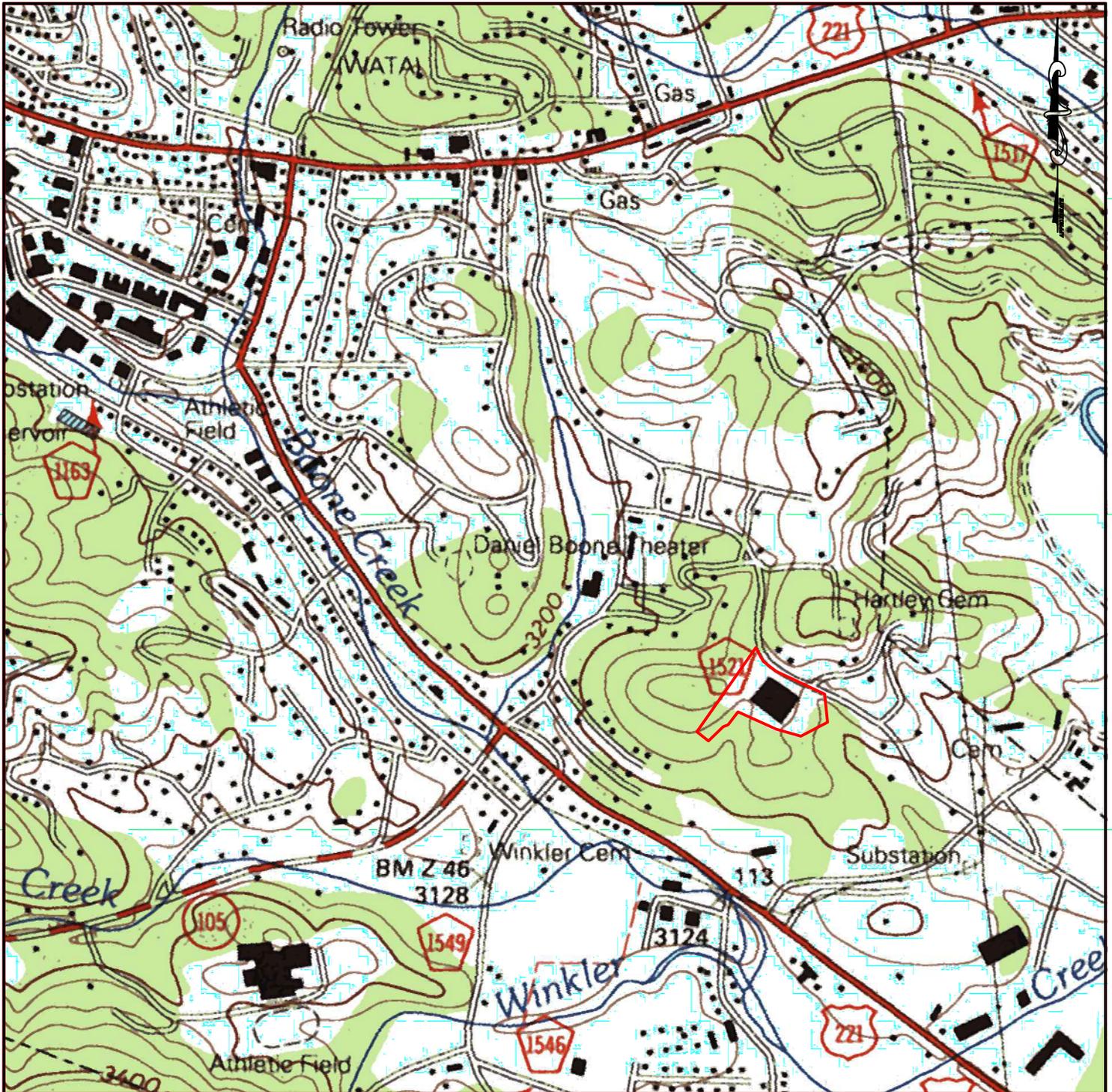
µg/L = micrograms per liter.

mg/L = milligrams per liter.

**Bold** values exceed the 2L Standards.

**FIGURES**

F:\AutoCAD Drawings Only\CHLCK\UI\BFLURK\DELLE\IMG\Environmental\Not 6228\bb80-04-9513\UI Boone RBTC\Site Map.dwg Fri, 22 Jul 2011 2:52pm nmhicks



EXPLANATION

— APPROXIMATE SITE BOUNDARY

APPROXIMATE SCALE IN FEET



REF.: USDA-NRCS BOONE QUADRANGLE DATED 1998



SITE LOCATION MAP  
RBTC FORMER BOONE DIVISION  
BOONE, NORTH CAROLINA

PREPARED BY HMH	DATE 4/22/11	CHECKED PSJ	DATE 4/22/11	JOB NO. 6680-04-9513.01	FIGURE 1
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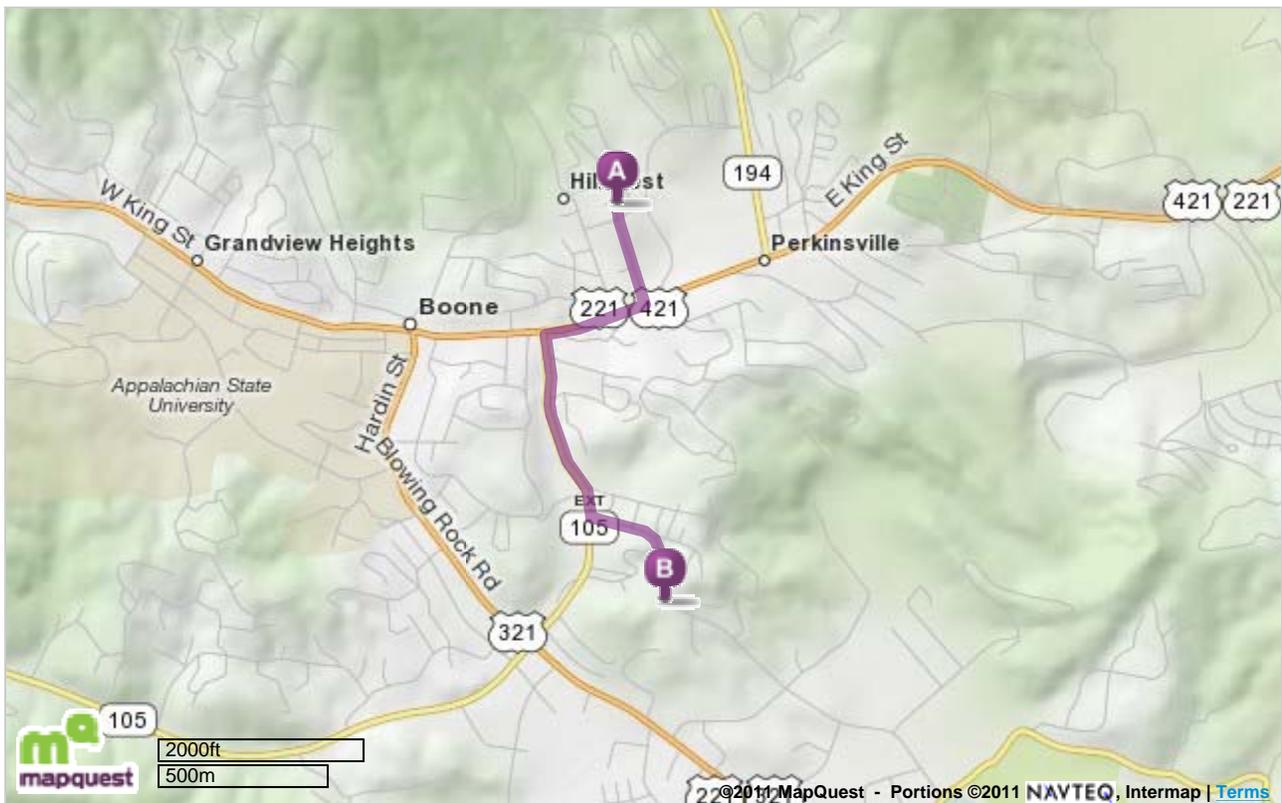


**Trip to:**

482 State Farm Rd  
Boone, NC 28607-4715

**1.30 miles**  
**3 minutes**

Notes



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Directions and maps are informational only. We make no warranties on the accuracy of their content, road conditions or route usability or expeditiousness. You assume all risk of use. MapQuest and its suppliers shall not be liable to you for any loss or delay resulting from your use of MapQuest. Your use of MapQuest means you agree to our [Terms of Use](#)

**FIGURE 2**  
**ROUTE TO HOSPITAL**  
**RBTC FORMER BOONE DIVISION**  
**BOONE, NORTH CAROLINA**  
**MACTEC PROJECT 6680-04-9513**

**Directions to:  
Boone Medical Center (704) 735-3071**

<b>Instruction</b>	<b>For</b>
Start out going North on State Farm Rd toward Laural Dr	0.3 mi
Turn RIGHT onto NC 105-EXT/US 221	0.5 mi
Turn RIGHT onto US-221/US-421/E King St/NC-194	0.3 mi
Take second LEFT onto Chestnut Dr	0.2 mi
418 Chestnut Drive is on the right	

Arrive Blowing Rock Hospital [418 Chestnut Dr, Boone, NC 28607,  
Tel: (828)295-3136]

**SUMMARY**

Driving distance: 1.3 miles  
Total travel time: 3 minutes  
Driving time: 3 minutes

**APPENDIX A  
PERSONNEL SIGN OFF SHEETS**



**APPENDIX B**  
**JOB HAZARD ANALYSES**

**ATTACHMENT 4**  
**Job Hazard Analysis Form**

Page 1 of 5

**JHA No.:** JHA - 6680 - 04 - 9513 - \_\_\_\_\_

**Job Title:** Bosch \_\_\_\_\_ **Date of Analysis:** 7-21-11 \_\_\_\_\_

**Job Location:** Boone, North Carolina \_\_\_\_\_ **Team Leader:** Troy L. Holzschuh \_\_\_\_\_

**Instructions:** The Team Leader will gather the appropriate team, including subject matter experts, operators, and support personnel, to analyze the job for hazards. Using the below table or similar format, address the three phases of this process:

- **Identify Key Job Steps:** Break the job down into individual key steps where work activities are presented in sequential order.
- **Identify Job Hazards:** Create a list of known or potential hazards within each step of the job. Consider hazards associated with the various tools, equipment or other hardware involved in the job. Consider environmental hazards such as thermal stress, biohazards, etc.
- **Identify Safe Practices and Equipment:** List one or more prevention or control measures to address each hazard identified, emphasizing engineering and administrative controls over PPE. Once this has been completed, the JHA Team will determine whether the job can be performed in a manner that eliminates the identified hazards.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
<b><i>DRIVING TO THE WORKSITE</i></b>	Personal vehicle	Check brakes, steering, seatbelts, fluid levels, lights.
	Two lane or narrow roads	Drive confidently and defensively at all times. Go slow around corners.
	Stormy weather	Inquire about conditions before leaving the office. Be aware of oncoming storms. Drive to avoid accident situations created by the mistakes of others.
	Animals on the road	Drive slowly, watch for other animals nearby.
	Breakdowns, flat tires, collisions	Keep current on preventive maintenance checks. Walk around vehicle prior to leaving compound to check for flat tires, fluid leaks, etc. Make sure the vehicle has a first aid kit and that all medications are current. All drivers will be training in defensive driving before operating the vehicle. Make sure you have enough gas to get you there and back again.

	Unsecured equipment in vehicle	Ensure all equipment is properly secure in vehicle so it will not shift/move during transit or fast stops. Be cautious opening doors/trunks – items may have shifted during drive
<b><i>WALKING AND WORKING IN THE FIELD</i></b>	Falling down, twisted ankles and knees, poor footing	Always watch your footing. Slow down and use extra caution around logs, rocks, and animal holes. Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. Wear laced boots non-skid Vibram-type soles for and traction.
	Irritated site owner	Be courteous and diplomatic. Leave if requested to do so.
	Poisonous Plants	Learn to identify, and avoid, toxic plants such as poison wood trees. Keep skin covered. If contact is made, avoid spreading the oil to other areas. Cool water and specialty soap should be used to clean skni as soon as possible after contact. Wash area three times followes by rubbing alcohol. Care should be taken when removing clothes that came into contact as well. If rash appears, apply approved lotion. Try not to scratch affected area. See doctor if serious swelling occurs.
	Dangerous Animals	Be aware of your surroundings. Watch for dangerous animals, such as aggressive dogs, raccoons, snakes and harmful insects. Wear appropriate clothing and boots.
	Bee and wasp stings	Watch for respiratory problems. Notify dispatcher and get person to a doctor immediately if there is trouble breathing. Gently scrape stinger off of one is present. Apply analgesic swab and a cold pack if possible, and watch for infection. Flag the location of any known nests and inform other crewmembers. Advise packing an inhaler and Benadryl or Epi-pen if you are prone to severe allergic reaction.
	Ticks and infected mosquitos	Wear long sleeve shirts. Tuck pants into socks/boots. Carry mosquito repellent. Visually check each other for ticks while in the field. Check yourself carefully at home at day's end. If a tick is imbedded in you: *Gently pull the tick out with tweezers or fingernails using a quick tug. *Wash the infected area and monitor for a red rash.

<b>ENVIRONMENTAL HEALTH CONSIDERATIONS</b>	Heat Stress	<p>Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load. Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action.</p> <p>NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments.</p>
	Dehydration (Be extra cautious since weather is cooling and people are less aware of heat-related hazards)	Remain constantly aware of heat stress. Drink water.
	Sunburn (UVA/UVB light)	Generously apply sunscreen to all exposed skin using a Sun Protection Factor (SPF) of at least 15 that provides broad-spectrum protection from both ultraviolet A (UVA) and ultraviolet B (UVB) rays. Reapply every two hours, even on cloudy days, and after sweating. Wear protective clothing, such as a long-sleeved shirt, pants, a wide-brimmed hat, and sunglasses, where possible. Know the UV Index rating for the day.
<b>All Drilling/ Boring Activities</b>	Slips, Trips, Falls	Keep work area free of excess material and debris; Remove all trip hazards by keeping materials/objects organized and out of walkways; Keep work surfaces dry when possible; Wear appropriate PPE; Stay aware of footing and do not run
	Traffic (including pedestrian)	Notify attendant or site owner/manager of work activities and location; Use cones, signs, flags or other traffic control devices; Inspect area around vehicles prior to backing and use spotter
<b>GEOPROBE SET-UP</b>	Slips, Trips, Falls	Keep work area free of excess material and debris; Remove all trip hazards by keeping materials/objects organized and out of walkways; Keep work surfaces dry when possible; Wear appropriate PPE; Stay aware of footing and do not run; Put fencing around excavation when not actively working

	Traffic (including pedestrian)	Notify attendant or site owner of work activities and location, Use cones, signs, flags or other traffic control devices; Set up exclusion zone surrounding work area, Wear appropriate PPE, including a reflective vest, Inspect area around vehicles prior to backing and use spotter
	Unqualified operator	Only qualified personnel will operate equipment. Ensure all personnel are aware when equipment is in use. Personnel on-site should have drilling operations training
	Rig Roll Over	Set riggers; Observe and avoid obstructions; If soil appears unstable, the soil should be assessed by a qualified professional engineer to ensure safe conditions with implementation of design control measures prior to start of work
	Contact with Electric Lines and Other Overhead Obstacles	Position rig to avoid overhead utility lines by distance defined by voltage and local regulations; Use a spotter when raising mast to confirm clearance of overhead lines and other obstructions. Stay away (30 feet minimum) from power lines.
	Rig Movement	Heavy equipment should be equipped with back-up alarm or use horn when backing - use spotter; Stay clear of operating equipment and rig when moving.
	Heavy Equipment Lifting/Carrying	Use at least 2 people to lift and carry sections, use mechanical lift devices whenever possible, bend and lift with legs and arms, not back. Do not twist and keep load close to body.
	Fire/Explosion	No smoking around work area, Establish smoking area away from work area, Ensure a type ABC fully charged fire extinguisher is on-site
	Rig Malfunction	If an emergency occurs while the rig is in operations, all personnel within 30 feet of drill rig shall evacuate the area. Egress routes must be identified prior to commencing work.
<b>GROUND DISTURBANCE: BORING ADVANCEMENT</b>	Faulty or Inappropriate Equipment	Qualified driller must inspect rig and hand tools prior to use, if faulty or inappropriate, do not proceed until repaired or replaced

	Moving Equipment	Clear area of obstructions and communicate with all workers involved that drilling is beginning; Do not exceed manufacturer's recommended speed, force, torque, or other specifications. and penetrate the ground slowly with hands on the controls; Wear appropriate PPE including leather gloves and steel-toed boots
	High Noise Levels	Use hearing protection if within 20 feet of active drill rig
	Impact to Subsurface Lines/Tanks	Only drill in areas where underground features have been identified and cleared, ensure at least one personnel on the site is first aid trained (for electric shock & burns) and that a first aid kit is available
<b>SOIL SAMPLING</b>	Sharp Sampling Tools	Wear appropriate PPE (i.e, gloves); Use correct tools; use sturdy surface for sampling, when opening containers/preservatives with a knife, cut away from body.
	Contaminated Materials	Wear appropriate PPE and nitrile gloves, use proper sampling techniques to minimize potential for splashing
	Vapors	Wear appropriate PPE. If respirator is required, stop work. Resume work only when qualified personnel are available to continue sampling with respirator.
	Exposure to fumes/contaminants	Work in open area & stand up wind when sampling; Wear chemical resistant PPE; personnel in the area need to be HAZWOPER qualified; take breaks as necessary
	Repetitive Motion and other Ergonomic Issues	Use mechanical means where possible to raise and lower equipment into well. Alternate raising and lowering equipment between field sampling team members, and alternate bailing the well. Use safe lifting techniques identified in previous section "Walking and Working at the site". Take breaks and stretch as required.
	Preservative Chemicals in sampling bottles	Use gloves, do not handle spilled or broken bottles, do not overfill bottles
	Sample cross contamination	Decontaminate or dispose of sampling equipment between sampling locations, Double check sample labels to ensure accuracy and adhesion to containers

<b>SAMPLE PROCESSING &amp; SHIPPING</b>	Broken bottles/spills	Use PPE; Properly pack sample containers
	Heavy coolers	Use proper lifting techniques, get assistance if needed. Use safe lifting techniques identified in previous section "Walking and Working at the site".

<b>HEAT STRESS INDEX</b>																
RELATIVE HUMIDITY	Actual Thermometer Reading (F°)															
	74	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104
	HUMIDITURE F° (Equivalent Temperature)															
10%	68	70	72	75	77	78	80	82	85	87	89	91	93	95	97	98
20%	70	72	75	77	79	81	84	86	88	90	93	95	97	99	101	104
30%	73	75	77	78	80	83	85	87	90	92	95	98	101	105	108	110
40%	74	76	78	79	81	85	87	89	92	96	100	104	106	110	117	120
50%	75	77	79	81	84	86	90	93	96	100	105	108	110	120	125	132
60%	75	77	80	83	86	89	92	95	100	106	111	120	125	132		
70%	75	77	81	85	89	91	96	100	106	115	122	128				
80%	76	78	83	86	91	95	100	106	114	122						
HUMIDITURE F°	Below 80		80 - 90		90 - 105			105 - 130			Above 130					
DANGER CATEGORY	NONE		CAUTION		EXTREME CAUTION			DANGER			EXTREME DANGER					
NONE	Little or no danger under normal circumstances.															
CAUTION	Fatigue possible, if exposure is prolonged and there is physical activity.															
EXTREME CAUTION	Heat cramps and heat exhaustion, if exposure is prolonged and there is physical activity.															
DANGER	Heat cramps or exhaustion likely; heat stroke possible, if prolonged and there is physical activity.															
EXTREME DANGER	HEAT STROKE IMMINENT!															

**ATTACHMENT 4  
 Job Hazard Analysis Form**

Page 2 of 5

**Identify Hazards and PPE**

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

<b>Standard Hazards</b>			
<input type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Rotating equipment
<input checked="" type="checkbox"/> Falls	<input checked="" type="checkbox"/> Power equipment/tools	<input type="checkbox"/> Elevated work surfaces	<input type="checkbox"/> _____
<b>Eye Hazards</b>			
<input type="checkbox"/> Particulates	<input type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> Tree Branches
<b>Hearing Hazards</b>			
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input checked="" type="checkbox"/> High ambient noise
<b>Respiratory Hazards</b>			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> _____	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> _____
<b>Chemical Hazards</b>			
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input checked="" type="checkbox"/> Volatiles / Semi-volatiles	<input type="checkbox"/> _____

Form ESH-2.9.1-3.2

**ATTACHMENT 4**  
**Job Hazard Analysis Form**

Page 3 of 5

<b>Environmental Hazards</b>			
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes	<input type="checkbox"/> Wet location	<input checked="" type="checkbox"/> Bio hazards (snakes, insects, spiders, bird / mouse droppings, fungus, etc.)
<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input type="checkbox"/> Engulfment Hazard	<input type="checkbox"/> _____
<b>Electrical Hazards</b>			
<input type="checkbox"/> None	<input type="checkbox"/> Energized equipment or circuits	<input checked="" type="checkbox"/> Overhead utilities <input type="checkbox"/> Underground utilities <input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Wet location
<b>Fire Hazards</b>			
<input type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location
<b>Ergonomic Hazards</b>			
<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input type="checkbox"/> Twisting	<input type="checkbox"/> Pulling/tugging
Computer Use in the: <input checked="" type="checkbox"/> Office <input type="checkbox"/> Field	<input type="checkbox"/> Repetitive motion	<input type="checkbox"/> _____	<input type="checkbox"/> _____
<b>Radiological Hazards</b>			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Radiation
<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radon	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron
<input type="checkbox"/> Tritium	<input type="checkbox"/> TRU	<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium
<b>Other Hazards</b>			
<input type="checkbox"/>			

Completed by: Troy L. Holzschuh

Date: 7-21-11



**ATTACHMENT 4**  
**Job Hazard Analysis Form**  
Page 5 of 5

<b>JHA Preparation Team</b>		
<u>Troy L. Holzschuh</u>	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

**Effective Date From:** 7-21-11 through 8-31-11

**Approval Signatures**

_____ Job Supervisor	_____ Date	_____ LHSR	_____ Date	_____ RSO	_____ Date
_____ ES&H Manager	_____ Date	<u><i>[Signature]</i></u> Project Manager	<u>7/20/11</u> Date	_____ Other	_____ Date



CORPORATE ES&H PROCEDURE

Issued: 1/23/06 Effective: 1/24/06 ESH-2.9.1 REVISION 2
Owner: H.J. Gordon Approver: S. D. Rima PAGE 19 OF 22

Form ESH-2.9.1-3.5

ATTACHMENT 5
Pre-Job Brief Attendance Sheet

Documents included in this briefing: JHA

Date of Briefing:

Table with 3 columns: Print/Type Name, Signature, Employee Number. Multiple empty rows for data entry.

Briefing presented by: Troy L. Holzschuh Signature:

**ATTACHMENT 4**  
**Job Hazard Analysis Form**

Page 1 of 5

**JHA No.:** JHA - 6680 - 04 - 9513 - \_\_\_\_\_

**Job Title:** \_\_\_\_\_ **Date of Analysis:** 7-21-11

**Job Location:** 482 State Farm Road **Team Leader:** Mark Filardi

**Instructions:** The Team Leader will gather the appropriate team, including subject matter experts, operators, and support personnel, to analyze the job for hazards. Using the below table or similar format, address the three phases of this process:

- **Identify Key Job Steps:** Break the job down into individual key steps where work activities are presented in sequential order.
- **Identify Job Hazards:** Create a list of known or potential hazards within each step of the job. Consider hazards associated with the various tools, equipment or other hardware involved in the job. Consider environmental hazards such as thermal stress, biohazards, etc.
- **Identify Safe Practices and Equipment:** List one or more prevention or control measures to address each hazard identified, emphasizing engineering and administrative controls over PPE. Once this has been completed, the JHA Team will determine whether the job can be performed in a manner that eliminates the identified hazards.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
<b><i>DRIVING TO THE WORKSITE</i></b>	In company vehicle	Check brakes, steering, seatbelts, fluid levels, lights.
	Aggressive drivers	Drive confidently and defensively at all times. Avoid rush hour traffic, when possible. Use main roads.
	Stormy weather	Inquire about conditions before leaving the office. Be aware of oncoming storms. Drive to avoid accident situations created by the mistakes of others.
	Breakdowns, flat tires, collisions	Keep current on preventive maintenance checks. Walk around vehicle prior to leaving compound to check for flat tires, fluid leaks, etc. Make sure the vehicle has a first aid kit and that all medications are current. All drivers will be training in defensive driving before operating the vehicle. Make sure you have enough gas to get you there and back again. Do not use cell phones while operating a vehicle.

	Unsecured equipment in vehicle	Ensure all equipment is properly secure in vehicle so it will not shift/move during transit or fast stops. Be cautious opening doors/trunks – items may have shifted during drive
<b><i>WALKING AND WORKING AT THE SITE</i></b>	Falling down, twisted ankles and knees, poor footing	Always watch your footing. Wear appropriate footgear (safety boots). Do not walk up/down steep slopes, take alternate route.
	Trucks & equipment moving on-site	Be aware of surroundings. Avoid high traffic areas and machinery. Wear bright clothing (reflective vest). Park vehicles away from work area.
	Back strain from lifting	Use proper lifting techniques. Use moving equipment when possible (i.e. wheel barrow, dolly) Do not twist while carrying load. Do not carry anything to hinder vision. Stand close to the load, bend knees not your back, keep load balanced, watch out for pinch points. Face the way you will be moving. Avoid lifting or lowering loads from high places. Do not reach and pull loads from rear cargo areas of truck – access cargo and slide load to rear of truck to avoid strain. Do not access cargo area with muddy boots to avoid slip. Boots must be clean and dry.
	Irritated site owner	Be courteous and diplomatic. Leave the site if requested to do so or if you feel threatened.
	Dangerous Animals	Be aware of your surroundings. Watch for dangerous animals, such as aggressive dogs, raccoons, snakes and harmful insects. Wear appropriate clothing and boots.
	Loss of Communication	Keep cell phone or radio with you at all times as well as photo id.
	Bee and wasp stings	Watch for respiratory problems. Notify dispatcher and get person to a doctor immediately if there is trouble breathing. Gently scrape stinger off of one is present. Apply analgesic swab and a cold pack if possible, and watch for infection. Flag the location of any known nests and inform other crewmembers. Advise packing an inhaler and Benadryl or Epi-pen if you are prone to severe allergic reaction.

	Ticks and infected mosquitos	<p>Wear long sleeve shirts. Tuck pants into socks/boots. Carry mosquito repellent. Visually check each other for ticks while in the field. Check yourself carefully at home at day's end.</p> <p>If a tick is imbedded in you:</p> <ul style="list-style-type: none"> <li>*Gently pull the tick out with tweezers or fingernails using a quick tug.</li> <li>*Wash the infected area and monitor for a red rash.</li> </ul>
<b>ENVIRONMENTAL HEALTH CONSIDERATIONS</b>	Dehydration (Be extra cautious since weather is cooling and people are less aware of heat-related hazards)	Remain constantly aware of heat stress. Drink water.
	Variable daily temperatures	Wear appropriate clothing and dress in layers.
	Sunburn (UVA/UVB light)	Generously apply sunscreen to all exposed skin using a Sun Protection Factor (SPF) of at least 15 that provides broad-spectrum protection from both ultraviolet A (UVA) and ultraviolet B (UVB) rays. Reapply every two hours, even on cloudy days, and after sweating. Wear protective clothing, such as a long-sleeved shirt, pants, a wide-brimmed hat, and sunglasses, where possible. Know the UV Index rating for the day.
<p align="center"><i>Below jobs steps, potential hazards, and preventative/corrective actions were referenced from the ES&amp;H Manual (ESH-2.5.A) Conducting Safe Drilling Operations, Attachment 7 "Drilling Job Hazard Analysis Form" and adopted to be site and task specific for this project.</i></p>		
<b>DRILL RIG/ GEOPROBE SET-UP</b>	Slips, Trips, Falls	Keep work area free of excess material and debris; Remove all trip hazards by keeping materials/objects organized and out of walkways; Keep work surfaces dry when possible; Wear appropriate PPE; Stay aware of footing and do not run; Put fencing around excavation when not actively working
	Traffic (including pedestrian)	Notify attendant or site owner of work activities and location, Use cones, signs, flags or other traffic control devices; Set up exclusion zone surrounding work area, Wear appropriate PPE, including a reflective vest, Inspect area around vehicles prior to backing and use spotter
	Unqualified operator	Only qualified personnel will operate equipment. Ensure all personnel are aware when equipment is in use. Personnel on-site should have drilling operations training

	Rig Roll Over	Set riggers; Observe and avoid obstructions; If soil appears unstable, the soil should be assessed by a qualified professional engineer to ensure safe conditions with implementation of design control measures prior to start of work
	Contact with Electric Lines and Other Overhead Obstacles	Position rig to avoid overhead utility lines by distance defined by voltage and local regulations; Use a spotter when raising mast to confirm clearance of overhead lines and other obstructions. Stay away (30 feet minimum) from power lines.
	Rig Movement	Heavy equipment should be equipped with back-up alarm or use horn when backing - use spotter; Stay clear of operating equipment and rig when moving.
	Heavy Equipment Lifting/Carrying	Use at least 2 people to lift and carry sections, use mechanical lift devices whenever possible, bend and lift with legs and arms, not back. Do not twist and keep load close to body.
	Fire/Explosion	No smoking around work area, Establish smoking area away from work area, Ensure a type ABC fully charged fire extinguisher is on-site
	Rig Malfunction	If an emergency occurs while the rig is in operations, all personnel within 30 feet of drill rig shall evacuate the area. Egress routes must be identified prior to commencing work.
	<b><i>GROUND DISTURBANCE: BORING ADVANCEMENT/ MONITORING WELL INSTALLATION</i></b>	Faulty or Inappropriate Equipment
Moving Equipment		Clear area of obstructions and communicate with all workers involved that drilling is beginning; Do not exceed manufacturer's recommended speed, force, torque, or other specifications. and penetrate the ground slowly with hands on the controls; Wear appropriate PPE including leather gloves and steel-toed boots
High Noise Levels		Use hearing protection if within 20 feet of active drill rig
Impact to Subsurface Lines/Tanks		Only drill in areas where underground features have been identified and cleared, ensure at least one personnel on the site is first aid trained (for electric shock & burns) and that a first aid kit is available

	Repetitive Motion and other Ergonomic Issues	Use safe lifting techniques identified in previous section “Walking and Working at the site”. Take breaks and stretch as required.
<b>GROUNDWATER/ SOIL SAMPLING</b>	Sharp Sampling Tools	Wear appropriate PPE (i.e, gloves); Use correct tools; use sturdy surface for sampling, when opening containers/preservatives with a knife, cut away from body.
	Pinch points (well cover & lock)	Use proper tools to open well covers and locks. Wear gloves. Place covers on flat surface.
	Insects in well casing	Be cautious when opening the well cover and inspect area for insects, specifically spiders. Wear gloves. Clear area before beginning sampling.
	Contaminated Materials	Wear appropriate PPE and nitrile gloves, use proper sampling techniques to minimize potential for splashing
	Vapors	Wear appropriate PPE. If respirator is required, stop work. Resume work only when qualified personnel are available to continue sampling with respirator.
	Exposure to fumes/contaminants	Work in open area & stand up wind when sampling; Wear chemical resistant PPE; personnel in the area need to be HAZWOPER qualified; take breaks as necessary
	Repetitive Motion and other Ergonomic Issues	Use mechanical means where possible to raise and lower equipment into well. Alternate raising and lowering equipment between field sampling team members, and alternate bailing the well. Use safe lifting techniques identified in previous section “Walking and Working at the site”. Take breaks and stretch as required.
	Preservative Chemicals in sampling bottles	Use gloves, do not handle spilled or broken bottles, do not overfill bottles
	Sample cross contamination	Decontaminate or dispose of sampling equipment between sampling locations, Double check sample labels to ensure accuracy and adhesion to containers
<b>SURFACE WATER SAMPLING</b>	Falling down, twisted ankles and knees, poor footing	Always watch your footing. Slow down and use extra caution around logs, rocks, and animal holes. Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. Wear laced boots non-skid Vibram-type soles for and traction.

	Preservative Chemicals in sampling bottles	Use gloves, do not handle spilled or broken bottles, do not overfill bottles
	Sample cross contamination	Decontaminate or dispose of sampling equipment between sampling locations, Double check sample labels to ensure accuracy and adhesion to containers
<b>SAMPLE PROCESSING &amp; SHIPPING</b>	Broken bottles/spills	Use PPE; Properly pack sample containers
	Heavy coolers	Use proper lifting techniques, get assistance if needed. Use safe lifting techniques identified in previous section "Walking and Working at the site".

**ATTACHMENT 4  
 Job Hazard Analysis Form**

Page 2 of 5

**Identify Hazards and PPE**

Complete the checklists for hazard identification and PPE requirements. Information from the RA and applicable permits are included in this section.

<b>Standard Hazards</b>			
<input checked="" type="checkbox"/> Falling Objects	<input checked="" type="checkbox"/> Slips and trips	<input checked="" type="checkbox"/> Pinch points	<input checked="" type="checkbox"/> Rotating equipment
<input checked="" type="checkbox"/> Falls	<input checked="" type="checkbox"/> Geoprobe	<input type="checkbox"/> Elevated work surfaces	<input checked="" type="checkbox"/> Drill Rig
<b>Eye Hazards</b>			
<input checked="" type="checkbox"/> Particulates	<input checked="" type="checkbox"/> Liquid splashes	<input type="checkbox"/> Welding Arc	<input type="checkbox"/> Tree Branches
<b>Hearing Hazards</b>			
<input type="checkbox"/> None	<input type="checkbox"/> Impact noise	<input type="checkbox"/> High frequency noise	<input checked="" type="checkbox"/> High ambient noise
<b>Respiratory Hazards</b>			
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Dust/particulates	<input type="checkbox"/> Organic Vapors	<input type="checkbox"/> Acid Gases
<input type="checkbox"/> Oxygen deficient	<input type="checkbox"/> Welding fumes	<input type="checkbox"/> Aerosols/Particulates	<input type="checkbox"/> Be, Hg, Cr, Pb
<input type="checkbox"/> _____	<input type="checkbox"/> Radon	<input type="checkbox"/> Asbestos	<input type="checkbox"/> _____
<b>Chemical Hazards</b>			
<input type="checkbox"/> None	<input type="checkbox"/> Organic solvents	<input type="checkbox"/> Reactive metals	<input type="checkbox"/> PCBs
<input type="checkbox"/> Acids / bases	<input type="checkbox"/> Oxidizers	<input type="checkbox"/> Volatiles / Semi-volatiles	<input checked="" type="checkbox"/> Sample Preservatives

**ATTACHMENT 4**  
**Job Hazard Analysis Form**

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<b>Environmental Hazards</b>			
<input type="checkbox"/> None	<input checked="" type="checkbox"/> Temperature extremes	<input type="checkbox"/> Wet location	<input checked="" type="checkbox"/> Bio hazards (snakes, insects, spiders, bird / mouse droppings, fungus, etc.)
<input type="checkbox"/> Explosive vapors	<input type="checkbox"/> Confined space	<input checked="" type="checkbox"/> Variable daily temperatures	<input checked="" type="checkbox"/> Dehydration
<b>Electrical Hazards</b>			
<input type="checkbox"/> None	<input type="checkbox"/> Energized equipment or circuits	<input checked="" type="checkbox"/> Overhead utilities <input type="checkbox"/> Underground utilities <input type="checkbox"/> Hidden utilities	<input type="checkbox"/> Wet location
<b>Fire Hazards</b>			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting, welding, or grinding generated sparks or heat sources	<input type="checkbox"/> Flammable materials present	<input type="checkbox"/> Oxygen enriched location
<b>Ergonomic Hazards</b>			
<input checked="" type="checkbox"/> Lifting	<input checked="" type="checkbox"/> Bending	<input checked="" type="checkbox"/> Twisting	<input checked="" type="checkbox"/> Pulling/tugging
Computer Use in the: <input checked="" type="checkbox"/> Office <input type="checkbox"/> Field	<input checked="" type="checkbox"/> Repetitive motion	<input type="checkbox"/> _____	<input type="checkbox"/> _____
<b>Radiological Hazards</b>			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Loose contamination	<input type="checkbox"/> Fixed Contamination	<input type="checkbox"/> Radiation
<input type="checkbox"/> Airborne contamination	<input type="checkbox"/> Radon	<input type="checkbox"/> EMF	<input type="checkbox"/> Criticality
<input type="checkbox"/> Alpha	<input type="checkbox"/> Beta	<input type="checkbox"/> Gamma/X-rays	<input type="checkbox"/> Neutron
<input type="checkbox"/> Tritium	<input type="checkbox"/> TRU	<input type="checkbox"/> Depleted Uranium	<input type="checkbox"/> Enriched Uranium
<b>Other Hazards</b>			
<input type="checkbox"/>			

Completed by: Troy L. Holzschuh

Date: 7-21-11



Form ESH-2.9.1-3.4  
**ATTACHMENT 4**  
**Job Hazard Analysis Form**  
Page 5 of 5

<b>JHA Preparation Team</b>		
<u>Troy Holzschuh</u>	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

**Effective Date From:** 7-21-11 through 8-31-11

**Approval Signatures**

_____ Job Supervisor	_____ Date	_____ LHSR	_____ Date	_____ RSO	_____ Date
_____ ES&H Manager	_____ Date	<u><i>[Signature]</i></u> Project Manager	<u>7/21/11</u> Date	_____ Other	_____ Date



**ATTACHMENT 6  
 DAILY DRILL SITE EQUIPMENT SAFETY CHECKLIST**

MACTEC Project No. \_\_\_\_\_

Lead Driller: \_\_\_\_\_ Driller Helper: \_\_\_\_\_

Rig Geologist/Engineer: \_\_\_\_\_ Date: \_\_\_\_\_

**NOTE:** Form to be filled out neatly and daily prior to initiating work and turned in to: \_\_\_\_\_

<b>Drilling Crew</b>	Yes	No	Comments
Hard Hat			
Safety Glasses			
Ear Plugs			
Gloves			
Hard Toe Shoes			
Reflective Vest			
Appropriate Clothing			

<b>Vehicles</b>	Drill Rig		Support Truck		Other (Specify)		Comments
	OK	N	OK	N	OK	N	
Seat Belts							
Tires							
Windows							
Mirrors							
Fluid Leaks							
Cleanliness							
First-Aid Kit							
Fire Extinguisher							

<b>Drilling Equipment</b>	OK	N	Comments
Derrick			
Working Platforms			
Stabilizers			
Ropes			
Winches			
Hydraulic Lines			
Hammer			
Fire Extinguisher			
Emergency Shut-off Switches			

<b>Site Conditions Crew</b>	Yes	No	Comments
Barriers in Place			
Weather Check			
Site Neat and Orderly			

Completed By: \_\_\_\_\_  
 Signature of Preparer

Date: \_\_\_\_\_

**ATTACHMENT 8  
 EQUIPMENT LOADING AND UNLOADING  
 JOB HAZARD ANALYSIS FORM**

PROJECT NO. 6228-07-4178		DRILLER:
DATE:	REVISION:	COORDINATOR: ANDREW FRANTZ
		PM: ROB FOSTER
		SAFETY OFFICER: KEERY REED
RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE): X Safety Glasses w/Sideshields X Steel-toed Boots X Hard Hat _X_ Nitrile Gloves _X_ Other Hearing protection and High Visibility Test		
STEPS	HAZARDS	PREVENTION
1. Check area for hazards	Uneven ground, wet obstruction	Park on dry flat area with nothing in the way
2. Try to have a spotter	Vision not being able to see where you are	Spotter – to check closeness to sides and ramp
3. Verify truck is in gear with brake	Truck and trailer could move when loading or unloading	Leave in gear, brake on and wheels chalked
4. Check hitch	Hitch coming loose when loading	Check hitch, verify it is locked with pin and safety chain is attached
5. Loading	Weather can make lift slide on ramps and trailer	Load in dry, level area – use 4-wheel drive, low gear: watch and be aware
6. Ramps	Not even, pins loose: raise and lower properly	Check ramps before lowering and when raising lift properly
7. Tying down	Mast too high, not enough chains, in gear with brake on and wheels chalked	Check mast height: use 4 chains tying down, check load after driving a few miles
8. Unloading – same steps in reverse	Brakes out of adjustment popping out of gearing, shutting off emergency brake	
9.		
10.		
11.		

Comments:

**ATTACHMENT 9**  
**DRILLING SAFETY ASSESSMENT FORM**

Job Name: \_\_\_\_\_ Job Number: \_\_\_\_\_ Date: \_\_\_\_\_

Location: \_\_\_\_\_ Client Rep.: \_\_\_\_\_

Driller: \_\_\_\_\_ Driller License Number: \_\_\_\_\_

Rig Number: \_\_\_\_\_ Rig Type: \_\_\_\_\_

Bit or Auger Type/Size: \_\_\_\_\_ Drill Method: \_\_\_\_\_

**NOTE: Any question with a NO answer or one which requires an explanation must have documented the corrective action taken to ensure compliance in the Comments section.**

	Yes	No	Comments
1. Was drill crew properly briefed prior to being sent to the project/work site?			
2. Have all personnel been trained on MACTEC's Drilling Safety Requirements?			
3. Have all underground utilities been cleared and or marked?			
4. Have all clearance procedures been documented?			
5. Are there any overhead utilities in work area?			
6. Are proper separation distances between equipment and utilities being maintained?			
7. Describe work site conditions on the space provided below.			
8. Are there any special actions needed to be taken in order for drilling equipment to access boring locations safely?			
9. Will a chain saw be required?			
10. If so, have all safety precautions been taken in order to protect the crew?			
11. Are there fire extinguishers and a first aid kit available and easily accessible to all personnel on job site?			
	Yes	No	Comments
12. Is there an MSDS provided for each chemical			



**ATTACHMENT 10**  
**DRILLING PRE-JOB SAFETY BRIEF**  
(Example)  
**5 Pages**

**Safety is everyone's responsibility! No job is so important nor is any task so difficult that it cannot or should not be performed safely!**

### **Safety Briefings**

Pre-Job, also known as a Tailgate, safety briefings are essential to ensure the safety of workers. These briefings must be conducted by the Project Manager. Work is not to commence until hazards have been identified and that a tailgate safety briefing has been performed. At a minimum, the following questions should be addressed during the briefing:

- Are all employees wearing proper personal protective equipment?
- If required, are climbing devices, harnesses, safety belts, lanyards, etc., present and in good operating condition?
- Are vehicles equipped with seat belts and in good operating condition?
- Are employees aware of accident reporting procedures?
- Are employees aware of medical facilities and rescue personnel that could be summoned in the event of an emergency?
- Are fire extinguishers present? Are they of the appropriate size and type for the fire hazard involved? Are the extinguishers currently in good working condition?
- Is fuel properly stored in a non-flammable location and properly labeled?
- Are safety cans being used for small amounts of fuels, and are they properly labeled?
- Do the conditions require that "no smoking" policies are observed?
- Is the work area clean and organized?
- Are any trip hazards present?
- Are all "shut down" devices on the drill rig installed and in good working condition?
- Are tools clean and in good working condition?
- Are pressure relief devices installed and in good working condition?
- Are Material Safety Data Sheets (MSDS) available for all chemicals in-use on the project?
- Are all containers or bags containing chemicals properly labeled and stored?
- Do the site conditions warrant wheel chocks being used on all vehicles?
- Are there emergency alarms (horn, whistle) on site?
- Is there an easily accessible map and phone number of nearest hospital?
- Is there an emergency communication source available?
- Have employees been trained in first aid and CPR?
- Is there a properly stocked first aid kit available on-site and in every vehicle?

#### *Site Related Questions:*

- Are high voltage overhead power lines or any other utility lines present in the immediate area? A safe distance of thirty or more feet should be observed when setting up in the vicinity of overhead lines.
- This distance may need to be increased, depending on the hazards involved, size of mast (tower) on the drill rig, etc.
- Have all underground utilities been identified?
- Is there a danger of being struck by other moving vehicles?

- Is there a danger because of possible instability of high walls, banks, pits, rivers, etc.?
- Are poisonous plants, animals or insects in the area of the drill site?
- Is there a danger of lightning strikes? This subject must be addressed regardless of time of year or current weather conditions. **Drill crews and related personnel must be evacuated from the vicinity of the drill rig or jobsite any time a storm with potential of lightning should approach.**

**Note:** The above is an example of some of the items that should be checked on a daily or pre-project basis. This list should be expanded as necessary to meet particular working conditions, drill rigs used, and possible hazards that may be encountered.

### **Personal Protective Equipment**

Unfortunately, it is impossible to “engineer out” all the possible hazards that an employee might encounter during the course of his or her daily activities. Therefore, it is essential that certain items of personal protective equipment (PPE) be worn by the employee. Several of these items include:

- Hard Hat (for use while working around drill rigs, or when falling objects are possible)
- Steel Toed Boots
- Safety Glasses, with Side Shields
- Sunscreen / Sun Hat / Sunglasses
- Hearing Protection
- Snug-Fitting Clothing
- Suitable gloves
- Rain Gear
- Gloves -- (of the appropriate type for the work being performed or materials being handled)

Other items may be necessary, depending on the type of activities being performed and the location of the jobsite. These items should be discussed at the tailgate safety briefing. It is essential that proper PPE be required at all times, especially when working on or near a drill rig. Serious injuries and deaths have been **prevented** when employees have been made to wear their PPE. On the other hand, all MACTEC employees have the responsibility to insure that the workplace is as safe as possible and not merely rely on PPE to keep an employee from sustaining personal injury.

### **Housekeeping**

Good housekeeping is another of the proactive approaches that the PM should insist upon. Many times during the course of conducting installation activities, tools and other items are left lying where they could cause injury. Every employee must be instructed to constantly “pick up after themselves. ” Most trip hazards can be eliminated when diligent housekeeping practices are enforced.

### **Materials Handling**

Due to the many varied materials that are commonly used during drilling operations, drilling employees must use great care from being injured while handling materials. Such materials might include, but not be limited to:

- Heavy bags of cement or sand
- Various cement products that are contained in bags
- Fuel
- Stainless rods, casing, rebar

Many of these items weigh fifty pounds or more. Employees must be instructed to use appropriate mechanical lifting devices, when possible, and to solicit the help of fellow workers when loads are too heavy for a single worker to safely handle.

It is recommended that all employees receive detailed instruction in lifting techniques. Classes will be made available to employees, if requested. MACTEC employees must constantly be on the alert for someone who attempts to lift improperly or attempts to lift something that is too heavy for him or her.

In addition to hazards involving heavy loads, employees must also be made aware of the necessity of handling with care those products that could pollute the environment if broken open or spilled.

Care should be taken not to breathe concrete or other hazardous materials. Dust masks should be worn during grouting operations.

### **Proper Maintenance of Hand Tools**

Usage of hand tools is an essential part of MACTEC field work. Hand tools such as pipe wrenches, shovels, pry bars, tube wrenches, etc., are commonplace in most drilling operations. These tools must be properly maintained in order to keep workers from being injured while using these tools.

#### **WHATEVER TYPE OF TOOL YOU ARE USING:**

- **Wear Eye Protection**

Safety glasses with side shields are required for most jobs, but if particles can come from any direction, then goggles or full face shields should be used.

People have lost an eye while using a screwdriver!

- **Store And Carry Tools Correctly**

Many accidents happen when a tool is not actually being used! Employees are often injured when they fall carrying a sharp tool, when they reach into a tool box to grasp a tool or when they simply trip over a tool that is left lying on the ground or deck. DO NOT put knives or other sharp tools in a tool box with their blades exposed. They should be stored separately with the blades covered.

- **Use The Correct Tool For The Job**

Trying to “make do” with the wrong tool, - especially attempting to use a tool that is too small for the job, causes many injuries. If using a tool causes the worker to strain then select a larger tool for the task. This is common when using pipe wrenches. The operator should provide a proper selection of these wrenches.

- **Keep Tools In Good Condition**

Broken handles should be immediately replaced. Loose handles should be repaired or replaced. Cutting blades on tools should be kept sharp.

Remember: Dull tools require greater force and thus could result in undue strain that could possibly result in an injury. Pipe wrenches should be inspected frequently for worn or damaged jaws and heels.

- **Support The Work**

Many injuries occur when people fail to take the time to use a sawhorse, vise or other proper support for the work. DO NOT hold the work with your hand. Make sure the work is on a stable, flat surface. If possible, use clamps when necessary.

- **Concentrate On the Job At Hand**

Many injuries, especially on drill rigs, occur when employees are distracted.

Employees should pay close attention to their job and not allow distractions to interfere with their activity.

- **Protect Your “Off Hand”**

Gouges from a screwdriver, lost fingernails from a hammer blow, amputated fingers from a power saw blade, etc., can occur when the employee fails to protect his or her “off hand.” Employees should

always protect their hands and position them in such a manner that a mere “slip” of the tool will not result in personal injury.

- **RTM**

Time should be taken to read the manual that normally comes with power tools and other equipment. The manual typically has instructions for safe use of the tool, which tends to minimize accidents and injuries.

**It is the responsibility of the Driller to ensure the following safe work practices:**

- **Employees should NEVER be on the MAST when the drill is in motion or when the driller is making an initial “pull” on the rods.** Note: Many drill rigs manufactured today, e.g. auger rigs, do not ever require that an employee be on the mast when it is “towered up.”
- **Neither stepladders nor any other method should be used to “access” any rotating part while the drill is in operation.** Note: It is strongly recommended that such climbing be completely avoided. It is the responsibility of the subcontractor to make sure that the drill is never operated when anyone is on or near the equipment or in a location other than the normal work platforms that the driller and helper would occupy. In fact, the helper should only be near the rig when his or her work activity at that time requires it. During other times, the helper should be performing his or her tasks in an area away from the drill.
- **Visitors to the drill site should never be allowed near the drill when it is being operated.** Also, any visitor to the drill site must be dressed in appropriate attire to include proper Personal Protective Clothing. It is the operator’s responsibility to keep unauthorized individuals away from the equipment.

## **Vehicle Safety**

Federal, state and local laws require that vehicles be properly maintained and safe to operate upon our highways. To ensure this, MACTEC employees who drive MACTEC vehicles will observe the following:

- All MACTEC drivers must be properly licensed for the equipment that they are to be driving and that they are trained in safe driving procedures. Equipment must be inspected prior to being moved.
- Seatbelts will be worn at all times.
- MACTEC Bul’s are responsible for annual and/or periodic inspections of vehicles.
- Daily inspections must be performed and any deficiencies must be corrected prior to operating a vehicle.

No motor vehicle shall be driven by MACTEC staff for MACTEC business unless the driver thereof shall have satisfied himself or herself that the following parts and accessories are in good working order, nor shall any driver fail to use or make use of such parts and accessories when and as needed:

- Service brakes, including trailer brake connections.
- Parking (hand) brake.
- Steering mechanism.
- Lighting devices and reflectors.
- Tires.
- Horn.
- Windshield wiper or wipers.
- Rear-vision mirror or mirrors.
- Coupling devices.
- Wheels (Insure that all lug nuts are properly tightened and that the wheels appear to be in good condition).
- Spare tire (Properly inflated and a suitable jack and lug wrench are available).

Additional checks should be done before driving a motor vehicle on MACTEC business:

- Checking the windshield for cracks.
- Ensuring that an appropriate fire extinguisher is within the driver's grasp and that the extinguisher is properly secured.
- Having flares and/or reflectors which can be used in the event of a breakdown while on the highway.
- Ensuring that seat belts are in good working condition.
- Windows must roll up and down properly.
- Doors must open and close properly.

Lastly:

- If it is necessary to back a vehicle, **HAVE A SPOTTER!!**
- Use safety cones, when a vehicle must be parked close to a road.
- Wear orange safety vests, when working close to a road.
- When parking in an uneven location, make sure that emergency brakes are set, the vehicle transmission is placed in the manufacturer's recommended "park" position, and that "chock blocks" are put in place upon exiting the vehicle.

## **FIRE PREVENTION**

Fire prevention must be addressed prior to commencing any job. Failure to prevent a fire on a job site could result in severe injury or even death of employees. In addition to the potential for loss of life; severe equipment damage can result along with damage to surrounding areas. It is therefore the responsibility of the MACTEC employee, driller, helper and anyone else involved in the monument installation operations to take proper steps to reduce the possibility of a fire. Such steps should include:

- When possible, the surrounding area should be cleared of materials that are readily combustible, such as weeds, grass, etc. Note: Some areas are extremely environmentally sensitive to this type of clearing, and such clearing may not be possible.
- The surrounding area should be wet down to reduce fire hazard.
- Fire extinguishers of the appropriate type for the particular fire hazard involved must be present on the job site. It is required that a fire extinguisher be present in every MACTEC vehicle and easily accessible at the job site. Note: The PM must make sure that fire extinguishers are serviced at appropriate intervals and that an inspection is performed on the fire extinguishers at least monthly. Such inspections and servicing must be documented.

## **First Aid**

It is recommended that all MACTEC Drilling staff be trained in and develop proficient skills in administering basic first aid. If an injury or illness should occur, it becomes essential that someone on the project be able to administer first aid until help arrives. In the case of serious injuries, MACTEC employees should immediately call for help prior to becoming involved in treatment of an injured or ill worker. MACTEC employees should understand the ABC's of first aid, procedures for immobilizing a possible spinal injury, and techniques for bandaging and splinting. Employees should be certified in CPR and be able to administer it if needed. **MACTEC employees should not attempt to provide First Aid that is outside the scope of their training.** Finally, employees must be educated regarding exposure to body fluids. OSHA has set forth definite requirements in this area, as outlined in the PBO Regional Health and Safety Plan. Certain items of PPE (Pocket masks, rubber gloves, face shields, etc.) are necessary to protect a rescuer in the event that he or she must provide first aid to an injured co-worker.

## HASP MODIFICATION

<b>HASP Title:</b> Community and Site Health and Safety Plan.	<b>HASP Date:</b> July 2011
<b>Project Name:</b> RBTC Boone	<b>Site Name:</b> Robert Bosch Tool Corp., Former Boone Manufacturing Division, Boone, NC
<b>Project #:</b> 6251-12-1001	<b>Site Location:</b> 482 State Farm Road, Boone, NC
<p><b>Modification:</b></p> <p>Project organization has changed. See project organization chart (next page) for changes.</p> <p>Emergency Contact and Hospital Information verified. Hospital telephone number verified on 6/30/2016.</p> <p>AHAs updated for the following:</p> <ul style="list-style-type: none"> <li>• Mobilization/Demobilization and Site Preparation</li> <li>• Vertical and Horizontal Drilling for Remediation Operations</li> <li>• Soil Excavation and Sampling</li> </ul> <p>Added Safety Data Sheets for Quik-Trol, hydrochloric acid (10%), Alconox<sup>®</sup>, hydrogen peroxide (30%), bentonite, and Synergist D (hydrogen peroxide catalyst).</p> <div style="text-align: right; color: blue; font-family: cursive;">             90-60%              TSA              8-31-16         </div>	
<b>Modification Author:</b> Mark Wescott	
<b>Signature:</b> 	<b>Date:</b> 8/31/16
<b>Project Manager and General Supervisor Name:</b> Paul S. Johnstone, P.G.	
<b>Signature:</b> 	<b>Date:</b> 8/31/16
<b>Project Site Safety Officer Name:</b> Chris Bruce	
<b>Signature:</b> 	<b>Date:</b> 8/31/16
<b>Health and Safety Professional Name:</b> Lynne Clem, Health, Safety and Environmental Coordinator	
<b>Signature:</b> 	<b>Date:</b> 8/31/16

**Project Organization:**

**Dates of Required Training and Medical Surveillance (add additional training topics, as required):**

Name	Tim Renn	Chris Bruce	Lori Mauldin	Mark Wescott	Zach Downes
<b>Job duties:</b>	<b>Field Team Lead</b>	<b>HSO</b>			
<b>Names:</b>					
	<b>Dates</b>	<b>Dates</b>	<b>Dates</b>	<b>Dates</b>	<b>Dates</b>
<b>Medical Surveillance</b>	2/24/2016	9/17/2015	4/12/2016	7/22/2016	5/25/2016
<b>40-Hour Initial</b>	7/17/1992	6/23/1989	2/11/2000	6/25/2015	6/17/2015
<b>8-Hour Supervisor <sup>3</sup></b>	10/16/2013	9/9/2013	7/17/2016		
<b>8-Hour Refresher</b>	2/16/2016	2/23/2016	11/24/2015	5/26/2016	5/26/2016
<b>First Aid <sup>2</sup></b>	7/08/2015	2/19/2015	2/19/2015	7/08/2015	7/08/2015
<b>CPR</b>	7/08/2015	2/19/2015	2/19/2015	7/08/2015	7/08/2015
<b>Hazard Communication</b>	6/17/2013	6/27/2013	6/2/2014	6/22/2015	6/16/2015
<b>Blood Borne Pathogens</b>	7/13/2015	8/5/2015		7/14/2015	7/29/2015

<sup>2</sup> At least one worker must be trained in First Aid/CPR and should receive Blood borne Pathogen Training

<sup>3</sup> Required for Field Lead and Site Health and Safety Officer

**EMERGENCY CONTACTS**

NAME	TELEPHONE NUMBERS		DATE OF PRE-EMERGENCY NOTIFICATION (if applicable)
	Office	Cell	
Fire Department: Boone Fire Dep.	911 or (828)-268-6180		
Hospital: Watauga Medical Center	911 or (828)-262-4100		
Work Care (Early case management)	1-888-449-7787		
Police Department: Boone Police Dep.	911 or (828)-268-6900		
	Office	Cell	
Site Health And Safety Officer: Chris Bruce	864-552-9624	864-430-7415	
Client Contact: Aromake Afieghbe	(224) 232-2220	(224) 725-8640	
Project Manager: Paul Johnstone	864-552-9624	864-616-4176	
*Eastern Group HSE Manager: Cindy Sundquist	207-828-3309	207-650-7593 (Cell) 207-892-4402 (Home)	
Corporate VP of HSE – Vlad Ivensky	610-877-6144	484-919-5175 (Cell) 215-947-0393 (Home)	
EPA/DEP (if applicable):			
OTHER: Ambulance	911		

\*See Incident Flow Chart for additional Group HSE Manager's Contact Information





Trip to:

**336 Deerfield Rd**

Boone, NC 28607-5008

0.89 miles / 2 minutes

Notes

WATAUGA MEDICAL CENTER



**482 State Farm Rd, Boone, NC 28607-4715**

Download  
Free App



1. Start out going **southeast** on **State Farm Rd** toward **Sunnyside Dr**. [Map](#)

**0.8 Mi**

*0.8 Mi Total*



2. Turn **right** onto **Deerfield Rd**. [Map](#)

**0.07 Mi**

*0.9 Mi Total*

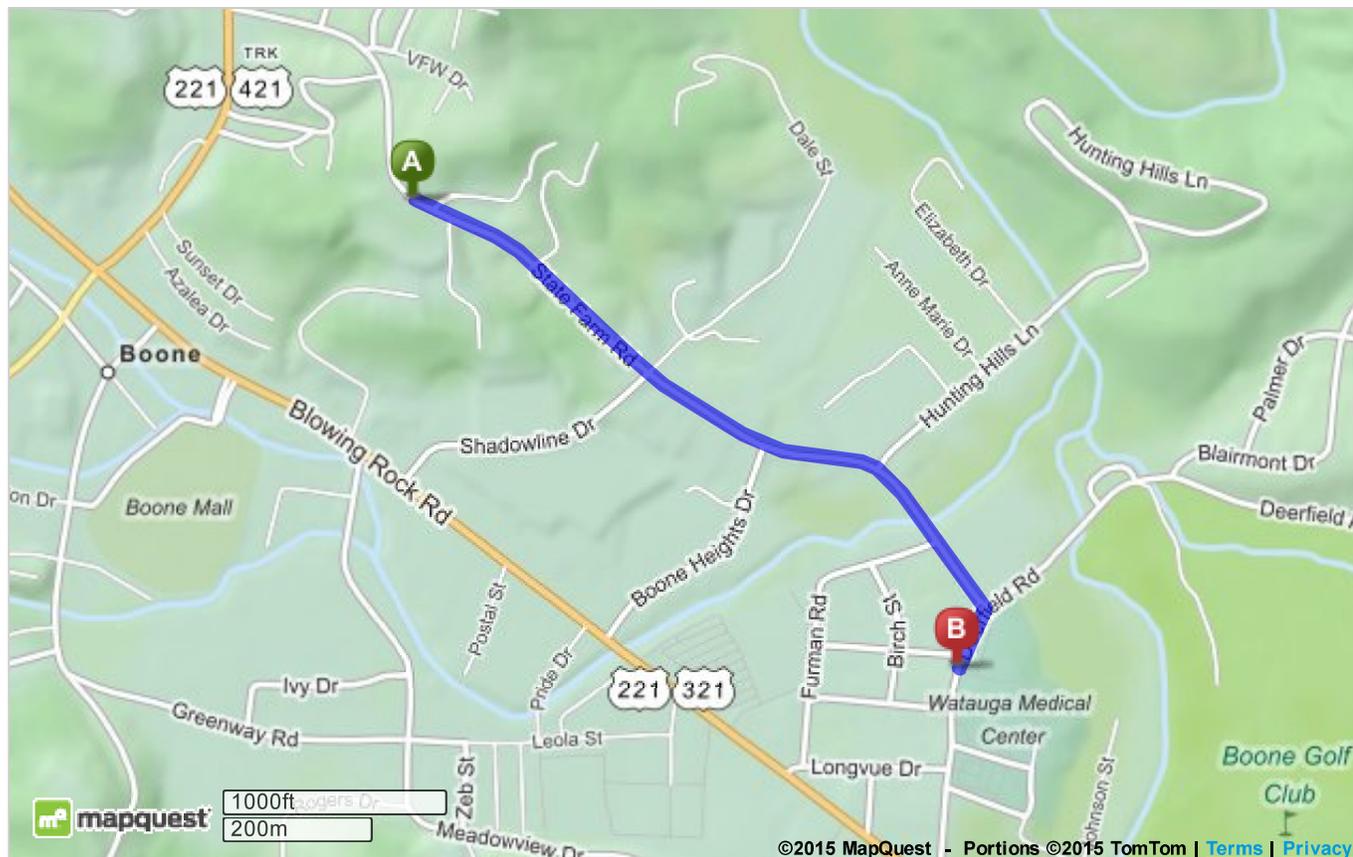


3. **336 DEERFIELD RD** is on the **left**. [Map](#)



**336 Deerfield Rd, Boone, NC 28607-5008**

Total Travel Estimate: **0.89 miles - about 2 minutes**



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## **ACTIVITY HAZARD ANALYSES**

# AHA – Field Work - General

Activity/Work Task:	Field Work General		Overall Risk Assessment Code (RAC) (Use highest code)				<b>M</b>	
Project Location:	Boone, NC		<b>Risk Assessment Code (RAC) Matrix</b>					
Contract Number:	6251121001		<b>Severity</b>	<b>Probability</b>				
Date Prepared:	8/4/2015	Date Accepted:		8/4/2015	Frequent	Likely	Occasional	Seldom
Prepared by (Name/Title):	Timothy Renn/Senior Professional I		Catastrophic	E	E	H	H	M
Reviewed by (Name/Title):	<i>Lynne Clem / Senior Scientist</i>		Critical	E	H	H	M	L
			Marginal	H	M	M	L	L
			Negligible	M	L	L	L	L
<b>Notes:</b> (Field Notes, Review Comments, etc.)			Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)					
This AHA involves the following:			“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				<b>RAC Chart</b>	
<ul style="list-style-type: none"> <li>Establishing site specific measures</li> </ul>			“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk	
This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.			Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk	
							M = Moderate Risk	
							L = Low Risk	

Job Steps	Hazards	Controls	RAC
1. Mobilization/ See Mobilization/Demobilization and Site Preparation JHA Demobilization and Site Preparation	1A) See Mobilization/Demobilization and Site Preparation AHA	See Mobilization/Demobilization and Site Preparation AHA	L
2. Communication	2A) Safety, crew unity	Talk to each other. <ul style="list-style-type: none"> <li>Let other crewmembers know when you see a hazard.</li> <li>Avoid working near known hazard trees (trees that are rotten, dead, damaged, etc.).</li> <li>Always know the whereabouts of fellow crewmembers.</li> <li>Carry a radio and spare batteries or cell phone.</li> <li>Review Emergency Evacuation Procedures (see below).</li> </ul>	L

# AHA – Field Work - General



Job Steps	Hazards	Controls	RAC
3. Walking and working in the field	3A) Falling down, twisted ankles and knees, poor footing	Always watch your footing. <ul style="list-style-type: none"> <li>▪ Slow down and use extra caution around logs, rocks, and animal holes.</li> <li>▪ Extremely steep slopes (&gt;50%) can be hazardous under wet or dry conditions; consider an alternate route.</li> <li>▪ Wear laced work boots with high upper and non-skid Vibram-type soles for ankle support and traction.</li> </ul>	L
	3B) Falling objects	Protect head against falling objects. <ul style="list-style-type: none"> <li>▪ Wear your hardhat for protection from falling limbs and pinecones, and from tools and equipment carried by other crewmembers.</li> <li>▪ Stay out of the woods during extremely high winds.</li> </ul>	L
	3C) Damage to eyes	Protect eyes: <ul style="list-style-type: none"> <li>▪ Watch where you walk, especially around trees and brush with limbs sticking out.</li> <li>▪ Exercise caution when clearing limbs from tree trunks. Advise wearing eye protection.</li> <li>▪ Ultraviolet light from the sun can be damaging to the eyes; look for sunglasses that specify significant protection from UV-A and UV-B radiation. If safety glasses require, use one's with tinted lenses</li> </ul>	L
	3D) Bee and wasp stings	See AHA for Insect Stings and Bites	L
	3E) Ticks and infected mosquitos	See AHA for Insect Stings and Bites	L
	3A) Lifting Injuries (e.g., Back Injuries)	Lifting Injuries (e.g., Back Injuries) <ul style="list-style-type: none"> <li>▪ Site personnel will be instructed on proper lifting techniques.</li> <li>▪ Perform warm-up exercises before starting work.</li> <li>▪ <b>DO NOT EXCEED THE AMEC LIFTING LIMIT OF 50 POUNDS.</b></li> <li>▪ Use two people to lift, lower, or carry equipment or materials heavier than 50 pounds.</li> <li>▪ Mechanical devices should be used to reduce manual handling of materials.</li> <li>▪ Drive the field vehicle as close to the point that the heavy equipment/material will be used as long as the area is safe to drive into and you do not create hazards to you, your co-worker, or the vehicle.</li> </ul>	M
	3F) Slips/Trips/Falls	Slips/Trips/Falls <ul style="list-style-type: none"> <li>▪ Maintain work areas safe and orderly; unloading areas should be on even terrain; mark or repair possible tripping hazards.</li> <li>▪ Site SHSO inspect the entire work area to identify and mark hazards.</li> <li>▪ Be aware of work area conditions that can cause slip hazards such as ponding of water on concrete surfaces. Ponding of water on smooth surfaces, such as concrete, coupled with the warm or freezing weather conditions has the potential to cause slippery conditions such as growth of scum or ice, as applicable. Adding a layer of clean fill to the surface may prevent the growth of scum, and/or create a non-slippery walking surface.</li> </ul>	M

# AHA – Field Work - General



Job Steps	Hazards	Controls	RAC
	3G) Vehicular Traffic	Vehicular Traffic <ul style="list-style-type: none"> <li>▪ Spotters will be used when backing up trucks and heavy equipment and when moving equipment.</li> <li>▪ High visibility vests will be worn when workers are exposed to vehicular traffic at the site or on public roads.</li> </ul>	L
	3H) Overhead Hazards	Overhead Hazards <ul style="list-style-type: none"> <li>▪ Personnel will be required to wear hard hats that meet ANSI Standard Z89.1.</li> <li>▪ All ground personnel will stay clear of suspended loads.</li> <li>▪ All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects.</li> <li>▪ All overhead hazards will be identified prior to commencing work operations.</li> </ul>	M
	3I) Dropped Objects	Dropped Objects <ul style="list-style-type: none"> <li>▪ Steel toe boots meeting ANSI Standard Z41 will be worn.</li> </ul>	L
	3J) Noise	Noise <ul style="list-style-type: none"> <li>▪ Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); all equipment will be equipped with manufacturer's required mufflers. Hearing protection shall be worn by all personnel working in or near heavy equipment.</li> </ul>	L
	3K) Eye Injuries	Eye Injuries <ul style="list-style-type: none"> <li>▪ Safety glasses meeting ANSI Standard Z87 will be worn.</li> </ul>	L
	3L) Heavy Equipment (overhead hazards, spills, struck by or against)	Heavy Equipment <ul style="list-style-type: none"> <li>▪ Equipment will have seat belts.</li> <li>▪ Operators will wear seat belts when operating equipment.</li> <li>▪ Do not operate equipment on grades that exceed manufacturer's recommendations.</li> <li>▪ Equipment will have guards, canopies or grills to protect from flying objects.</li> <li>▪ Ground personnel will stay clear of all suspended loads.</li> <li>▪ Ground personnel will wear high visibility vests</li> <li>▪ Spill and absorbent materials will be readily available.</li> <li>▪ Drip pans, polyethylene sheeting or other means will be used for secondary containment.</li> <li>▪ Ground personnel will stay out of the swing radius of excavators.</li> <li>▪ Eye contact with operators will be made before approaching equipment.</li> <li>▪ Operator will acknowledge eye contact by removing his hands from the controls.</li> <li>▪ Equipment will not be approached on blind sides.</li> <li>▪ All equipment will be equipped with backup alarms and use spotters when significant physical movement of equipment occurs on-site, (i.e., other than in place excavation or truck loading).</li> </ul>	M

# AHA – Field Work - General



Job Steps	Hazards	Controls	RAC
	3M) Struck by vehicle/equipment	Struck by vehicle/equipment <ul style="list-style-type: none"> <li>▪ Be aware of heavy equipment operations.</li> <li>▪ Keep out of the swing radius of heavy equipment.</li> <li>▪ Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times and will wear high visibility vests.</li> <li>▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone.</li> <li>▪ Ground personnel will not stand directly behind heavy equipment when it is in operation.</li> <li>▪ Drivers will keep workers on foot in their vision at all times, if you lose sight of someone, Stop!</li> </ul>	M
	3N) Struck/cut by tools	Struck/cut by tools <ul style="list-style-type: none"> <li>▪ Cut resistant work gloves will be worn when dealing with sharp objects.</li> <li>▪ All hand and power tools will be maintained in safe condition.</li> <li>▪ Guards will be kept in place while using hand and power tools.</li> </ul>	L
	3O) Caught in/on/between	Caught in/on/between <ul style="list-style-type: none"> <li>▪ Workers will not position themselves between equipment and a stationary object.</li> <li>▪ Workers will not wear long hair down (place in pony-tail and tuck into shirt) or jewelry if working with tools/machinery.</li> </ul>	M
	3P) Contact with Electricity/Lightning	Contact with Electricity/Lighting <ul style="list-style-type: none"> <li>▪ All electrical tools and equipment will be equipped with GFCI.</li> <li>▪ Electrical extension cords will be of the “Hard” or “Extra Hard” service type.</li> <li>▪ All extension cords shall have a three-blade grounding plug.</li> <li>▪ Personnel shall not use extension cords with damaged outer covers, exposed inner wires, or splices.</li> <li>▪ Electrical cords shall not be laid across roads where vehicular traffic may damage the cord without appropriate guarding.</li> <li>▪ All electrical work will be conducted by a licensed electrician.</li> <li>▪ All utilities will be marked prior to excavation activities.</li> <li>▪ All equipment will stay a minimum of 10 feet from overhead energized electrical lines (50 kV). This distance will increase by 4 inches for each 10 kV above 50 kV. Rule of Thumb: Stay 10 feet away from all overhead powerlines known to be 50 kV or less and 35 feet from all others.)</li> <li>▪ The SHSO shall halt outdoor site operations whenever lightning is visible, outdoor work will not resume until 30 minutes after the last sighting of lightning.</li> </ul>	M
	3Q) Equipment failure	Equipment failure <ul style="list-style-type: none"> <li>▪ All equipment will be inspected before use. If any safety problems are noted, the equipment should be tagged and removed from service until repaired or replaced.</li> </ul>	L

# AHA – Field Work - General



Job Steps	Hazards	Controls	RAC
	3R) Hand & power tool usage, cuts, burns, etc.	Hand & power tool usage <ul style="list-style-type: none"> <li>▪ Inspect the tool daily.</li> <li>▪ Remove broken or damaged tools from service.</li> <li>▪ Use the tool for its intended purpose.</li> <li>▪ Use in accordance with manufacturers instructions.</li> </ul>	L
	3S) Burns and Exposure to Exhaust from Portable Propane Torch Use	Portable propane torch usage <ul style="list-style-type: none"> <li>▪ Read the manual to become familiar with the propane torch and follow all safety precautions. Don PPE (safety glasses, heavy leather gloves) before using the torch.</li> <li>▪ Inspect the propane cylinder and the torch tip to ensure there are no defects, damage, etc.</li> <li>▪ Assemble the torch kit per instruction manual. The torch is designed to be used with the small propane cylinder, do not attempt to attach the torch to any other gas cylinder.</li> <li>▪ Do not use the torch in areas where gasoline or other liquids having flammable vapors are stored or used.</li> <li>▪ Do not smoke while igniting or operating the propane torch.</li> <li>▪ Have an ABC type fire extinguisher readily accessible to the work area.</li> <li>▪ Be sure the torch tip has a tight seal to the cylinder. If you smell gas, do not try to light the torch. Check the seal between the cylinder and torch. Do not attempt to light the torch until the seal is secure and no gas is leaking.</li> <li>▪ To ignite the torch flame, first position the point of the torch tip away from you.</li> <li>▪ If the unit requires a striker to ignite the torch, only use the striker provided with the unit. Never use a match or lighter to ignite torch.</li> </ul> Do not place hand or any part of your body in the path of the flame while lighting or operating the propane torch. <ul style="list-style-type: none"> <li>▪ Never leave an ignited torch unattended while in operation. When not in use, the torch tip must be removed from the propane cylinder.</li> <li>▪ Be aware of the weather conditions. On bright sunny days, the torch flame may be barely visible. On windy days, the wind may carry the torch's heat back towards you.</li> <li>▪ The torch can produce combustion products such as carbon monoxide. Do not breathe in the exhaust. Propane vapors are heavier than air and can accumulate in low or confined areas. Use the torch only in a well ventilated area.</li> <li>▪ Heating a surface may cause heat to be conducted to adjoining surfaces that may be combustible or become pressurized when heated. Always check to make sure no unintended parts or materials are being heated.</li> <li>▪ Torch will be extremely hot, allow the torch to cool before touching it to remove it from the cylinder.</li> <li>▪ Never store a torch that is still hot.</li> </ul>	M

# AHA – Field Work - General



Job Steps	Hazards	Controls	RAC
		<ul style="list-style-type: none"> <li>▪ When cooled, disconnect the torch from the cylinder for storage, and store them in a safe manner to prevent damage.</li> </ul>	
4. Environmental health considerations	4A) HEAT Stress	<p>Take precautions to prevent heat stress</p> <ul style="list-style-type: none"> <li>▪ Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load.</li> <li>▪ Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action.</li> </ul> <p>NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments.</p> <ul style="list-style-type: none"> <li>▪ Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability).</li> <li>▪ Allow approximately 2 weeks with progressive degrees of heat exposure and physical exertion for substantial acclimatization.</li> <li>▪ Acclimatization is necessary regardless of an employee's physical condition (the better one's physical condition, the quicker the acclimatization). Tailor the work schedule to fit the climate, the physical condition of employees, and mission requirements.                             <ul style="list-style-type: none"> <li>▪ A reduction of work load markedly decreases total heat stress.</li> <li>▪ Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization.</li> </ul> </li> <li>▪ Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.</li> </ul>	<b>M</b>
	4C) Cold Extremes	<p>Take precautions to prevent cold stress injuries</p> <ul style="list-style-type: none"> <li>▪ Cover all exposed skin and be aware of frostbite. While cold air will not freeze the tissues of the lungs, slow down and use a mask or scarf to minimize the effect of cold air on air passages.</li> <li>▪ Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended.</li> <li>▪ Take layers off as you heat up; put them on as you cool down.</li> <li>▪ Wear head protection that provides adequate insulation and protects the ears.</li> <li>▪ Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia.</li> <li>▪ Acclimate to the cold climate to minimize discomfort.</li> <li>▪ Maintain adequate water/fluid intake to avoid dehydration.</li> </ul>	<b>M</b>

## AHA – Field Work - General

Job Steps	Hazards	Controls	RAC
	4D) Wind	Effects of the wind <ul style="list-style-type: none"> <li>▪ Wind chill greatly affects heat loss (see attached Wind Chill Index).</li> <li>▪ Avoid working in old, defective timber, especially hardwoods, during periods of high winds due to snag hazards.</li> </ul>	L
	4E) Thunderstorms	Thunderstorms <ul style="list-style-type: none"> <li>▪ Monitor weather channels to determine if electrical storms are forecasted.</li> <li>▪ Plan ahead and identify safe locations to be in the event of a storm. (e.g., sturdy building, vehicle, etc.)</li> <li>▪ Suspend all field work at the first sound of thunder. You should be in a safe place when the time between the lightning and thunder is less than 30 seconds.</li> <li>▪ Only return to work 30 minutes after the after the last strike or sound of thunder</li> </ul>	L
5. Check and calibrate industrial hygiene and other field instruments and equipment as required and as recommended by the manufacturer	5A) Exposure to Calibration Gases/Chemicals due to: <ul style="list-style-type: none"> <li>• Use of damaged instruments.</li> </ul>	Verify proper operation of the instrument prior to calibration. Calibrate instruments in an area with adequate ventilation and follow the manufacturer's recommendations. <ul style="list-style-type: none"> <li>▪ Wear appropriate PPE to conduct calibrations as specified in the instrument manual.</li> </ul>	L
	5B) Exposure to Site contaminants due to: <ul style="list-style-type: none"> <li>• Improper instrument calibration;</li> <li>• Misinterpretation of calibration results;</li> <li>• Improper instrument repair;</li> <li>• Improper use of instrument due to lack of training.</li> </ul>	5A) Calibrate the instrument in accordance with the manufacturer's recommendations (see instrument manual) using the applicable calibration standard and calibration procedure. <ul style="list-style-type: none"> <li>▪ Perform calibrations at a frequency recommended by the manufacturer. Be aware of the instrument's limitations (e.g., detection limit, maximum sensitivity) and the conditions (e.g., humidity) that may affect correct operation or accuracy of that equipment. Possible sources of error that may affect the correct calibration of the instrument.</li> <li>▪ Use only calibration materials recommended by the manufacturer for calibration. Do not use substitutions.</li> <li>▪ Confirm that the connections between the instrument and the calibration gas/material is leak-free.</li> <li>▪ Record all instrument calibrations in the field logbook or field data sheets. Include the instrument ID (type/manufacture/serial number/lamp eV, etc.), calibration gas used (chemical and concentration), and instrument result.</li> <li>▪ Do not attempt to repair instrument. Return to the vendor for replacement. Report any damaged or malfunctioning instrument to the vendor.</li> <li>▪ All personnel must be familiar with operation of the instrument and understand:               <ul style="list-style-type: none"> <li>- Theory of its operation including any alarms and their setpoints</li> <li>- Materials the instrument can and cannot detect</li> <li>- Instrument's limitations</li> <li>- The expected responses to calibration gases/materials</li> <li>- Interfering gases/chemicals and their affects on the instrument readings</li> </ul> </li> </ul>	L

## AHA – Field Work - General

Job Steps	Hazards	Controls	RAC
		- When re-zeroing is appropriate.	

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (Hard Hat, safety glasses, gloves (per HASP), steel toe work boots, high visibility safety vest, hearing protection)	<p><b>Competent / Qualified Personnel:</b></p> <p>All Amec Foster Wheeler Employees with 40 hour training</p> <p><b>Training requirements:</b></p> <p>Site Specific HASP Orientation</p> <p>Toolbox safety meeting</p> <p>Task kick-off meeting</p>	<p>Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service.</p> <p>Inspect power cord sets prior to use.</p> <p>Inspect all PPE prior to use</p>

## NOAA's National Weather Service

### Heat Index

Temperature (°F)

Relative Humidity (%)	Temperature (°F)															
	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

 Caution

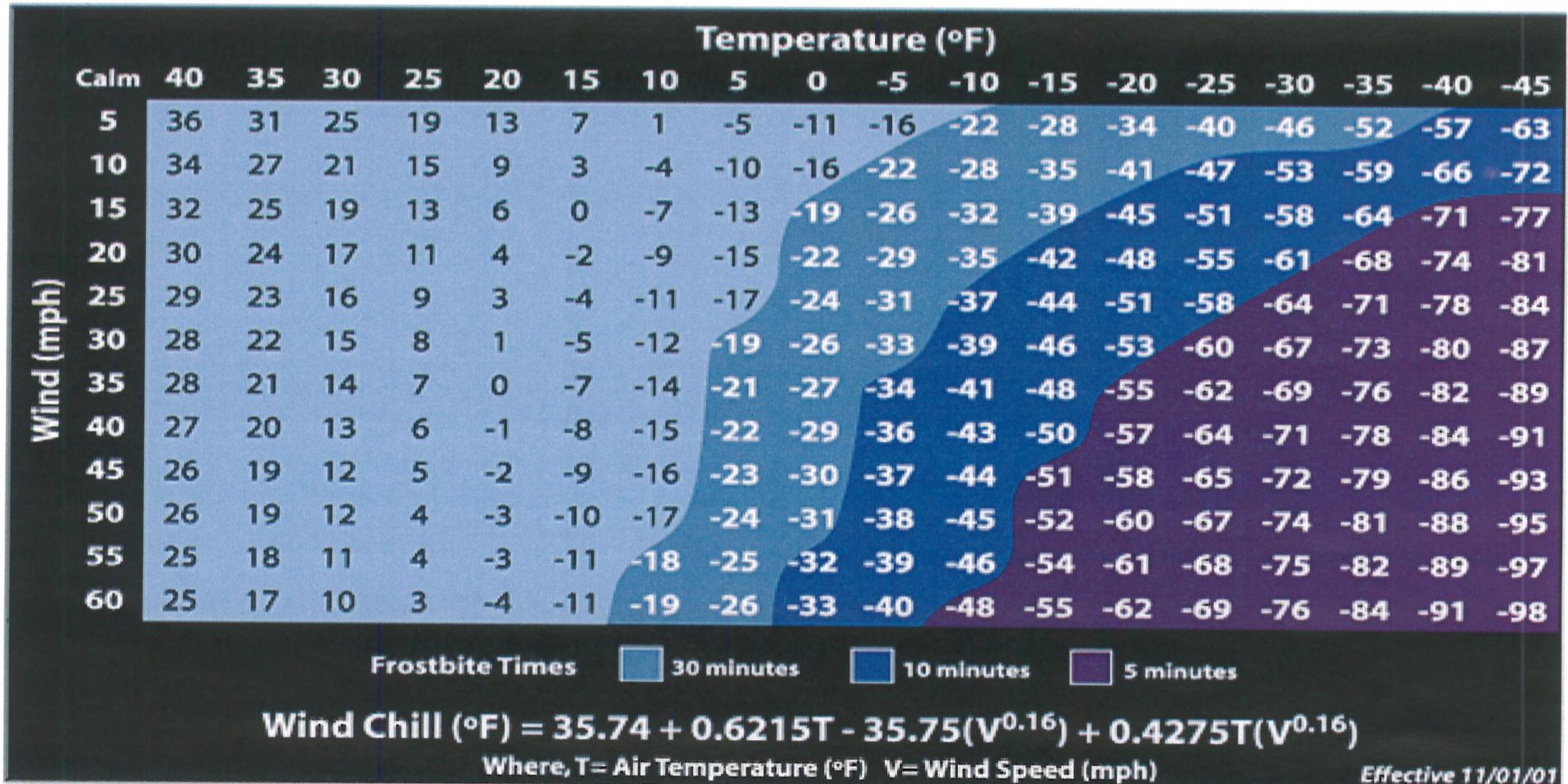
 Extreme Caution

 Danger

 Extreme Danger



# Wind Chill Chart



# AHA RBTC Boone Injection Injection of Chemical Oxidants



Activity/Work Task:	In Situ Chemical Oxidant Injection(s)	Overall Risk Assessment Code (RAC) (Use highest code)	<b>M</b>				
Project Location:	Boone, NC	<b>Risk Assessment Code (RAC) Matrix</b>					
Contract Number:	6251121001	<b>Severity</b>	<b>Probability</b>				
Date Prepared:	8/4/2015		Date Accepted:	8/4/2015			
Prepared by (Name/Title):	Timothy Renn/Senior Professional I	Catastrophic	E	E	H	H	M
Reviewed by (Name/Title):	<i>Lynne Clem / Senior Scientist</i>	Critical	E	H	H	M	L
		Marginal	H	M	M	L	L
		Negligible	M	L	L	L	L
<b>Notes:</b> (Field Notes, Review Comments, etc.)		Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					
This AHA involves the following:		"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				<b>RAC Chart</b>	
<ul style="list-style-type: none"> <li>Establishing site specific measures</li> <li>Procedures for setup and work preparation</li> <li>Procedures for gravity injection</li> <li>Procedures for pumped injection</li> </ul>		"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk	
This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.		Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk	
						M = Moderate Risk	
						L = Low Risk	

Job Steps	Hazards	Controls	RAC
1. Pre-job tailgate briefing	1A) Unfamiliarity of personnel with materials, procedures, and site features	1A) SSO to lead tailgate briefing. <ul style="list-style-type: none"> <li>Outline work to be performed, personnel assignments, and materials.</li> <li>Review HASP, this AHA.</li> <li>Emergency procedures.</li> </ul>	L
2. General Site Hazards	2A) See JHA Field Work - General 2B) Chemical exposure, chemical storage	2A) See JHA Field Work – General 2B) Chemical Exposure <ul style="list-style-type: none"> <li>Read HASP and SDS/MSDSs and determine air monitoring and PPE needs.</li> <li>Work in a well ventilated area, wear chemical resistant PPE as identified in HASP, review SDS/MSDSs</li> <li>Have access to first aid kit and eyewash bottle within a reasonable distance.</li> <li>When not in use chemicals will be stored securely in order to prevent unauthorized persons from inadvertently coming into contact with the chemicals.</li> </ul>	M  L

## AHA RBTC Boone Injection Injection of Chemical Oxidants



	2C) Protecting Visitors	<p>2C) Protecting Visitors</p> <ul style="list-style-type: none"> <li>Set up clear site barriers/exclusion zone in accordance with HASP to establish visible work zone boundaries.</li> <li>Escort visitors and require all visitors to respect the boundaries.</li> <li>Should any visitors intentionally or unintentionally cross the boundaries, immediately cease work until the visitor exits or is escorted beyond the work zone boundary.</li> </ul>	<b>M</b>
3. Mobilization	3A) Collisions, unsafe driving conditions, insufficient emergency equipment, unsecured loads	3A) See JHA Mobilization/Demobilization	<b>M</b>
4. Moving containers of chemicals	4A) Back or muscle strain	<p>4A) Back or muscle strain</p> <ul style="list-style-type: none"> <li>Avoid lifting as much as possible.</li> <li>Use materials handling aid (e.g., cart, dolly, etc.) whenever possible</li> <li>Use a platform or ladder to avoid lifting materials outside the "strike zone" (knees to shoulders).</li> <li>If container must be lifted, use proper lifting techniques (lift with legs, not back, don't reach or use a twisting motion).</li> <li>Obtain assistance in lifting objects weighing more than 40 lbs.</li> </ul>	<b>M</b>
	4B) Foot injury	<p>4B) Foot injury</p> <ul style="list-style-type: none"> <li>Wear steel toed work boots</li> </ul>	<b>L</b>
	4C) Potential for injury as a result of chemical contact (liquid, dust, and vapor) from spills.	<p>4C) Avoid Spills:</p> <ul style="list-style-type: none"> <li>Secure containers adequately.</li> <li>Do not stack containers more than 3-high.</li> <li>Wear appropriate PPE specified in the HASP and SDS/MSDS when handling amendments.</li> <li>Follow contingency plan in HASP and/or SDS/MSDS in the event of a spill.</li> <li>Store liquid containers within secondary containment as much as practical.</li> </ul>	<b>L</b>
5. Chemical Injections	5A) Back strain due to lifting hoses, pumps, or other equipment from vehicles to injection locations	<p>5A) Back strain</p> <ul style="list-style-type: none"> <li>Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items.</li> <li>Use proper lifting techniques</li> </ul>	<b>M</b>
	5B) Foot injuries from dropped equipment	<p>5B) Foot Injuries</p> <ul style="list-style-type: none"> <li>Be aware when moving objects, ensure you have a good grip when lifting and carrying objects.</li> <li>Do not carry more than you can handle safely</li> <li>Wear steel toed work boots</li> </ul>	<b>M</b>

# AHA RBTC Boone Injection Injection of Chemical Oxidants



	<p>5C) Working with pumps – Hose and hose connector rupture or leaks.</p> <p>5D) Pinch points</p> <p>5E) Exposure to “daylighting” liquid chemicals or injection well reflux.</p> <p>5F) Exposure to chemical dusts, gases or vapors</p>	<p>5C) Exposure of pressurized liquid chemicals.</p> <ul style="list-style-type: none"> <li>• Procure hoses and connectors rated for the pressures developed by the pumps.</li> <li>• Thoroughly inspect hoses and connectors prior to and during use. Discard any defective or damaged hoses and connectors.</li> <li>• Maintain safe distance from all operating pumps and minimize time spent near operating pumps.</li> <li>• Route hoses to avoid contact with vehicles and foot traffic.</li> <li>• Test all connections at low pressure (&lt;5 psi) and repair all leaks prior to operating at elevated pressures (5 to 30 psi).</li> </ul> <p>5D) Hand Injuries.</p> <ul style="list-style-type: none"> <li>• Be aware of pinch points at lever action locations and hose quick connections.</li> <li>• Wear heavy-duty work gloves when working around potential pinch points.</li> </ul> <p>5E) Exposure to “daylighting” (i.e., injected chemicals that appear on the ground surface) liquid chemicals or injection well reflux.</p> <ul style="list-style-type: none"> <li>• Visually monitor for “daylighting” liquid chemicals or injection well reflux.</li> <li>• Wear PPE as identified in HASP.</li> <li>• Place plastic sheeting over hose fittings during injection as a spray shield.</li> <li>• Disconnect hose fittings beneath shield after injection.</li> <li>• Provide and use appropriate containment and liquid recovery equipment.</li> <li>• Containerize recovered liquids appropriately. Recovered liquids will either be returned to the injection feed tank or drummed for disposal.</li> </ul> <p>5F) Exposure to chemical dusts gases or vapors</p> <ul style="list-style-type: none"> <li>• Wear dust masks while opening and mixing CL-Out and dextrose packages.</li> <li>• Empty packages below the rim of the feed tank to minimize dust travel.</li> <li>• Use a water spray to control dust if necessary.</li> </ul>	<p><b>M</b></p> <p><b>M</b></p> <p><b>L</b></p> <p><b>M</b></p>
<p>6. Using a generator</p>	<p>6A) Fire/Explosion/Contamination hazard from refueling generators</p> <p>6B) Electrocution</p>	<p>6A) Fire/Explosion/Contamination hazard from refueling generators</p> <ul style="list-style-type: none"> <li>• Turn the generator off and let it cool down before refueling</li> <li>• Segregate fuel and other hydrocarbons from injection amendments to minimize contamination potential</li> <li>• Transport fuels in approved safety containers. The use of containers other than those specifically designed to carry fuel is prohibited</li> <li>• See JHA for General Field Work</li> </ul> <p>6B) Electrocution</p> <ul style="list-style-type: none"> <li>• A ground fault circuit interrupter (GFCI) device must protect all AC electrical circuits. Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off.</li> <li>• Make sure that the electrical cords from generators and power tools are not allowed to contact water and do not stand in wet areas while operating power equipment.</li> <li>• Always make sure all electrically-powered equipment is in good repair. Report any problems so the equipment can be repaired or replaced.</li> </ul>	<p><b>M</b></p>



# AHA RBTC Boone SVE Startup and Operation



Activity/Work Task:	SVE Startup and Operation	Overall Risk Assessment Code (RAC) (Use highest code)	<b>M</b>				
Project Location:	Boone, NC	<b>Risk Assessment Code (RAC) Matrix</b>					
Contract Number:	6251121001	<b>Severity</b>	<b>Probability</b>				
Date Prepared:	8/4/2015		Date Accepted: <b>8/4/2015</b>				
Prepared by (Name/Title):	Timothy Renn/Senior Professional I	Catastrophic	Frequent	Likely	Occasional	Seldom	Unlikely
Reviewed by (Name/Title):	<i>Lynne Clem / Senior Scientist</i>	Critical	<b>E</b>	<b>E</b>	<b>H</b>	<b>H</b>	<b>M</b>
		Marginal	<b>E</b>	<b>H</b>	<b>H</b>	<b>M</b>	<b>L</b>
		Negligible	<b>H</b>	<b>M</b>	<b>M</b>	<b>L</b>	<b>L</b>
			<b>M</b>	<b>L</b>	<b>L</b>	<b>L</b>	<b>L</b>
<b>Notes:</b> (Field Notes, Review Comments, etc.)		Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					
<p>This AHA involves the following:</p> <ul style="list-style-type: none"> <li>Establishing site specific measures</li> <li>Procedures for SVE startup</li> <li>Procedures for SVE operation</li> <li>Procedures for monitoring</li> </ul> <p>This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.</p>		"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				<b>RAC Chart</b>	
		"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				<b>E = Extremely High Risk</b>	
		Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				<b>H = High Risk</b>	
						<b>M = Moderate Risk</b>	
				<b>L = Low Risk</b>			
<b>Job Steps</b>	<b>Hazards</b>	<b>Controls</b>					<b>RAC</b>
1. Pre-job tailgate briefing	1A) Unfamiliarity of personnel with materials, procedures, and site features	1A) SSO to lead tailgate briefing. <ul style="list-style-type: none"> <li>Outline work to be performed, personnel assignments, and materials.</li> <li>Review HASP, this AHA.</li> <li>Emergency procedures.</li> </ul>					<b>L</b>
2. General Site Hazards	2A) See JHA Field Work - General 2B) Chemical exposure, chemical storage	2A) See JHA Field Work – General 2B) Chemical Exposure <ul style="list-style-type: none"> <li>Read HASP and SDS/MSDSs and determine air monitoring and PPE needs.</li> <li>Work in a well ventilated area, wear chemical resistant PPE as identified in HASP, review SDS/MSDSs</li> <li>Have access to first aid and eyewash bottle within a reasonable distance.</li> <li>When not in use chemicals will be stored securely in order to prevent unauthorized persons from inadvertently coming into contact with the chemicals.</li> </ul>					<b>M</b>  <b>L</b>

# AHA RBTC Boone SVE Startup and Operation



3. Moving equipment and SVE system materials	3A) Back or muscle strain	3A) Back or muscle strain <ul style="list-style-type: none"> <li>• Avoid unnecessary lifting.</li> <li>• Use materials handling aid (e.g., cart, dolly, etc.) whenever possible</li> <li>• Use a platform or ladder to avoid lifting materials outside the “strike zone” (knees to shoulders).</li> <li>• If container must be lifted, use proper lifting techniques (lift with legs, not back, don’t reach or use a twisting motion).</li> <li>• Obtain assistance in lifting objects weighing more than 50 lbs.</li> </ul>	<b>M</b>
	3B) Foot injury	3B) Foot injury <ul style="list-style-type: none"> <li>• Wear steel-toed work boots</li> </ul>	<b>M</b>
	3C) Potential for exposure as a result of chemical contact (liquid, dust, and vapor) from spills.	3C) Avoid Spills: <ul style="list-style-type: none"> <li>• Wear appropriate PPE specified in the HASP and SDS/MSDS when handling carbon or condensate.</li> <li>• Follow contingency plan in HASP and/or SDS/MSDS in the event of a spill.</li> <li>• Store liquid containers within secondary containment as much as practical.</li> </ul>	<b>L</b>
4. SVE System Operation	4A) Back strain due to lifting tools, supplies or monitoring equipment from vehicles to work locations	4A) Back strain <ul style="list-style-type: none"> <li>• Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items.</li> <li>• Use proper lifting techniques</li> </ul>	<b>M</b>
	4B) Foot injuries from dropped equipment	4B) Foot Injuries <ul style="list-style-type: none"> <li>• Be aware when moving objects, ensure you have a good grip when lifting and carrying objects.</li> <li>• Do not carry more than you can handle safely</li> <li>• Wear steel toed work boots</li> </ul>	<b>M</b>
	4C) Working with blowers and pumps – Pipe and connector leaks.	4C) Exposure to pressurized liquid waste. <ul style="list-style-type: none"> <li>• Thoroughly inspect hoses and connectors prior to and during use. Discard any defective or damaged hoses and connectors.</li> <li>• Test all connections at low pressure (&lt;5 psi) and repair all leaks prior to resuming normal continuous operation.</li> </ul>	<b>L</b>

# AHA RBTC Boone SVE Startup and Operation



	<p>4D) Working with blowers and pumps - Hot surfaces.</p> <p>4E) Pinch points</p> <p>4F) Rotating Equipment</p> <p>4F) Exposure to noise</p> <p>4G) Exposure to chemical dusts, liquids, gases or vapors – identified volatile contaminants include primarily TCE; however other chlorinated and non-chlorinated VOCs are present to a lesser degree.</p> <p>4H) Electrocutation</p>	<p>4D) Burns</p> <ul style="list-style-type: none"> <li>• Be aware of hot surfaces on motors and blower housings.</li> <li>• Avoid contact or wear gloves while equipment is hot or allow time for equipment to cool before handling.</li> </ul> <p>4E) Hand Injuries.</p> <ul style="list-style-type: none"> <li>• Be aware of pinch points at lever action locations and hose quick connections.</li> <li>• Wear heavy-duty work gloves when working around potential pinch points.</li> </ul> <p>4F) Hand and Limb Injuries</p> <ul style="list-style-type: none"> <li>• Do not operate unguarded equipment, except for approved tests with safety procedures in place.</li> <li>• Do not wear loose clothing, jewelry,</li> </ul> <p>4F) Exposure to noise</p> <ul style="list-style-type: none"> <li>• Wear hearing protection inside the SVE trailer when the blower is running unless testing shows that noise levels are below 85 dB.</li> </ul> <p>4G) Exposure to chemical dusts gases or vapors</p> <ul style="list-style-type: none"> <li>• Wear dust masks while opening and transferring activated carbon.</li> <li>• Empty packages below the rim of the adsorber drum to minimize dust travel.</li> <li>• Use a water spray to control dust if necessary.</li> <li>• Do not operate the SVE blower unless the exhaust piping is in place to discharge outside the trailer.</li> </ul> <p>4H) Electrocutation</p> <ul style="list-style-type: none"> <li>• Never do repairs on electrical equipment unless both authorized and qualified.</li> <li>• Only qualified and authorized personnel may access energized circuits (50 volts or higher) for equipment testing and troubleshooting.</li> <li>• A ground fault circuit interrupter (GFCI) device must protect all AC power outlets.</li> <li>• Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off.</li> <li>• Make sure that portable electrical cords are not allowed to be in contact with water.</li> <li>• Do not stand in wet areas while operating power equipment.</li> <li>• Always make sure all electrically-powered equipment is in good repair. Report any problems so the equipment can be repaired or replaced.</li> <li>• When unplugging a cord, pull on the plug rather than the cord.</li> </ul>	<p>M</p> <p>M</p> <p>M</p> <p>M</p> <p>M</p> <p>M</p>
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# AHA RBTC Boone SVE Startup and Operation



5. System disassembly	5A) Exposure to liquid chemicals.	5A) Exposure to liquid chemicals or injection well reflux. <ul style="list-style-type: none"> <li>• Ensure all liquids have drained and hoses are not pressurized prior to disconnection.</li> <li>• Wear correct PPE.</li> <li>• Place plastic sheeting over hose fittings during injection as a spray shield.</li> <li>• Disconnect hose fittings beneath shield after injection.</li> <li>• Provide and use appropriate containment and liquid recovery equipment.</li> <li>• Containerize recovered liquids appropriately. Recovered liquids will either be returned to the injection feed tank or drummed for disposal.</li> </ul>	L
	5B) Exposure to groundwater contaminants	5B) Exposure to groundwater contaminants <ul style="list-style-type: none"> <li>• Wear nitrile or latex gloves while removing injection hoses and tubing.</li> <li>• Rinse hoses and tubing with potable water prior to storage.</li> </ul>	L

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (dust mask, safety glasses, gloves, steel toe work boots)	<b>Competent / Qualified Personnel:</b> Gary Wise – Engineer / Amec Foster Wheeler Chris Bruce – Geologist / Amec Foster Wheeler Zach Downes – Geologist/ Amec Foster Wheeler Timothy Renn – Engineer / Amec Foster Wheeler Lori Mauldin – Scientist / Amec Foster Wheeler Mark Wescott – Geologist / Amec Foster Wheeler  <b>Training requirements:</b> HAZWOPER 40-hr and 8-hr Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting	Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service.  Inspect power cord sets prior to use.  Inspect rotating equipment for proper guarding.  Inspect hoses, tubing, pumps, and tanks for leakage.  Inspect all PPE prior to use



# AHA – Decontamination

Activity/Work Task:	Decontamination			Overall Risk Assessment Code (RAC) (Use highest code)					<b>M</b>			
Project Location:	Boone, NC			<b>Risk Assessment Code (RAC) Matrix</b>								
Contract Number:	6251121001			<b>Severity</b>	<b>Probability</b>							
Date Prepared:	8/4/2015	Date Accepted:	8/4/2015		Frequent	Likely	Occasional	Seldom	Unlikely			
Prepared by (Name/Title):	Timothy Renn/Senior Professional I			Catastrophic	E	E	H	H	M			
Reviewed by (Name/Title):	<i>Leyna Chen / Senior Scientist</i>			Critical	E	H	H	M	L			
<b>Notes:</b> (Field Notes, Review Comments, etc.)  This AHA involves the following: <ul style="list-style-type: none"> <li>Establishing site specific measures</li> </ul> This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.				Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					<b>RAC Chart</b>			
				"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.							E = Extremely High Risk	
				"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible							H = High Risk	
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.					M = Moderate Risk							
					L = Low Risk							

Job Steps	Hazards	Controls	RAC
1. Establish Decontamination Station	1A) Materials Handling	1A) Materials Handling <ul style="list-style-type: none"> <li>Use proper lifting techniques</li> <li>Use mechanical aids, if available, to move heavy items.</li> </ul>	<b>M</b>
2. Decontamination / Steam cleaning.	2A) Struck by steam/hot water/pressure washing	2A) Struck by steam/hot water <ul style="list-style-type: none"> <li>Workers not directly engaged in steam cleaning operations must stay clear.</li> <li>Workers using steam cleaning equipment must be trained on operation and safety devices/procedures using the owners/operators manual.</li> <li>Use face shield <b>and</b> safety glasses or goggles, if steam cleaning.</li> <li>Stay out of the splash/steam radius.</li> <li>Pressure washer must have dead man switch.</li> <li>Do not direct steam at anyone.</li> <li>Do not hold objects with your feet or hands.</li> <li>Ensure that direction of spray minimizes spread of contaminants of concern.</li> <li>Use shielding as necessary.</li> </ul>	<b>M</b>

## AHA – Decontamination

Job Steps	Hazards	Controls	RAC
	2B) Exposure to contaminants	2B) Exposure to contaminants <ul style="list-style-type: none"> <li>▪ Conduct air monitoring (see HASP).</li> <li>▪ Wear proper PPE (see HASP).</li> <li>▪ See SDS/MSDSs for hazards associated with the decon solutions used (if other than water alone is used).</li> </ul>	L
	2C) Slips/Trips/Falls	2C) Slips/Trips/Falls <ul style="list-style-type: none"> <li>▪ Be cautious as ground/plastic can become slippery</li> <li>▪ Use boots or boot covers with good traction</li> </ul>	L
3. Vehicle Decontamination	3A) Vehicle traffic in and out of the Contamination Reduction Zone (CRZ)	3A) Large Vehicle Traffic <ul style="list-style-type: none"> <li>▪ Always wear a hard hat, steel toe boots, and a high visibility vest (unless Tyveks are used and are high visibility).</li> <li>▪ Vehicle drivers are not to exit the vehicle in the CRZ.</li> <li>▪ Identify an individual to communicate with vehicle drivers and maintain order</li> <li>▪ Trucks will be lined with plastic and kept out of direct contact with any contaminated materials during loading. Wear PPE when removing plastic lining from truck beds.</li> <li>▪ If not in the vehicle, obtain eye contact with the driver, so he is aware of your presence and location in the CRZ.</li> <li>▪ If you are driving the vehicle, be aware of personnel in the CRZ and maintain communication with the identified personnel.</li> </ul>	L
	3B) Exposure to contaminants	3B) Exposure to contaminants <ul style="list-style-type: none"> <li>▪ Use safety glasses or goggles, Polycoated Tyvek (if level of contamination poses dermal hazard or to keep work clothes dry), high visibility vest (if high visibility Tyveks are not used) hard hats, steel toe boots, and gloves while cleaning contaminated materials.</li> <li>▪ Do not doff PPE until decontamination of the vehicle is complete.</li> <li>▪ Conduct air monitoring (see HASP).</li> <li>▪ See SDS/MSDSs for hazards associated with the decon solutions (if other than water alone is used).</li> </ul>	L
	3C) Slips/Trips/Falls	3C) Slips/Trips/Falls <ul style="list-style-type: none"> <li>▪ Be cautious as ground/plastic can become slippery</li> <li>▪ Use boots or boot covers with good traction</li> </ul>	M
4. Equipment and Sample Decontamination	4A) Chemical exposure when handling contaminated sample jars and equipment	4A) Chemical exposure <ul style="list-style-type: none"> <li>▪ Wear PPE as outlined in the HASP.</li> <li>▪ Refer to SDS/MSDS for specific hazards associated with decon solutions</li> <li>▪ Monitor breathing zone for contaminants</li> <li>▪ Monitor breathing zone for decon solutions (e.g., methanol, hexane, etc.) if appropriate (see HASP)</li> </ul>	M

## AHA – Decontamination

Job Steps	Hazards	Controls	RAC
	4B) Materials Handling related injuries	4B) Materials Handling related injuries <ul style="list-style-type: none"> <li>▪ Use proper lifting techniques when lifting heavy equipment</li> <li>▪ Use two person lift for heavy coolers</li> </ul>	M
5. Personal Decontamination	4C) Exposure to contaminants	4C) Exposure to contaminants <ul style="list-style-type: none"> <li>▪ Avoid bringing contaminated materials via shoes and clothing into the CRZ by examining such prior to exiting the Exposure Zone (EZ).</li> <li>▪ Removal of PPE will be performed by the following tasks in the listed order:               <ul style="list-style-type: none"> <li>▪ Gross boot wash and rinse and removal</li> <li>▪ Outer glove removal</li> <li>▪ Suit removal</li> <li>▪ Respirator removal (if worn).</li> <li>▪ Inner glove removal</li> </ul> </li> <li>▪ Contaminated PPE is to be placed in the appropriate, provided receptacles.</li> <li>▪ Respirators will be removed and decontaminated at a specified location within the CRZ by a designated technician, then placed in storage bag.</li> <li>▪ Employees will wash hands, face, and any other exposed areas with soap and water.</li> <li>▪ Portable eyewash stations and showers will be available should employees come into direct contact with contaminated materials.</li> <li>▪ See SDS/MSDSs for hazards associated with the decontamination solutions used.</li> <li>▪ Decon solutions will be disposed of according to the work plan.</li> </ul>	M

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (Safety glasses, gloves (HASP), steel toe work boots, high visibility safety vest, hearing protection.)	<p><b>Competent / Qualified Personnel:</b> All Amec Foster Wheeler Employees with 40 hour training</p> <p><b>Training requirements:</b> Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting</p>	<p>Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service.</p> <p>Inspect power cord sets prior to use.</p> <p>Inspect all PPE prior to use</p>

# AHA – Gasoline

Activity/Work Task:	Gasoline	Overall Risk Assessment Code (RAC) (Use highest code)				<b>M</b>		
Project Location:	RBTC Boone, NC	<b>Risk Assessment Code (RAC) Matrix</b>						
Contract Number:	6251161020	<b>Severity</b>	<b>Probability</b>					
Date Prepared:	08/09/2016		Date Accepted:	08/09/2016	Frequent	Likely	Occasional	Seldom
Prepared by (Name/Title):	Mark Wescott/Technical Professional 2	Catastrophic	E	E	H	H	M	M
Reviewed by (Name/Title):	Lynne Clem/Senior Scientist <i>LWC</i>	Critical	E	H	H	M	L	L
		Marginal	H	M	M	L	L	
		Negligible	M	L	L	L	L	
<b>Notes:</b> (Field Notes, Review Comments, etc.)		Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above)						
This AHA involves the following:		“Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				<b>RAC Chart</b>		
<ul style="list-style-type: none"> <li>Establishing site specific measures</li> <li>Safe practices when using gasoline in the field</li> </ul>		“Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk		
This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to all site AHAs/JHAs for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.		Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk		
						M = Moderate Risk		
						L = Low Risk		

Job Steps	Hazards	Controls	RAC
1. Filling up gasoline containers	1A) Fire, Explosion	1A) Fire, Explosion <ul style="list-style-type: none"> <li>Shut off the vehicles engine</li> <li>Leave mobile phone in the vehicle.</li> <li>Do not smoke or use mobile phone while filling container</li> <li>Touch the side of the vehicle to discharge any static build up on you prior to filling the containers.</li> <li>Only use approved containers with approved labels.</li> <li>Remove gasoline cans from field vehicle to fill. Place gasoline container on the ground to help dissipate electrical charges. Do not fill gasoline containers in pickup truck, especially those with plastic bed liners. Static electricity may cause fire or explosion.</li> <li>Manually control the nozzle valve throughout the filling process</li> <li>Fill container slowly – will decrease the chance of static ignition buildup and minimize incidents of spillage or splattering</li> </ul>	<b>M</b>

## AHA – Gasoline

Job Steps	Hazards	Controls	RAC
		<ul style="list-style-type: none"> <li>▪ Keep nozzle in contact with gasoline container at all times to avoid static build-up</li> <li>▪ Fill container no more than 95 percent full to allow for expansion</li> <li>▪ Place cap tightly on the container after filling – do not use containers that do not seal properly</li> <li>▪ Report spills to the attendant</li> </ul>	
	1B) Chemical Exposure	1B) Chemical Exposure <ul style="list-style-type: none"> <li>▪ Keep face away from the nozzle or container opening</li> <li>▪ Avoid prolonged breathing of gasoline vapors</li> <li>▪ Never siphon gasoline by mouth</li> <li>▪ <b>Avoid contact with skin; may cause serious chemical burns</b></li> <li>▪ If gasoline spills on the container, make sure that it has evaporated before placing container in your vehicle</li> <li>▪ Place cap tightly on the container after filling – do not use containers that do not seal properly</li> </ul>	L
2. Transporting gasoline	2A) Fire, Explosion	2A) Fire, Explosion <ul style="list-style-type: none"> <li>▪ Transport gasoline in an approved container with a flash arrestor vent and proper labeling</li> <li>▪ Transport no more than 5 gallons.</li> <li>▪ Make sure the container is secure from tipping and sliding</li> <li>▪ Do not leave gasoline containers in the trunk of the vehicle <b>overnight</b> or in direct sunlight.</li> <li>▪ <b>Do not mount can outside vehicle when transporting.</b></li> </ul>	M
	2B) Breathing fumes / toxic vapors	2B) Breathing fumes / toxic vapors <ul style="list-style-type: none"> <li>▪ Use only cans that are in good working order.</li> <li>▪ Secure caps tightly to prevent fumes from entering the vehicle.</li> <li>▪ Avoid transporting containers in the cab of the vehicle.</li> </ul>	L

## AHA – Gasoline

Job Steps	Hazards	Controls	RAC
3. Storage	3A) Fire, Explosion	3A) Fire, Explosion <ul style="list-style-type: none"> <li>▪ Store gasoline in approved container.</li> <li>▪ Store gasoline containers in a flammable liquid storage cabinet if available.</li> <li>▪ Gasoline is a flammable liquid and should be stored at room temperature.</li> <li>▪ Store away from potential heat sources such as the sun, hot water heater, space heater, furnace, generator, and other potential ignition sources</li> <li>▪ Store in well ventilated area.</li> <li>▪ Gasoline is heavier than air and can travel along the floor to ignition sources.</li> </ul>	M
4. Refueling small gasoline engines	4A) Fire, Explosion	4A) Fire, Explosion <ul style="list-style-type: none"> <li>▪ Turn off engine and let engine cool down before refueling.</li> <li>▪ Do not smoke <b>or use mobile phone</b> while refueling equipment.</li> </ul>	M
Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements	
	<b>Competent / Qualified Personnel:</b> All Amec Foster Wheeler Personnel <b>Training requirements:</b> Site Specific AHA/JHA Orientation Toolbox safety meeting Task kick-off meeting	Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service.  Inspect all PPE prior to use	

# AHA - Groundwater Sampling Activity Description



Activity/Work Task:	Groundwater Sampling	Overall Risk Assessment Code (RAC) (Use highest code)	L				
Project Location:	Boone, NC	<b>Risk Assessment Code (RAC) Matrix</b>					
Project Number:	6251121001	<b>Severity</b>	<b>Probability</b>				
Date Prepared:	07/27/2015      Date Accepted:		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title):	Zach Downes/Technical Professional I	Catastrophic	E	E	H	H	M
Reviewed by (Name/Title):	Lynne Clem / Senior Scientist <i>LWC 7/29/15</i>	Critical	E	H	H	M	L
		Marginal	H	M	M	L	L
		Negligible	M	L	L	L	L
<p>This AHA involves the following:</p> <ul style="list-style-type: none"> <li>Establishing site specific measures for groundwater sampling</li> </ul> <p>This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.</p>		<p>Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)</p> <p>"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.</p> <p>"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible</p> <p>Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.</p>					L
		<b>RAC Chart</b>					
		E = Extremely High Risk					
		H = High Risk					
		M = Moderate Risk					
		L = Low Risk					

Job Steps	Hazards	Controls	RAC
1. Mobilization	1A) See AHA Mobilization/Demobilization/Site Preparation	1A) See AHA Mobilization/Demobilization/Site Preparation	L
2. General Site Hazards	2A) See AHA Field Work - General	2A) See AHA Field Work - General	
	2B) Chemical exposure	2B) Chemical Exposure <ul style="list-style-type: none"> <li>Read HASP TO determine air monitoring and PPE needs.</li> </ul>	L
3. Calibrate monitoring equipment	3A) Exposure to calibration gases	3A) Exposure to calibration gases <ul style="list-style-type: none"> <li>Review equipment manuals</li> <li>Calibrate in a clean, well ventilated area</li> </ul>	L

# AHA - Groundwater Sampling Activity Description



Job Steps	Hazards	Controls	RAC
4. Opening the port/valve	4A) Contact with poisonous plants or the oil from poisonous plants	4A) Contact with poisonous plants or the oil from those plants: <ul style="list-style-type: none"> <li>▪ Look for signs of poisonous plants and avoid.</li> <li>▪ Ensure all field workers can identify the plants. Mark identified poisonous plants with spray paint if working at a fixed location.</li> <li>▪ Wear PPE as described in the HASP.</li> <li>▪ Do not touch any part of your body/clothing.</li> <li>▪ Always wash gloves before removing them.</li> <li>▪ Discard PPE in accordance with the HASP.</li> <li>▪ Use commercially available products such as Ivy Block or Ivy Wash as appropriate.</li> </ul>	L
	4B) Contact with biting insects (i.e., spiders, bees, etc.) which may have constructed a nest in the well cap/well.	4B) Contact with stinging/biting insects <ul style="list-style-type: none"> <li>▪ Discuss the types of insects expected at the Site and be able to identify them.</li> <li>▪ Look for signs of insects in and around the well.</li> <li>▪ Wear Level of PPE as described in the HASP. At a minimum, follow guidelines in the AHA "Insects Stings and Bites."</li> <li>▪ If necessary, wear protective netting over your head/face.</li> <li>▪ Avoid contact with the insects if possible.</li> <li>▪ Inform your supervisor and the Site Health and Safety Supervisor if you have any allergies to insects and insect bites. Make sure you have identification of your allergies with you at all times and appropriate response kits if applicable.</li> <li>▪ Get medical help immediately if you are bitten by a black widow or brown recluse, or if you have a severe reaction to any spider bite or bee sting.</li> </ul>	L
	4C) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated groundwater/soil); liquid splash; flammable atmospheres.	4C) Exposure to hazardous substances <ul style="list-style-type: none"> <li>▪ Wear PPE as identified in HASP.</li> <li>▪ Review hazardous properties of site contaminants with workers before sampling operations begin</li> <li>▪ Immediately monitor breathing zone after opening well to determine exposure and verify that level of PPE is adequate – see Action Levels in HASP</li> <li>▪ Monitor headspace in well. After the initial headspace reading (if required by the Work Plan), allow the well to vent for several minutes before obtaining water level and before sampling.</li> <li>▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.</li> </ul>	L
	4D) Back strain due to lifting bailers or pumps and from moving equipment to well locations	4D) Back strain <ul style="list-style-type: none"> <li>▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items.</li> <li>▪ Use proper lifting techniques</li> </ul>	L
	4E) Foot injuries from dropped equipment	4E) Foot Injuries <ul style="list-style-type: none"> <li>▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects.</li> <li>▪ Do not carry more than you can handle safely</li> <li>▪ Wear Steel toed boots</li> </ul>	L

# AHA - Groundwater Sampling Activity Description



Job Steps	Hazards	Controls	RAC
5. Collecting water samples	5A) Exposure to contaminants	5A) Exposure to Contaminants <ul style="list-style-type: none"> <li>▪ Stand up wind when sampling</li> <li>▪ Monitor breathing zone with appropriate monitoring equipment (see HASP)</li> <li>▪ Wear chemical resistant PPE as identified in HASP</li> <li>▪ See section 4C) under Safe Practices above</li> </ul>	L
	5B) Infectious water born diseases	5B) Infectious water born diseases <ul style="list-style-type: none"> <li>▪ Wear chemical resistant gloves and other PPE – as identified in HASP</li> <li>▪ Prevent water from contacting skin</li> <li>▪ Wash exposed skin with soap and water ASAP after sampling event</li> <li>▪ Ensure that all equipment is adequately decontaminated using a 10% bleach solution</li> </ul>	L
	5C) Exposure to water preservatives	5C) Exposure to water preservatives <ul style="list-style-type: none"> <li>▪ Work in a well ventilated area, upwind of samples</li> <li>▪ Wear chemical resistant PPE as identified in HASP</li> <li>▪ When preserving samples always add acid to water, avoid the opposite.</li> </ul>	L
	5D) Slips/trips/falls	5D) Slips/trips/falls <ul style="list-style-type: none"> <li>▪ Ground can become wet/muddy, created by spilled water</li> <li>▪ Place all purged water in drums for removal</li> <li>▪ Wear good slip resistant footwear</li> </ul>	L
	5E) Repetitive Motion and other Ergonomic Issues	5E) Ergonomic Issues <ul style="list-style-type: none"> <li>▪ Use mechanical means where possible to raise and lower equipment into well.</li> <li>▪ Alternate raising and lowering equipment between field sampling team members, and alternate bailing the well.</li> <li>▪ Use safe lifting techniques.</li> </ul>	L
6. Sample Processing	6A) Contaminated water	6A) Contaminated water <ul style="list-style-type: none"> <li>▪ Wear appropriate PPE as identified in HASP</li> <li>▪ Decontaminate outside of bottles</li> <li>▪ Prevent water from contacting skin</li> <li>▪ Work in well ventilated area – upwind of samples</li> <li>▪ Waste will be returned to the operation office for storage and disposal</li> </ul>	L
7. Shipping Samples	7A) Freeze burns, back strain, hazardous chemical exposure, sample leakage	7A) Freeze burns, back strain, hazardous chemical exposure, sample leakage <ul style="list-style-type: none"> <li>▪ Wear appropriate chemical resistant gloves as identified in HASP.</li> <li>▪ Wear leather or insulated gloves when handling dry ice.</li> <li>▪ Follow safe lifting techniques – get help lifting heavy coolers.</li> <li>▪ Samples that contain hazardous materials under the DOT definition, must be packaged, manifested and shipped by personnel that have the appropriate DOT HAZMAT training.</li> </ul>	L

# AHA - Groundwater Sampling Activity Description



Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
<p>PPE - safety glasses, gloves, steel toe work boots, (See project specific HASP)</p>	<p><b>Competent / Qualified Personnel:</b> All AMEC Employees with 40 hour training</p> <p><b>Training requirements:</b> HAZCOM Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting</p>	<p>Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service.</p> <p>Inspect power cord sets prior to use.</p> <p>Inspect all PPE prior to use</p>

# AHA –Vertical and Horizontal Drilling for Remediation Activities



Activity/Work Task:	Drilling Operation	Overall Risk Assessment Code (RAC) (Use highest code)	H				
Project Location:	RTBC Boone	<b>Risk Assessment Code (RAC) Matrix</b>					
Contract Number:	6251161020	<b>Severity</b>	<b>Probability</b>				
Date Prepared:	6/28/2016	Date Accepted:	8/9/2016				
Prepared by (Name/Title):	Mark M Wescott/ Technical Professional 2	Catastrophic	E	E	H	H	M
		Critical	E	H	H	M	L
Reviewed by (Name/Title):	Lynne W. Clem/ Senior Scientist <i>LWC</i>	Marginal	H	M	M	L	L
		Negligible	M	L	L	L	L
<b>Notes:</b> (Field Notes, Review Comments, etc.)		Step 1: Review each “ <b>Hazard</b> ” with identified safety “ <b>Controls</b> ” and determine RAC (See above)					
This AHA involves the following: <ul style="list-style-type: none"> <li>Establishing site-specific measures</li> <li>Establishing task-specific measures</li> </ul> This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.		“ <b>Probability</b> ” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.				<b>RAC Chart</b>	
		“ <b>Severity</b> ” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				E = Extremely High Risk	
		Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.				H = High Risk	
						M = Moderate Risk	
				L = Low Risk			

# AHA –Vertical and Horizontal Drilling for Remediation Activities



Job Steps	Hazards	Controls	RAC
1. Drive drilling rig onto site	1A) Malfunction of vehicle/equipment	1A) Drivers shall perform a pre-operational check of equipment, read and be familiar with any operator's manual. <ul style="list-style-type: none"> <li>▪ Report all needed repairs promptly.</li> <li>▪ Operators shall not use defective/unsafe equipment.</li> </ul>	<b>M</b>

# AHA –Vertical and Horizontal Drilling for Remediation Activities



	<p>1B) Collision while being driven</p>	<p>1B) Wreck of drill rig while being driven</p> <ul style="list-style-type: none"> <li>▪ All drivers shall be properly licensed.</li> <li>▪ Supervisors shall verify that drivers are capable and qualified on each type of equipment before allowing the equipment to be used unsupervised.</li> <li>▪ Keep windshields, windshield wipers, side mirrors and side windows clean</li> <li>▪ Drivers shall conduct a pre-operation vehicle safety check</li> <li>▪ Drivers shall plan ahead to minimize or eliminate the need for backing. Always check to the rear before backing and use an observer when available. If an observer is not available, the driver shall walk around the vehicle to make sure rear is clear prior to backing.</li> <li>▪ Seat belts shall be worn when driving by driver and passengers.</li> <li>▪ Choose the safest location possible to park equipment. Avoid parking in blind spots of other equipment.</li> <li>▪ Driver is to be sure the back-up alarm is working</li> <li>▪ Adjust vehicle speed for load and weather. Tire chains should be utilized as dictated by weather conditions.</li> <li>▪ Operators should always check and be sure of load height.</li> <li>▪ When operating a vehicle off the roadway, be aware of possible hidden objects in the grass and unstable terrain.</li> <li>▪ The mast shall always be in a lowered position when moving the drill rig.</li> <li>▪ Never allow anyone between truck and trailer when backing to hook trailer</li> <li>▪ Make sure tilt beds or ramps are secured before putting trailer in use</li> <li>▪ Perform periodic checks of equipment on long trips to assure the load is secure.</li> <li>▪ Do not leave equipment unattended with the engine running. Shut off engine and set the parking brake when equipment is not in use.</li> </ul>	<p style="text-align: center;"><b>M</b></p>
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# AHA –Vertical and Horizontal Drilling for Remediation Activities



2. Mounting and dismounting equipment	2A) Fall while mounting and dismounting equipment	2A) When mounting and dismounting equipment, use steps and handhold. Do not jump from vehicle.	<b>M</b>
3. Loading/unloading of equipment	3A) Crush and pinch points created when loading/unloading equipment	<p>3A) Crush and pinch points created when loading/unloading equipment</p> <ul style="list-style-type: none"> <li>▪ Be aware of crushing and pinching hazards when loading, unloading and fastening down equipment.</li> <li>▪ Make sure cargo is properly loaded, secured and covered using only approved chain and load binders. Check for loose material on bed and trailer. Secure loose material.</li> <li>▪ Wear protective equipment consistent with the hazard (hard hats, safety glasses, leather gloves, safety shoes, etc.)</li> <li>▪ Hook/unhook on stable ground with the trailer secure.</li> </ul>	<b>M</b>

# AHA –Vertical and Horizontal Drilling for Remediation Activities



<p>4. Rig equipment operation.</p>	<p>4A) Crushing injuries, slip trips and falls, material under stress, power equipment operations, contact with buried or overhead utility lines, overhead loads, flying particles, rope or cable blocks, equipment limitations, lifting and pinch points</p> <p>4B) Personnel exposure to exhaust fumes and carbon monoxide.</p>	<p>4A) Rig equipment operation.</p> <ul style="list-style-type: none"> <li>▪ Before use, inspect cable, chain or wire for wear and replace if necessary.</li> <li>▪ Observe OSHA guidelines for use of cable clamps, safety latches, chains and slings.</li> <li>▪ Know rated capacity of chain, cable or wire rope being used and never exceed the rating.</li> <li>▪ Avoid overloading and sudden jerks.</li> <li>▪ Wear appropriate personal protective equipment with the hazard, including hard hats, safety glasses, leather gloves and safety shoes.</li> <li>▪ Check loads to be lifted for balance and have the rigging inspected to ensure a safe and balanced condition exists.</li> <li>▪ Do not allow employees to stand or work under suspended loads.</li> <li>▪ Awkward loads shall have taglines attached to control the load.</li> <li>▪ Review signals and operator communications with crew. Only one person shall direct the operator.</li> <li>▪ Review the area for utility lines, tree limbs and other overhead hazards. Work no closer than 20 feet to active overhead power lines. Follow OSHA guidelines.</li> <li>▪ Personnel working tag lines shall review the area for slipping, tripping and falling hazards. If not possible to eliminate the hazards, take precautions to avoid them.</li> </ul> <p>4B) Ensure that atmosphere is monitored for carbon monoxide if drill rig is operated indoors and provide fresh air using fans. When operating drill rig outside ensure that operator is not in location of excessive exhaust fumes.</p>	<p style="text-align: center;"><b>H</b></p>
<p>5. Stabilize rig with hydraulic jack/pads</p>	<p>5A) Crushing injuries, slip, trip, fall hazards and potential back injuries.</p>	<p>5A) Crushing injuries, slip, trip, fall hazards and potential back injuries.</p> <ul style="list-style-type: none"> <li>▪ Use proper lifting techniques.</li> <li>▪ Ensure jack is rated for weight/operation with safe limits</li> <li>▪ Assure that area is clear of personnel and obstacles.</li> <li>▪ Place pads under jacks to prevent them from sinking into the ground.</li> </ul>	<p style="text-align: center;"><b>M</b></p>

# AHA –Vertical and Horizontal Drilling for Remediation Activities



<p>6. Start/operate drill rig</p>	<p>6A) Moving machinery parts, buried and overhead utilities, drill rod stacking, lifting, winching, movement of Standard Penetration Test (SPT) automatic hammer, moving equipment, noise, adverse weather conditions, animals, slippery surfaces, uneven terrain, poisonous plants/snakes/insects, and overhead hazards</p>	<p>6A) Moving machinery parts, buried and overhead utilities, drill rod stacking, lifting, winching, movement of SPT automatic hammer, moving equipment, noise, adverse weather conditions, animals, slippery surfaces, uneven terrain, poisonous plants/snakes/insects and overhead hazards</p> <ul style="list-style-type: none"> <li>▪ Wear appropriate personal protective equipment consistent with the hazard (hard hat, safety glasses, leather gloves, safety shoes, etc.)</li> <li>▪ Avoid contact with rotating equipment</li> <li>▪ Use caution when moving SPT automatic hammer assembly into working position. This assembly is heavy and could pose a pinning/crushing hazard if operator's body is placed between an immovable object such as a truck and the SPT hammer assembly.</li> <li>- Observe and stay clear (minimum of 10 feet for nominal system voltage, utility lines, rated 50kV, minimum of 15 feet for nominal voltage rated 50 to 200 kV, and an additional 5 feet for each 1-150kV over 200kV) of overhead utility lines. Stay minimum of 20 feet away from distribution lines of undetermined voltage and stay 50 feet away from transmission lines of undetermined voltage.</li> <li>- A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means.</li> <li>- Avoid storing materials under or near overhead power lines.</li> <li>- Workers should stay back at least 20 feet from equipment operating near overhead distribution power lines due to ground potential.</li> <li>- Have underground utility lines properly located and marked prior to drilling.</li> <li>▪ Employees on foot must use extreme caution to stay clear of operating equipment. Always establish eye contact with the operator before approaching the equipment.</li> <li>▪ Be aware of drop-offs, uneven ground and potential hidden objects which may cause loss of control when maneuvering drill rigs or create unstable drill set-ups. In heavily wooded area, scout to locate hidden objects.</li> <li>▪ Drill rod stacking must not exceed a length of 1.5 times the height of the tower.</li> <li>▪ Be aware of poisonous plants, insects, snakes, animals and animal waste products and carcasses. Wear long sleeve shirts, gloves, and high top boots when hazards cannot be avoided. Proper first aid supplies, insect repellents shall accompany field crews.</li> </ul>	<p>H</p>
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# AHA –Vertical and Horizontal Drilling for Remediation Activities



		<ul style="list-style-type: none"><li>▪ Be alert to conditions that can lead to slippery surfaces. Examples: high groundwater resulting in muddy soils brought to the surface by augers and the utilization of bentonite drilling fluid.</li><li>▪ Inspect all cables and clamps prior to winching operation. Stand clear of winching operations.</li><li>▪ Use proper lifting techniques. Get help or use lifting equipment.</li><li>▪ Suspend drilling operations during electrical storms</li><li>▪ Be aware of overhead hazards which may come in contact with the drill rig, when moving or setting up equipment.</li><li>▪ Complete a daily operations checklist to ensure that equipment is working properly. Make special note of emergency kill switches.</li></ul>	
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# AHA –Vertical and Horizontal Drilling for Remediation Activities



	6B) Contaminated soils, buried power or gas lines, landfills and containment of spills	<p>6B) Contaminated soils, buried power or gas lines, landfills and containment of spills</p> <ul style="list-style-type: none"> <li>▪ During drilling operations, always be aware of the possibility of encountering potentially hazardous materials, such as petroleum hydrocarbons, herbicides, pesticides, chemical manufacturing by-products or solid waste materials.</li> <li>▪ In the event that any unknown or questionable materials are encountered, then the drilling operations are to be suspended immediately until further instructions are received from supervisor</li> <li>▪ Do not handle any suspected contaminated materials unless trained to do so and proper protective methods are followed.</li> <li>▪ During drilling operations, always be aware of the possibility of striking an unlocated or improperly located gas or power line.</li> <li>▪ In the event a buried utility line is struck, drilling operations are to be suspended <b>immediately</b>.             <ul style="list-style-type: none"> <li>- If the utility line is electric, keep personnel at least 10 feet from all metal surfaces connected with the drill rig.</li> <li>- If the utility is gas, then the area is to be evacuated and secured. Immediate notification to the utility company is MANDATORY.</li> </ul> </li> <li>▪ In the event of a gas or oil spill, the proper authorities are to be contacted immediately so that containment operations can be implemented. All drill rigs must have on hand a spill kit for mitigation of oil or gas spills.</li> </ul>	<b>M</b>
7. Attach auger to drill	7A) Auger coming loose from drill	<p>7A) Auger coming loose from drill Insert a holding pin in auger</p> <ul style="list-style-type: none"> <li>▪ Insert a holding pin in auger</li> <li>▪ Use personal protective equipment such as leather gloves, safety glasses, hard hat and safety shoes.</li> <li>▪ Be aware of hand and finger positions when inserting holding pin</li> </ul>	<b>M</b>
8. Start drill by lever operations	8A) Operation of wrong lever	8A) Label levers as to their operation and review equipment manual.	<b>L</b>
9. Maintain proper auger drill speed with down hole pressure speed.	9A) Unstable rig from improper speed of auger	9A) Use of trained drill rig personnel and follow equipment manual specification.	<b>L</b>

# AHA –Vertical and Horizontal Drilling for Remediation Activities



10. When auger has dug into ground unhook pin and insert another auger on top of the previous auger	10A) Auger coming loose (reference item #7)	10A) Insert another catch pin into newly installed auger (reference item #7)	M
11. Insert PVC pipe into hollow stem auger in 10 foot sections	11A) Reference Hazard item #6a	11A) Reference Control item #6A	M
12. Install filter pack (50 pound bags of sand) into hole (by pouring) to filter water into screen	12A) Back injuries, slips and falls	12A) Proper lifting procedures, team lifting and use of mechanical devices. Wear proper foot wear and maintain area in good housekeeping condition.	M
13. Reverse auger after each five foot section of sand is installed	13A) Reference hazard item #4	13A) Reference Control item #4	M
14. Install bentonite on top of sand (3 foot) to seal up area above sand.	14A) Reference hazard item #12	14A) Reference control item #12	M
15. Remove auger	15A) Auger falling	15A) Insert auger- maintain auger at ground surface to prevent auger from falling into hole.	M
16. Release auger tension and remove pins. Remove auger from hole.	16A) Reference hazard item #4	16A) Reference control item #4	L
17. Lower drill head attached to auger remaining in bore hole attach with a pin	17A) Reference hazard in item #4	17A) Reference control in item #4	L
18. Decontamination of drill equipment-usually pressure water	18A) Contamination of personnel and environment	18A) Follow health and safety plan, dress to proper EPA level, contain material washed from contaminated equipment with proper containment materials. Trained/authorized personnel to use pressure washer and assure area is clear of unauthorized personnel prior to operation of pressure water device.	L
19. Mix grout on site and fill/place in hole between the well pipe and bore hole wall	19A) Reference hazard item #12	19A) Reference control item #12	L
20. Cut PVC pipe off at determined height with a hand saw	20A) cutting of hand with hand saw	20A) Be aware of where hands are placed prior and during cutting with hand saw	L

# AHA –Vertical and Horizontal Drilling for Remediation Activities



21. Install a protective cover and fill with grout.	21A) Reference hazard item #12	21A) Reference control item #12	<b>L</b>
22. Driving drilling rig offsite.	22A) Reference item # 1	22A) Reference item #1.	<b>M</b>

# AHA –Vertical and Horizontal Drilling for Remediation Activities



Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
<p>PPE (Hard Hat, safety glasses, gloves, steel toe work boots, high visibility safety vest, hearing protection)</p>	<p><b>Competent / Qualified Personnel:</b></p> <p>All Greenville Amec Foster Wheeler Personnel</p> <p><b>Training requirements:</b></p> <p>SSO must take and successfully pass AFW training course <a href="#">Overhead Electrical Line Safety Awareness</a> prior to work on site.</p> <p>Site Specific HASP Orientation</p> <p>Toolbox safety meeting</p> <p>Task kick-off meeting</p>	<p>Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service.</p> <p>Inspect power cord sets prior to use.</p> <p>Inspect all PPE prior to use</p>

# AHA - Insect Stings and Bites

Activity/Work Task:	Insect Stings and Bites	Overall Risk Assessment Code (RAC) (Use highest code)	L				
Project Location:	Boone, NC	<b>Risk Assessment Code (RAC) Matrix</b>					
Project Number:	6251121001	<b>Severity</b>	<b>Probability</b>				
Date Prepared:	7/27/2015		Date Accepted:				
Prepared by (Name/Title):	Zach Downes/Technical Professional I	Frequent	Likely	Occasional	Seldom	Unlikely	
Reviewed by (Name/Title):	Lynne Clem / Senior Scientist <i>LWC 7/29/15</i>	Catastrophic	E	E	H	H	M
		Critical	E	H	H	M	L
		Marginal	H	M	M	L	L
		Negligible	M	L	L	L	L
This AHA involves the following:		Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)					
<ul style="list-style-type: none"> <li>Establishing site specific measures for dealing with insect stings and bites</li> </ul>		"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.			<b>RAC Chart</b>		
This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.		"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible			E = Extremely High Risk		
		Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.			H = High Risk		
					M = Moderate Risk		
					L = Low Risk		

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (Safety glasses, gloves (HASP), steel toe work boots, and long pants.)	<b>Competent / Qualified Personnel:</b> Tim Renn – Engineer / AMEC Chris Bruce – Geologist / AMEC  <b>Training requirements:</b> Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting	Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service.  Inspect all PPE prior to use

# AHA - Insect Stings and Bites

Job Steps	Hazards	Controls	RAC
1. Traveling/working in areas with potential Tick Bites – Example outdoor wooded areas or fields.	1. Lyme Disease, Rocky Mountain Spotted Fever, etc.	<ul style="list-style-type: none"> <li>▪ Spray clothing with insect repellent as a barrier.</li> <li>▪ Wear light colored clothing that fits tightly at the wrists, ankles, and waist.</li> <li>▪ Each outer garment should overlap the one above it.</li> <li>▪ Cover trouser legs with high socks or boots.</li> <li>▪ Tuck in shirt tails.</li> <li>▪ Search the body on a regular basis, especially hair and clothing; ticks generally do not attach for the first couple of hours.</li> <li>▪ If a tick becomes attached, pull it by grasping it as close as possible to the point of attachment and pull straight out with gentle pressure. Wash skin with soap and water then cleanse with rubbing alcohol. Place the tick in an empty container for later identification, if the victim should have a reaction. Record dates of exposure and removal.</li> <li>▪ Do not try to remove the tick by burning with a match or covering it with chemical agents.</li> <li>▪ If you can not remove the tick, or the head detaches, seek prompt medical help.</li> <li>▪ Watch for warning signs of illness: a large red spot on the bite area; fever, chills, headache, joint and muscle ache, significant fatigue, and facial paralysis are reactions that may appear within two weeks of the attack. Symptoms specific to Lyme disease include: confusion, short-term memory loss, and disorientation.</li> </ul>	L
2. Working/traveling in areas with potential bee and wasp stings-Example wooded areas and fields	2. Allergic reactions, painful stings	<ul style="list-style-type: none"> <li>▪ Be alert to hives in brush or in hollow logs. Watch for insects travelling in and out of one location.</li> <li>▪ If you or anyone you are working with is known to have allergic reactions to bee stings, tell the rest of the crew and your supervisor. Make sure you carry emergency medication with you at all times.</li> <li>▪ Wear long sleeve shirts and trousers; tuck in shirt. Bright colors and metal objects may attract bees.</li> <li>▪ If you are stung, cold compresses may bring relief.</li> <li>▪ If a stinger is left behind, scrape it off the skin. Do not use a tweezers as this squeezes the venom sack, worsening the injury.</li> <li>▪ If the victim develops hives, asthmatic breathing, tissue swelling, or a drop in blood pressure, seek medical help immediately. Give victim antihistime, (Benadryl, chlo-amine tabs).</li> </ul>	L
3. Traveling/working in areas of potential Mosquito Bites- Example- Woods, fields, near bodies of water and etc.	3. Skin irritation, encephalitis	<ul style="list-style-type: none"> <li>▪ Wear long sleeves and trousers.</li> <li>▪ Avoid heavy scents.</li> <li>▪ Use insect repellants. If using DEET, do not apply directly to skin, apply to clothing only.</li> <li>▪ Carry after-bite medication to reduce skin irritation.</li> </ul>	L

# AHA - Mobilization/Demobilization and Site Preparation



Activity/Work Task:	Mobilization/Demobilization and Site Preparation	Overall Risk Assessment Code (RAC) (Use highest code)				H		
Project Location:	RTBC-Boone, NC	<b>Risk Assessment Code (RAC) Matrix</b>						
Contract Number:	6251161020	<b>Severity</b>	<b>Probability</b>					
Date Prepared:	06/30/2016		Date Accepted:	08/09/2016	Frequent	Likely	Occasional	Seldom
Prepared by (Name/Title):	Mark Wescott/Technical Professional 2	Catastrophic	E	E	H	H	H	M
Reviewed by (Name/Title):	Lynne W. Clem/Senior Scientist <i>LWC</i>	Critical	E	H	H	H	M	L
		Marginal	H	M	M	M	L	L
		Negligible	M	L	L	L	L	L
<b>Notes:</b> (Field Notes, Review Comments, etc.)		Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)						
This AHA involves the following:		"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.					<b>RAC Chart</b>	
This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.		"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible					E = Extremely High Risk	
		Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.					H = High Risk	
							M = Moderate Risk	
					L = Low Risk			

Job Steps	Hazards	Controls	RAC
1. Prepare for Site Visit	1a) N/A	Prior to leaving for site: <ul style="list-style-type: none"> <li>▪ Obtain and review HASP prior to site visit, if possible</li> <li>▪ Determine PPE needs – bring required PPE to the site, if not otherwise being provided at the site (e.g., steel toed boots)</li> <li>▪ Determine training and medical monitoring needs and ensure all required Health and Safety training and medical monitoring has been received and is current</li> <li>▪ Ensure all workers are fit for duty (alert, well rested, and mentally and physically fit to perform work assignment)</li> <li>▪ If respiratory protection is required/potentially required, ensure that training and fit-testing has occurred within the past year.</li> <li>▪ Familiarize yourself with route to the site</li> </ul>	L

# AHA - Mobilization/Demobilization and Site Preparation



Job Steps	Hazards	Controls	RAC
	1b) Vehicle defects	Inspect company owned/leased vehicle for defects such as: <ul style="list-style-type: none"> <li>▪ Flat tires</li> <li>▪ Windshield wipers worn or torn</li> <li>▪ Oil puddles under vehicle</li> <li>▪ Headlights, brake lights, turn signals not working</li> </ul>	L
	1c) Insufficient emergency equipment, unsecured loads	Insufficient emergency equipment, unsecured loads: <ul style="list-style-type: none"> <li>▪ Ensure vehicle has first aid kit and that all medications are current (if first aid kits are not provided at the site)</li> <li>▪ Ensure vehicle is equipped with warning flashers and/or flares and that the warning flashers work</li> <li>▪ Cell phones are recommended to call for help in the event of an emergency</li> <li>▪ All tools must be properly secured.</li> <li>▪ Ensure sufficient gasoline is in the tank</li> </ul>	M
2. Operating vehicles	2a) Collisions, unsafe driving conditions	Drive Defensively!: <ul style="list-style-type: none"> <li>▪ Seat belts must be used at all times when operating any vehicle on company business.</li> <li>▪ Drive at safe speed for road conditions</li> <li>▪ Maintain adequate following distance</li> <li>▪ Pull over and stop if you have to look at a map</li> <li>▪ Try to park so that you don't have to back up to leave.</li> <li>▪ If backing in required, walk around vehicle to identify any hazards (especially low level hazards that may be difficult to see when in the vehicle) that might be present. Use a spotter if necessary</li> </ul>	M
3. Driving to the jobsite (mobilization)	3a) Dusty, winding, narrow roads	Dusty, winding, narrow roads <ul style="list-style-type: none"> <li>▪ Drive confidently and defensively at all times.</li> <li>▪ Go slow around corners, occasionally clearing the windshield.</li> </ul>	M
	3b) Rocky or one-lane roads	Rocky or one-lane roads: <ul style="list-style-type: none"> <li>▪ Stay clear of gullies and trenches, drive slowly over rocks.</li> <li>▪ Yield right-of-way to oncoming vehicles---find a safe place to pull over.</li> </ul>	M
	3c) Stormy weather, near confused tourists	Stormy weather, near confused tourists: <ul style="list-style-type: none"> <li>▪ Inquire about conditions before leaving the office.</li> <li>▪ Be aware of oncoming storms.</li> <li>▪ Drive to avoid accident situations created by the mistakes of others.</li> </ul>	M

# AHA - Mobilization/Demobilization and Site Preparation



Job Steps	Hazards	Controls	RAC
	3d) When angry or irritated	When angry or irritated: <ul style="list-style-type: none"> <li>Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.</li> </ul>	M
	3e) Turning around on narrow roads	Turning around on narrow roads: <ul style="list-style-type: none"> <li>Safely turn out with as much room as possible.</li> <li>Know what is ahead and behind the vehicle.</li> <li>Use a backer if available.</li> </ul>	M
	3f) Sick or medicated	Sick or medicated: <ul style="list-style-type: none"> <li>Let others on the crew know you do not feel well.</li> <li>Let someone else drive.</li> </ul>	M
	3g) On wet or slimy roads	On wet or slimy roads <ul style="list-style-type: none"> <li>Drive slow and safe, wear seatbelts.</li> <li>Watch out for unstable/soft shoulders of roadway.</li> </ul>	M
	3h) Animals on road	Animals on road <ul style="list-style-type: none"> <li>Drive slowly, watch for other animals nearby.</li> <li>Be alert for animals darting out of wooded areas</li> </ul>	M
4. Gain permission to enter site	4a) Hostile landowner, livestock, pets	Hostile landowner, livestock, pets <ul style="list-style-type: none"> <li>Talk to land owner, be courteous and diplomatic</li> <li>Ensure all animals have been secured away from work area</li> </ul>	M
5. Mobilization/ Demobilization of Equipment and Supplies	5a) Struck by Heavy Equipment/Vehicles	Struck by heavy equipment: <ul style="list-style-type: none"> <li>Be aware of heavy equipment operations.</li> <li>Keep out of the swing radius of heavy equipment.</li> <li>Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times</li> <li>Employees shall wear a high visibility vest or T-shirt (reflective vest required if working at night).</li> <li>Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone.</li> <li>Ground personnel will not stand directly behind heavy equipment when it is in operation.</li> </ul>	M

# AHA - Mobilization/Demobilization and Site Preparation



Job Steps	Hazards	Controls	RAC
	5b) Struck by Equipment/Supplies	Struck by Equipment/Supplies: <ul style="list-style-type: none"> <li>Workers will maintain proper space around their work area, if someone enters it, stop work.</li> <li>When entering another worker's work space, give a verbal warning so they know you are there.</li> </ul>	M
	5c) Overexertion Unloading/Loading Supplies	Overexertion Unloading/Loading Supplies: <ul style="list-style-type: none"> <li>Train workers on proper body mechanics, do not bend or twist at the waist while exerting force or lifting.</li> <li>Tightly secure all loads to the truck bed to avoid load shifting while in transit.</li> </ul>	M
	5d) Overexertion Unloading/Loading Supplies	Caught in/on/between: <ul style="list-style-type: none"> <li>Do not place yourself between two vehicles or between a vehicle and a fixed object.</li> </ul>	M
	5e) Slip/Trip/Fall	Slip/Trip/Fall: <ul style="list-style-type: none"> <li>Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas.</li> <li>Drivers will maintain 3 point contact when mounting/dismounting vehicles/equipment.</li> <li>Drivers will check surface before stepping, not jumping down.</li> </ul>	M
	5f) Vehicle accident	Vehicle accident: <ul style="list-style-type: none"> <li>Employees should follow AMEC Foster Wheeler vehicle operation policy and be aware of all stationary and mobile vehicles.</li> </ul>	M
	5g) Contact with overhead powerlines.	<ul style="list-style-type: none"> <li>Observe and stay clear (minimum of 10 feet for nominal system voltage, utility lines, rated 50kV, minimum of 15 feet for nominal voltage rated 50 to 200 kV, and an additional 5 feet for each 1-150kV over 200kV) of overhead utility lines. Stay minimum of 20 feet away from distribution lines of undetermined voltage and stay 50 feet away from transmission lines of undetermined voltage.</li> <li>A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means.</li> <li>Avoid storing materials under or near overhead power lines.</li> <li>Workers should stay back at least 20 feet from equipment operating near overhead distribution power lines due to ground potential.</li> </ul>	H
6. Site Preparation	6a) Slip/Trip/Fall	Slip/Trip/Fall: <ul style="list-style-type: none"> <li>Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas</li> </ul>	M

# AHA - Mobilization/Demobilization and Site Preparation



Job Steps	Hazards	Controls	RAC
7. Installation of soil erosion and sediment controls	7a) Overexertion	Overexertion: <ul style="list-style-type: none"> <li>Workers will be trained in the proper method of placing erosion controls.</li> <li>Do not bend and twist at the waist while lifting or exerting force.</li> </ul>	M
	7b) Struck by Equipment/Supplies	Struck by Equipment/Supplies: <ul style="list-style-type: none"> <li>Workers will maintain proper space around their work area, if someone enters it, stop work.</li> <li>When entering another worker's work space, give a verbal warning so they know you are there.</li> </ul>	M
8. Driving back from the jobsite	8) See hazards listed under item #3	See safe work practices under item #3	M

<p><b>Competent / Qualified Personnel:</b> All AMEC Foster Wheeler employees with 40 hour training</p> <p><b>Training requirements:</b> Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting SSO must take and successfully pass AFW training course <a href="#">Overhead Electrical Line Safety Awareness</a> prior to work on site.</p>	<p>Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service.</p> <p>Inspect power cord sets prior to use.</p> <p>Inspect all PPE prior to use</p>
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# AHA - Soil Excavation and Sampling

Activity/Work Task:	Soil Excavation and Sampling	Overall Risk Assessment Code (RAC) (Use highest code)	<b>M</b>				
Project Location:	RTBC Boone, SC	<b>Risk Assessment Code (RAC) Matrix</b>					
Project Number:	6251161020	<b>Severity</b>	<b>Probability</b>				
Date Prepared:	7/1/2016		Date Accepted:	8/9/2016			
Prepared by (Name/Title):	Mark Wescott/ Technical Professional 2	Catastrophic	Frequent	Likely	Occasional	Seldom	Unlikely
Reviewed by (Name/Title):	Lynne W. Clem/Senior Scientist <i>LWC</i>	Critical	E	E	H	H	M
		Marginal	E	H	H	M	L
		Negligible	H	M	M	L	L
			M	L	L	L	L
<p>This AHA involves the following:</p> <ul style="list-style-type: none"> <li>Establishing site specific measures soil sampling by hand (direct push or hand auger). For safety measures associated with drilling for soil sampling, also look at the drilling AHA</li> </ul> <p>This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.</p>		<p>Step 1: Review each “<b>Hazard</b>” with identified safety “<b>Controls</b>” and determine RAC (See above)</p> <p>“<b>Probability</b>” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.</p> <p>“<b>Severity</b>” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible</p> <p>Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA.</p>		<p><b>RAC Chart</b></p> <p><b>E = Extremely High Risk</b></p> <p><b>H = High Risk</b></p> <p><b>M = Moderate Risk</b></p> <p><b>L = Low Risk</b></p>			

Job Steps	Hazards	Controls	RAC
1. Prepare for excavation and sampling event	1A) Chemical exposure	1A) Chemical Exposure <ul style="list-style-type: none"> <li>Read HASP and determine air monitoring and PPE needs.</li> </ul>	<b>L</b>
2. Carrying equipment to site location	2A) Back or muscle strain	2A) Back or muscle strain <ul style="list-style-type: none"> <li>Use proper lifting techniques when lifting pumps or generators</li> <li>Use mechanical aids if available</li> <li>Use 2 person lift for heavy items</li> </ul>	<b>M</b>
3. Calibrate monitoring equipment	3A) Exposure to calibration gases	3A) Exposure to calibration gases <ul style="list-style-type: none"> <li>Review equipment manuals</li> <li>Calibrate in a clean, well ventilated area</li> </ul>	<b>L</b>
4. Preparing excavation and sampling location	4A) Contact with poisonous plants or the oil from poisonous plants	4A) Contact with poisonous plants or the oil from those plants: <ul style="list-style-type: none"> <li>Look for signs of poisonous plants and avoid.</li> <li>Wear PPE as described in the HASP.</li> <li>Do not touch any part of your body/clothing.</li> <li>Always wash gloves before removing them.</li> <li>Discard PPE in accordance with the HASP.</li> </ul>	<b>L</b>

# AHA - Soil Excavation and Sampling

Job Steps	Hazards	Controls	RAC
	4B) Contact with biting insects (i.e., spiders, bees, etc.)	4B) Contact with stinging/biting insects <ul style="list-style-type: none"> <li>▪ Discuss the types of insects expected at the Site and be able to identify them.</li> <li>▪ Look for signs of insects in and around the well.</li> <li>▪ Wear Level of PPE as described in the HASP. At a minimum, follow guidelines in the AHA "Insects Stings and Bites."</li> <li>▪ If necessary, wear protective netting over your head/face.</li> <li>▪ Avoid contact with the insects if possible.</li> <li>▪ Inform your supervisor and the Site Health and Safety Supervisor if you have any allergies to insects and insect bites. Make sure you have identification of your allergies with you at all times and appropriate response kits if applicable.</li> <li>▪ Get medical help immediately if you are bitten by a black widow or brown recluse, or if you have a severe reaction to any spider bite or bee sting.</li> </ul>	<b>L</b>
	4C) Exposure to hazardous Inhalation and contact with hazardous substances (benzo[a]pyrene and manganese contaminated soil).	4C) Exposure to hazardous substances <ul style="list-style-type: none"> <li>▪ Wear PPE as identified in HASP.</li> <li>▪ Review hazardous properties of site contaminants with workers before sampling operations begin</li> <li>▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present.</li> <li>▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.</li> </ul>	<b>L</b>
	4D) Back strain due to lifting or moving equipment to excavation and sampling location	4D) Back strain <ul style="list-style-type: none"> <li>▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items.</li> <li>▪ Use proper lifting techniques</li> </ul>	<b>M</b>
	4E) Foot injuries from dropped equipment	4E) Foot Injuries <ul style="list-style-type: none"> <li>▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects.</li> <li>▪ Do not carry more than you can handle safely</li> <li>▪ Wear steel toed boots</li> </ul>	<b>M</b>
5. Excavation	5A) Heavy Equipment	5A) See Field Work - General	<b>L</b>
	5B) Slips/trips/falls	5B) Slips/trips/falls <ul style="list-style-type: none"> <li>▪ Ground can become wet/muddy</li> <li>▪ Wear good slip resistant footwear</li> <li>• Assure pathway and surrounding area is clear</li> </ul>	
	5C) Foot injuries from dropped equipment	5C) Foot Injuries <ul style="list-style-type: none"> <li>▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects.</li> <li>▪ Do not carry more than you can handle safely</li> <li>▪ Wear steel toed boots</li> </ul>	<b>L</b>

# AHA - Soil Excavation and Sampling



Job Steps	Hazards	Controls	RAC
	5D) Back strain due to lifting or moving equipment or soil from excavation	5D) Back strain <ul style="list-style-type: none"> <li>• Use proper lifting techniques</li> <li>• Use proper ergonomics when hand digging</li> <li>• Use mechanical aids, if available</li> <li>• Use two person lifts for heavy items.</li> </ul>	<b>M</b>
	5E) Encountering underground utilities	5E) Have all utilities located.	<b>M</b>
	5F) Exposure to contaminants	5F) Exposure to contaminants <ul style="list-style-type: none"> <li>• Stand up wind while digging, if possible</li> <li>• Monitor breathing zone with appropriate monitoring equipment (see HASP)</li> <li>• Wear chemical resistant PPE as identified in HASP</li> </ul>	<b>L</b>
	5G) Eye Injury	5G) Eye Injury <ul style="list-style-type: none"> <li>• Wear eye protection when using picks or similar devices to loosen soil</li> </ul>	<b>L</b>
	5H) Slips/trip/falls	5H) Slips/trips/falls <ul style="list-style-type: none"> <li>• Ground can become wet/muddy</li> <li>• Wear good slip resistant footwear</li> <li>• Assure pathway and surrounding area is clear</li> </ul>	<b>L</b>
	5I) Electrocutation	5I) Electrocutation <ul style="list-style-type: none"> <li>▪ A ground fault circuit interrupter (GFCI) device must protect all AC electrical circuits.</li> <li>▪ Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off.</li> <li>▪ Make sure that the electrical cords from generators and power tools are not allowed to be in contact with water</li> <li>▪ Do not stand in wet areas while operating power equipment</li> <li>▪ Always make sure all electrically-powered sampling equipment is in good repair. Report any problems so the equipment can be repaired or replaced.</li> <li>▪ When unplugging a cord, pull on the plug rather than the cord.</li> <li>▪ Never do repairs on electrical equipment unless you are both authorized and qualified to do so.</li> </ul>	<b>L</b>
6. Collecting soil samples	6A) Encountering underground or overhead utilities	6A) Have all utilities located. <ul style="list-style-type: none"> <li>• Observe and stay clear (minimum of 10 feet for nominal system voltage, utility lines, rated 50kV, minimum of 15 feet for nominal voltage rated 50 to 200 kV, and an additional 5 feet for each 1-150kV over 200kV) of overhead utility lines. Stay minimum of 20 feet away from distribution lines of undetermined voltage and stay 50 feet away from transmission lines of undetermined voltage.</li> <li>• A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means.</li> <li>• Avoid storing materials under or near overhead power lines.</li> <li>• Workers should stay back at least 20 feet from equipment operating near overhead distribution power lines due to ground potential.</li> </ul>	<b>L</b>

## AHA - Soil Excavation and Sampling

Job Steps	Hazards	Controls	RAC
	6B) Electrocution	6B) Electrocution <ul style="list-style-type: none"> <li>▪ A ground fault circuit interrupter (GFCI) device must protect all AC electrical circuits.</li> <li>▪ Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off.</li> <li>▪ Make sure that the electrical cords from generators and power tools are not allowed to be in contact with water</li> <li>▪ Do not stand in wet areas while operating power equipment</li> <li>▪ Always make sure all electrically-powered sampling equipment is in good repair. Report any problems so the equipment can be repaired or replaced.</li> <li>▪ When unplugging a cord, pull on the plug rather than the cord.</li> <li>▪ Never do repairs on electrical equipment unless you are both authorized and qualified to do so.</li> </ul>	<b>L</b>
	6C) Exposure to contaminants	6C) Exposure to Contaminants <ul style="list-style-type: none"> <li>▪ Stand up wind when sampling</li> <li>▪ Monitor breathing zone with appropriate monitoring equipment (see HASP)</li> <li>▪ Wear chemical resistant PPE as identified in HASP</li> <li>▪ See section 4C) under Safe Practices above</li> </ul>	<b>L</b>
	6D) Exposure to preservatives	6D) Exposure to preservatives <ul style="list-style-type: none"> <li>▪ Work in a well ventilated area, upwind of samples</li> <li>▪ Wear chemical resistant PPE as identified in HASP</li> <li>▪ Review SDSs/MSDSs</li> </ul>	<b>L</b>
	6E) Slips/trips/falls	6E) Slips/trips/falls <ul style="list-style-type: none"> <li>▪ Ground can become wet/muddy</li> <li>▪ Wear good slip resistant footwear</li> <li>▪ Assure pathway and surrounding area is clear</li> </ul>	<b>L</b>
	6F) Lifting Injury	6F) Lifting injury <ul style="list-style-type: none"> <li>▪ Use proper lifting techniques when carrying quantities of samples</li> <li>▪ Use proper ergonomics when hand digging for samples</li> </ul>	<b>M</b>
	6G) Eye injury	6G) Eye Injury <ul style="list-style-type: none"> <li>▪ Wear eye protection when using picks or similar devices to loosen soil</li> </ul>	<b>L</b>
	6H) Fire	6H) Fire <ul style="list-style-type: none"> <li>▪ When using gas powered auger, maintain fire watch whenever fueling or otherwise handling gasoline</li> <li>▪ See AHA - Gasoline</li> </ul>	<b>L</b>

## AHA - Soil Excavation and Sampling

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
<p>PPE: Hard Hat, safety glasses, gloves, steel toe work boots, high visibility safety vest</p>	<p><b>Competent / Qualified Personnel:</b> All Greenville Amec Foster Wheeler Personnel</p> <p><b>Training requirements:</b> SSO must take and successfully pass AFW training course <a href="#">Overhead Electrical Line Safety Awareness</a> prior to work on site.</p> <p>Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting</p>	<p>Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service.</p> <p>Inspect all PPE prior to use</p>

# AHA - Utility Clearance



Activity/Work Task:	Utility Clearance and Survey	Overall Risk Assessment Code (RAC) (Use highest code)	<b>H</b>				
Project Location:	Boone, NC	<b>Risk Assessment Code (RAC) Matrix</b>					
Project Number:	6251121001	<b>Severity</b>	<b>Probability</b>				
Date Prepared:	7/27/2015      Date Accepted:		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title):	Timothy Renn/Senior Professional I	Catastrophic	E	E	H	H	M
Reviewed by (Name/Title):	Chris Bruce/Senior Professional II <i>CKB 7/27/15</i>	Critical	E	H	H	M	L
		Marginal	H	M	M	L	L
		Negligible	M	L	L	L	L
<p>This AHA involves the following:</p> <ul style="list-style-type: none"> <li>Establishing site specific measures for the locating of utilities before drilling, excavating, or other intrusive activities</li> </ul> <p>This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.</p>		<p>Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)</p> <p>"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.</p> <p>"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible</p> <p>Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.</p>					<p><b>RAC Chart</b></p> <p style="background-color: #f4a460; padding: 2px;">E = Extremely High Risk</p> <p style="background-color: #f4a460; padding: 2px;">H = High Risk</p> <p style="background-color: #ffff00; padding: 2px;">M = Moderate Risk</p> <p style="background-color: #008000; padding: 2px;">L = Low Risk</p>

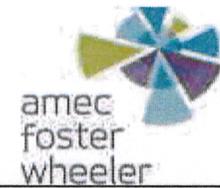
Job Steps	Hazards	Controls	RAC
1. Pre-planning	1a) Property Access <ul style="list-style-type: none"> <li>▪ Animal bites</li> <li>▪ Dangerous social areas/violent neighborhoods</li> <li>▪ Lost</li> <li>▪ Electrocutation</li> </ul>	Ensure communications with the property owner. Request pets and animals to be confined during the survey: <ul style="list-style-type: none"> <li>▪ Maintain communications via two way radios or cell phones.</li> <li>▪ Learn animal posturing including how to identify rabid animals.</li> <li>▪ Contract security as appropriate for safety and equipment theft.</li> <li>▪ Be prepared with a map and compass as necessary.</li> <li>▪ Be aware of overhead and underground utilities. Ensure Dig-Safe has been contacted.</li> </ul> When working with electrical equipment avoid wet surfaces and exposed connections.	<b>L</b>

# AHA - Utility Clearance



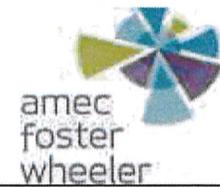
Job Steps	Hazards	Controls	RAC
	<p>1b) Utilities Not Cleared (damage to utilities, worker injury)</p>	<p>Utilities Not Cleared:</p> <ul style="list-style-type: none"> <li>▪ Provide sufficient time and budget to ensure that utilities have been adequately located, prior to the start of up of work.</li> <li>▪ Contact One Call Utility identifier organization at least 6 days prior to the project start date.</li> <li>▪ Cite or have subcontractor cite a start date of at least 3 working days prior to actual planned start date (provides window to inspect locations prior to job start-up.</li> <li>▪ Verify via emails or phone that all utilities have visited the site and marked their respective utilities.</li> <li>▪ If subcontractor calls One Call organization, require them to forward all e-mail responses from member utilities as they receive them.</li> <li>▪ If verification cannot be done remotely, send worker to site to inspect ground for markings (cheaper to identify issues prior to mobilization to the site).</li> <li>▪ Document all phone communications with driller about utility clearance issues and requests (e-mail the conversation highlights or document in a field notebook – it becomes part of the file record)</li> <li>▪ Call any member utilities that have not responded indicating they have cleared or marked-out utilities. Place the call morning of ticket start date (e.g., 3 days prior to actual start date). Document the phone conversations in notes or e-mails to the file.</li> <li>▪ If town services (e.g., sanitary sewer, storm sewer, water) aren't listed as a One Call member, contact the town office to schedule mark-out, obtain copies of utility networks, and identify the appropriate town contacts.</li> <li>▪ If town maps have lateral connections to private lots marked and /or if we are drilling along road right-of way opposite developed properties, identify the locations of the lateral connections. This may mean contacting abutters and asking to look in basements for location of pipes. If possible do this during a site visit prior to field start. If not, it should occur during the first day of work so any issues can be identified and decisions made on the risk of proceeding.</li> </ul>	<p><b>H</b></p>

# AHA - Utility Clearance



Job Steps	Hazards	Controls	RAC
		<ul style="list-style-type: none"> <li>▪ Walk all planned locations with the subcontractor, prior to start of excavation/drilling to identify marked utilities and note any uncertainties. Field Lead should call PM and relay any issues. Document this inspection in the field book and note subcontractor's responses to any AMEC concerns.</li> </ul>	
	1c) Locating Utilities on Private Property	Locating Utilities on Private Property: <ul style="list-style-type: none"> <li>▪ Hire private utility locater company</li> <li>▪ Locate underground utilities by ground penetrating radar, electromagnetic, deep metal detector, pipe transmitter, vibracator, etc</li> <li>▪ Review locations with property owner, member of operations and maintenance.</li> <li>▪ Check as built drawings when available. Be aware possible drawing error or construction drawings may not be representative of actual locations.</li> <li>▪ Use field clues such as manhole covers, repaved areas, depressions, disturbed areas, signs and postings, etc. as indications of access to utilities or recently installed/moved utilities.</li> </ul>	<b>H</b>
	1d) Lack of Reliable Data on Utility Locations	Lack of Reliable Data on Utility Locations: <ul style="list-style-type: none"> <li>▪ If the surveys are not providing reliable data, plan to use non-destructive means to drill/excavate e.g., soil vacuum, water jet, air knife and/or hand tools.</li> <li>▪ Use caution and proper PPE when using hand tools (hand augers, posthole diggers, shovels, steel rods, etc.).</li> <li>▪ Involve the Project Manager, Technical Lead and/or Office Manager to make a decision to proceed or move the location</li> </ul>	<b>H</b>
	1e) Working Near Live Utilities	Working Near Live Utilities: <ul style="list-style-type: none"> <li>▪ If live utilities are known to be present near drilling/excavation location, if possible, move drilling/excavation to another location.</li> <li>▪ Lockout/Tagout utilities, if possible.</li> <li>▪ Use non-destructive means to drill/excavate (see # 1D) until safe to proceed.</li> </ul>	<b>H</b>
2. Walking Around Site	2a) Slips/Trips/Falls	Slips/Trips/Falls	<b>L</b>

# AHA - Utility Clearance



Job Steps	Hazards	Controls	RAC
Identifying Utility Clearances.		<ul style="list-style-type: none"> <li>▪ Keep work area free of excess material and debris</li> <li>▪ Remove all trip hazards by keeping materials/objects organized and out of walkways</li> <li>▪ Keep work surfaces dry when possible</li> <li>▪ Wear appropriate PPE (see HASP) including non-slip rubber boots if working on wet or slick surfaces</li> <li>▪ Install rough work surface covers where possible</li> <li>▪ Stay aware of footing and do not run</li> </ul>	
	2b) Heat/Cold Stress	Heat/Cold Stress: <ul style="list-style-type: none"> <li>▪ Take breaks if feeling faint or overexerted</li> <li>▪ Consume adequate food/beverages (water, sports drinks)</li> <li>▪ If possible, adjust work schedule to avoid temperature extremes</li> </ul>	L
	2c) Biological Hazards: Insects, Snakes, Wildlife, Vegetation	Biological Hazards: Insects, Snakes, Wildlife, Vegetation <ul style="list-style-type: none"> <li>▪ Inspect work areas when arrive at site to identify hazard(s)</li> <li>▪ Use insect repellent if observe mosquitoes/gnats</li> <li>▪ Survey site for presence of biological hazards and maintain safe distance</li> <li>▪ Wear appropriate PPE including leather gloves, long sleeves and pants, and snake chaps as warranted by site conditions</li> </ul>	L
	2d) Traffic (including pedestrian)	Traffic (including pedestrian): <ul style="list-style-type: none"> <li>▪ Notify attendant or site owner/manager of work activities and location</li> <li>▪ Use cones, signs, flags or other traffic control devices</li> <li>▪ Wear appropriate PPE including high visibility clothing such as reflective vest</li> <li>▪ Inspect area behind vehicle prior to backing and use spotter</li> </ul>	M
	2e) Back strain due to lifting, pulling or tugging equipment	Back strain: <ul style="list-style-type: none"> <li>▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items.</li> <li>▪ Use proper lifting techniques</li> </ul>	L

## AHA - Utility Clearance



Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (Hard Hat, safety glasses, gloves, steel toe work boots, high visibility safety vest)	<p><b>Competent / Qualified Personnel:</b>                      Tim Renn – Engineer / AMEC                      Chris Bruce – Geologist / AMEC                      Ryan Adams – Engineer / AMEC</p> <p><b>Training requirements:</b>                      HAZWOPER 40-hr and 8-hr                      Site Specific HASP Orientation                      Toolbox safety meeting                      Task kick-off meeting</p>	<p>Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service.</p> <p>Inspect power cord sets prior to use.</p> <p>Inspect all PPE prior to use</p>

## **SAFETY DATA SHEETS**

# Safety Data Sheet

## Synergist D

### COMPANY & PRODUCT IDENTIFICATION

<b>Company Name</b>	EN Rx, Inc. PO Box 270586 Flower Mound, TX 75027
<b>Phone Number</b>	(832) 250-1700
<b>Effective Date</b>	September 5, 2006
<b>Trade Name</b>	Synergist D
<b>Components:</b>	Proprietary Blend

### HAZARD IDENTIFICATION

1	HMIS HEALTH
0	HMIS FLAMMABILITY
1	HMIS REACTIVITY
F	HMIS PERSONAL PROTECTION

### COMPOSITION

<b>Components:</b>	Acid	25 - 75%
	Salt	25 - 75%

### FIRST AID MEASURES

**First Aid:** Eye Contact - Immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.  
Skin Contact - Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse.  
Inhalation - Remove to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.  
Ingestion - Do not induce vomiting. Give large quantities of water. Call a physician. Never give anything by mouth to an unconscious person.

### FIRE FIGHTING MEASURES

**Flammable Properties:** Will not burn.  
**Fire and Explosion Hazards:** May release SO<sub>2</sub>, SO<sub>3</sub>, and NH<sub>3</sub> if involved in a fire.  
**Extinguishing Media:** As appropriate for combustibles in area.  
**Fire Fighting Instructions:** None

### ACCIDENTAL RELEASE MEASURES

**SAFEGUARDS (Personnel):** NOTE: Review FIRE FIGHTING MEASURES AND HANDLING (Personnel) sections before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.  
**Accidental Release:** Neutralize spills with lime or soda ash. Flush spill area with plenty of water.

# Safety Data Sheet

## Synergist D

### HANDLING AND STORAGE

**Handling (Personnel):** Avoid breathing dust. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling.

**Storage:** Keep in a well-ventilated area. Protect bulk storage area from sparks and flame. Keep packages tightly closed.

### EXPOSURE CONTROLS & PERSONAL PROTECTION

**Engineering Controls:** Respirator with dust filter if exposure limits may be exceeded.

**Personal Protective Equipment:** Chemical splash goggles and rubber gloves. Wear a butyl rubber acid suit and NIOSH permissible respiratory protection if there is a reasonable possibility for exposure.

**Exposure Guidelines (Exposure Limits):** Synergist  
PEL (OSHA) None established TLV (ACGIH) None Established

**Potential Health Effects:** This compound may cause burns and ulceration of the eyes, and is a severe skin irritant. Prolonged exposure may cause skin burns and ulceration. Inhalation may cause nose, throat, and lung irritation. Ingestion may cause burns and/or perforation of the gastrointestinal tract. Gross overexposure may result in death.

**Human Health Effects:** Eye contact may cause eye corrosion with corneal or conjunctival ulceration. Skin contact may cause skin irritation with discomfort or rash. Higher or prolonged skin irritation may cause burns or ulceration. Inhalation may cause irritation of the respiratory passages with cough, difficulty in breathing and bronchial irritation. Ingestion may cause irritation of the gastrointestinal tract with abdominal pain, nausea, vomiting, diarrhea, and abnormal kidney function. Ingestion may also cause corrosion of mucous membranes with stomach discomfort, nausea, and prostration. Individuals with preexisting diseases of the skin, kidneys, or reproductive system may have increased susceptibility to the toxicity of excessive exposure.

**Carcinogenicity Information:** None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

### PHYSICAL & CHEMICAL PROPERTIES

**Boiling Point:** 209°C **Sp. Gr.:** 2.126 g/cc at 26°C (79°F) **Sol. in Water:** Miscible **Form:** White Crystalline Solid

**Odor:** Slight **pH:** 1.18 @ 25°C (77°F)

### STABILITY & REACTIVITY

**Chemical Stability:** Stable **Decomposition:** Will not occur

**Polymerization:** Will not occur **Other Hazards:** Incompatibility: Hazardous reaction in aqueous solution may occur with chlorine, hypochlorous acid, hypochlorites, cyanides, nitric acid, or sulfides.

### TOXICOLOGICAL

**Animal Data:** Synergist  
Inhalation 4 hour LC50: 7.7 mg/L in rats  
Oral LD50: 4,240 mg/kg in rats

The compound is a skin and eye corrosive, but is not a skin sensitizer in animals. Toxic effects described in animals from a single exposure by inhalation include body weight losses, ocular and nasal discharges, and other nonspecific effects. Repeated inhalation exposures produced liver, spleen, and thymus changes, and gastrointestinal tract alterations. By ingestion, the administration of single high oral doses produced severe gastrointestinal tract irritation, liver damage, increased kidney weights, and the formation of dosing in cats produced weight and appetite loss, depression, vomiting, coma, convulsions,

## Safety Data Sheet

### Synergist D

kidney failure due to calcium oxalate deposition, and death. Dogs given similar and higher doses exhibited no toxic effects. Long-term dosing in male and female rats exhibited no toxic effects. At a high dietary level, a reduced number of offspring were observed in rats, but this effect occurred only at a maternally toxic dose. In a developmental toxicity study, fetal abnormalities were indicated in rats orally dosed during gestation with Synergist at levels that also produced maternal toxicity. The compound does not produce genetic damage in bacteria cell cultures.

#### ECOLOGICAL INFORMATION

**Ecotoxicological Information:** Aquatic Toxicity - Slight

24-48 hour LC50, bluegill sunfish: 93mg/L

96 hour LC50, fathead minnows: 164 mg/L

These data indicate that Synergist has slight aquatic toxicity.

Biodegradability - Readily biodegradable. After 7 days, 89.6% is biodegraded (closed bottle test).

#### DISPOSAL CONSIDERATIONS

**Waste Disposal:** Comply with Federal, State, local regulations. If approved, may be neutralized with lime or soda ash and flushed to wastewater treatment system. This material may be a RCRA hazardous waste due to its corrosive characteristic (pH).

#### TRANSPORTATION INFORMATION

**Shipping Information:** DOT/IMO

Proper Shipping name: Corrosive Solids, Acid

Class: 85

Hazard Class: 8

UN #: 3260

DOT/IMO: Corrosive Packing Group: III

NMFC# 43940-02 Shipping Containers: 50 and 400 lb Containers

#### FEDERAL REGULATORY INFORMATION

**U.S. Federal Regulations:** TSCA Inventory Status Reported/Included

Title III Hazardous Classifications sections 311, 312

Acute: Yes Chronic: No

Fire: No Reactivity: No

Pressure: No

LISTS: SARA Extremely Hazardous Substance - No

CERCLA Hazardous Substance: Yes (see disposal section)

SARA Toxic Chemical: No

CANADIAN WHMIS CLASSIFICATION: E

#### REGULATORY INFORMATION

**NFPA, NPCA-HMIS:** NPCA - Rating: Health 1; Flammability 0; Reactivity 1; Personal Protection F

**Additional Information:** Do not use this product in personal care applications due to the high level of impurities.

This product's health and safety information is provided to assist our customers in assessing compliance with Health, Safety and Environmental regulations. The information contained herein is based on data available to us, and is believed to be accurate, although no guarantee or warranty is provided or implied by the company in this respect. Since the use of this product is within the exclusive control of the user, it is the user's responsibility to determine the conditions of safe use. Such conditions must comply with all governmental regulations.

## Safety Data Sheet

### Synergist D

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**Prepared by:** Erik R. Piatt

**Revision Date:** May 26, 2015

This product's health and safety information is provided to assist our customers in assessing compliance with Health, Safety and Environmental regulations. The information contained herein is based on data available to us, and is believed to be accurate, although no guarantee or warranty is provided or implied by the company in this respect. Since the use of this product is within the exclusive control of the user, it is the user's responsibility to determine the conditions of safe use. Such conditions must comply with all governmental regulations.

## SAFETY DATA SHEET BENTONITE

Product Trade Name:

Revision Date: 15-Mar-2016

Revision Number: 38

### 1. Identification

#### 1.1. Product Identifier

Product Trade Name: BENTONITE  
Synonyms: None  
Chemical Family: Mineral  
Internal ID Code: HM000126

#### 1.2 Recommended use and restrictions on use

Application: Weight Additive  
Uses advised against: No information available

#### 1.3 Manufacturer's Name and Contact Details

##### Manufacturer/Supplier

Halliburton Energy Services, Inc.  
P.O. Box 1431  
Duncan, Oklahoma 73536-0431  
Emergency Telephone: (1-866-519-4752 (US, Canada, Mexico) or 1-760-476-3962

Halliburton Energy Services  
645 - 7th Ave SW Suite 2200  
Calgary, AB  
T2P 4G8  
Canada

Prepared By: Chemical Stewardship  
Telephone: 1-281-871-6107  
e-mail: fdunexchem@halliburton.com

#### 1.4. Emergency telephone number

Emergency Telephone Number: 1-866-519-4752 or 1-760-476-3962

### 2. Hazard(s) Identification

#### 2.1 Classification in accordance with paragraph (d) of §1910.1200

Carcinogenicity	Category 1A - H350
Specific Target Organ Toxicity - (Repeated Exposure)	Category 1 - H372

#### 2.2. Label Elements

Hazard pictograms



<b>Signal Word</b>	Danger
<b>Hazard Statements</b>	H350 - May cause cancer H372 - Causes damage to organs through prolonged or repeated exposure
<b>Precautionary Statements</b>	
<b>Prevention</b>	P201 - Obtain special instructions before use P202 - Do not handle until all safety precautions have been read and understood P260 - Do not breathe dust/fume/gas/mist/vapors/spray P264 - Wash face, hands and any exposed skin thoroughly after handling P270 - Do not eat, drink or smoke when using this product P280 - Wear protective gloves/protective clothing/eye protection/face protection
<b>Response</b>	P308 + P313 - IF exposed or concerned: Get medical advice/attention P314 - Get medical attention/advice if you feel unwell
<b>Storage</b>	P405 - Store locked up
<b>Disposal</b>	P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

**2.3 Hazards not otherwise classified**

None known

**3. Composition/information on Ingredients**

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Crystalline silica, quartz	14808-60-7	1 - 5%	Carc. 1A (H350) STOT RE 1 (H372)
Crystalline silica, cristobalite	14464-46-1	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)
Crystalline silica, tridymite	15468-32-3	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)

The exact percentage (concentration) of the composition has been withheld as proprietary.

**4. First-Aid Measures****4.1. Description of first aid measures**

<b>Inhalation</b>	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
<b>Eyes</b>	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
<b>Skin</b>	Wash with soap and water. Get medical attention if irritation persists.
<b>Ingestion</b>	Under normal conditions, first aid procedures are not required.

**4.2 Most important symptoms/effects, acute and delayed**

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

**4.3. Indication of any immediate medical attention and special treatment needed**

**Notes to Physician** Treat symptomatically.

**5. Fire-fighting measures****5.1. Extinguishing media**

**Suitable Extinguishing Media**

All standard fire fighting media

**Extinguishing media which must not be used for safety reasons**

None known.

**5.2 Specific hazards arising from the substance or mixture****Special exposure hazards in a fire**

None anticipated

**5.3 Special protective equipment and precautions for fire-fighters****Special protective equipment for firefighters**

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

**6. Accidental release measures****6.1. Personal precautions, protective equipment and emergency procedures**

Use appropriate protective equipment. Avoid creating and breathing dust.

See Section 8 for additional information

**6.2. Environmental precautions**

None known.

**6.3. Methods and material for containment and cleaning up**

Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

**7. Handling and storage****7.1. Precautions for safe handling****Handling Precautions**

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

**Hygiene Measures**

Handle in accordance with good industrial hygiene and safety practice.

**7.2. Conditions for safe storage, including any incompatibilities****Storage Information**

Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

**8. Exposure Controls/Personal Protection****8.1 Occupational Exposure Limits**

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Crystalline silica, quartz	14808-60-7	TWA: 10 mg/m <sup>3</sup> %SiO <sub>2</sub> + 2	TWA: 0.025 mg/m <sup>3</sup>
Crystalline silica, cristobalite	14464-46-1	TWA: 1/2 x 10 mg/m <sup>3</sup> %SiO <sub>2</sub> + 2	TWA: 0.025 mg/m <sup>3</sup>
Crystalline silica, tridymite	15468-32-3	TWA: 1/2 x 10 mg/m <sup>3</sup> %SiO <sub>2</sub> + 2	TWA: 0.05 mg/m <sup>3</sup>

**8.2 Appropriate engineering controls**

**Engineering Controls** Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

### **8.3 Individual protection measures, such as personal protective equipment**

**Personal Protective Equipment** If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

**Respiratory Protection** Wear a NIOSH certified, European Standard EN 149 (FFP2/FFP3), AS/NZS 1715, or equivalent respirator when using this product.

**Hand Protection** Normal work gloves.

**Skin Protection** Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

**Eye Protection** Wear safety glasses or goggles to protect against exposure.

**Other Precautions** None known.

## **9. Physical and Chemical Properties**

### **9.1. Information on basic physical and chemical properties**

<b>Physical State:</b> Solid	<b>Color</b>	Various
<b>Odor:</b> Odorless	<b>Odor</b>	No information available
	<b>Threshold:</b>	

<u>Property</u>	<u>Values</u>
<u>Remarks/ - Method</u>	
<b>pH:</b>	9.9
<b>Freezing Point / Range</b>	No data available
<b>Melting Point / Range</b>	No data available
<b>Boiling Point / Range</b>	No data available
<b>Flash Point</b>	No data available
<b>Flammability (solid, gas)</b>	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
<b>Evaporation rate</b>	No data available
<b>Vapor Pressure</b>	No data available
<b>Vapor Density</b>	No data available
<b>Specific Gravity</b>	2.65
<b>Water Solubility</b>	Insoluble in water
<b>Solubility in other solvents</b>	No data available
<b>Partition coefficient: n-octanol/water</b>	No data available
<b>Autoignition Temperature</b>	No data available
<b>Decomposition Temperature</b>	No data available
<b>Viscosity</b>	No data available
<b>Explosive Properties</b>	No information available
<b>Oxidizing Properties</b>	No information available

### **9.2. Other information**

<b>VOC Content (%)</b>	No data available
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## **10. Stability and Reactivity**

### **10.1. Reactivity**

Not expected to be reactive.

### **10.2. Chemical stability**

Stable

### **10.3. Possibility of hazardous reactions**

Will Not Occur

### **10.4. Conditions to avoid**

None anticipated

### **10.5. Incompatible materials**

Hydrofluoric acid.

### **10.6. Hazardous decomposition products**

Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

## **11. Toxicological Information**

### **11.1 Information on likely routes of exposure**

**Principle Route of Exposure** Eye or skin contact, inhalation.

### **11.2 Symptoms related to the physical, chemical and toxicological characteristics**

#### **Acute Toxicity**

##### **Inhalation**

Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).

##### **Eye Contact**

May cause mechanical irritation to eye.

##### **Skin Contact**

None known.

##### **Ingestion**

None known.

#### **Chronic Effects/Carcinogenicity**

**Silicosis:** Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

**Cancer Status:** The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2). There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other

internal organs) and kidney disease.

### 11.3 Toxicity data

#### Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Crystalline silica, quartz	14808-60-7	> 15000 mg/kg (human)	No information available	No data available
Crystalline silica, cristobalite	14464-46-1	>15,000 mg/kg (Human)	No data available	No data available
Crystalline silica, tridymite	15468-32-3	>15,000 mg/kg (Human)	No data available	No data available

Substances	CAS Number	Skin corrosion/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin
Crystalline silica, cristobalite	14464-46-1	Non-irritating to the skin
Crystalline silica, tridymite	15468-32-3	Non-irritating to the skin

Substances	CAS Number	Serious eye damage/irritation
Crystalline silica, quartz	14808-60-7	Mechanical irritation of the eyes is possible. No information available
Crystalline silica, cristobalite	14464-46-1	Mechanical irritation of the eyes is possible.
Crystalline silica, tridymite	15468-32-3	Mechanical irritation of the eyes is possible.

Substances	CAS Number	Skin Sensitization
Crystalline silica, quartz	14808-60-7	No information available.
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	Respiratory Sensitization
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	Mutagenic Effects
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.
Crystalline silica, cristobalite	14464-46-1	Not regarded as mutagenic.
Crystalline silica, tridymite	15468-32-3	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
Crystalline silica, quartz	14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, cristobalite	14464-46-1	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, tridymite	15468-32-3	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.

Substances	CAS Number	Reproductive toxicity
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	STOT - single exposure
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, cristobalite	14464-46-1	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, tridymite	15468-32-3	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, cristobalite	14464-46-1	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, tridymite	15468-32-3	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Crystalline silica, quartz	14808-60-7	Not applicable
Crystalline silica, cristobalite	14464-46-1	Not applicable
Crystalline silica, tridymite	15468-32-3	Not applicable

## 12. Ecological Information

### 12.1. Toxicity

#### Ecotoxicity effects

Product is not classified as hazardous to the environment.

#### Product Ecotoxicity Data

No data available

#### Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Crystalline silica, quartz	14808-60-7	EC50 (72 h) =440 mg/L (Selenastrum capricornutum)	LL0 (96 h) =10000 mg/L (Danio rerio)	No information available	LL50 (24 h) >10000 mg/L (Daphnia magna)
Crystalline silica, cristobalite	14464-46-1	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, tridymite	15468-32-3	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)

### 12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, cristobalite	14464-46-1	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, tridymite	15468-32-3	The methods for determining biodegradability are not applicable to inorganic substances.

### 12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

### 12.4. Mobility in soil

Substances	CAS Number	Mobility
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

### 12.5 Other adverse effects

No information available

## 13. Disposal Considerations

**13.1. Waste treatment methods****Disposal methods**

Bury in a licensed landfill according to federal, state, and local regulations. Substance should NOT be deposited into a sewage facility.

**Contaminated Packaging**

Follow all applicable national or local regulations. Contaminated packaging may be disposed of by: rendering packaging incapable of containing any substance, or treating packaging to remove residual contents, or treating packaging to make sure the residual contents are no longer hazardous, or by disposing of packaging into commercial waste collection.

**14. Transport Information****US DOT**

**UN Number** Not restricted  
**UN proper shipping name** Not restricted  
**Transport Hazard Class(es)** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards** Not applicable

**Canadian TDG**

**UN Number** Not restricted  
**UN proper shipping name** Not restricted  
**Transport Hazard Class(es)** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards** Not applicable

**IMDG/IMO**

**UN Number** Not restricted  
**UN proper shipping name** Not restricted  
**Transport Hazard Class(es)** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards** Not applicable

**IATA/ICAO**

**UN Number** Not restricted  
**UN proper shipping name** Not restricted  
**Transport Hazard Class(es)** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards** Not applicable

**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code** Not applicable

**Special Precautions for User** None

**15. Regulatory Information****US Regulations****US TSCA Inventory**

All components listed on inventory or are exempt.

**TSCA Significant New Use Rules - S5A2**

Substances	CAS Number	TSCA Significant New Use Rules - S5A2
Crystalline silica, quartz	14808-60-7	Not applicable
Crystalline silica, cristobalite	14464-46-1	Not applicable
Crystalline silica, tridymite	15468-32-3	Not applicable

**EPA SARA Title III Extremely Hazardous Substances**

Substances	CAS Number	EPA SARA Title III Extremely Hazardous
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		Substances
Crystalline silica, quartz	14808-60-7	Not applicable
Crystalline silica, cristobalite	14464-46-1	Not applicable
Crystalline silica, tridymite	15468-32-3	Not applicable

**EPA SARA (311,312) Hazard Class**

Chronic Health Hazard

**EPA SARA (313) Chemicals**

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Crystalline silica, quartz	14808-60-7	Not applicable	Not applicable
Crystalline silica, cristobalite	14464-46-1	Not applicable	Not applicable
Crystalline silica, tridymite	15468-32-3	Not applicable	Not applicable

**EPA CERCLA/Superfund Reportable Spill Quantity**

Substances	CAS Number	CERCLA RQ
Crystalline silica, quartz	14808-60-7	Not applicable
Crystalline silica, cristobalite	14464-46-1	Not applicable
Crystalline silica, tridymite	15468-32-3	Not applicable

**EPA RCRA Hazardous Waste Classification**

If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.

**California Proposition 65** The California Proposition 65 regulations apply to this product.**MA Right-to-Know Law** One or more components listed.**NJ Right-to-Know Law** One or more components listed.**PA Right-to-Know Law** One or more components listed.**NFPA Ratings:** Health 0, Flammability 0, Reactivity 0**HMIS Ratings:** Health 0\*, Flammability 0, Physical Hazard 0, PPE: E**Canadian Regulations****Canadian Domestic Substances List (DSL)** All components listed on inventory or are exempt.**16. Other information****Preparation Information**

**Prepared By** Chemical Stewardship  
 Telephone: 1-281-871-6107  
 e-mail: fdunexchem@halliburton.com

**Revision Date:** 15-Mar-2016**Reason for Revision** SDS sections updated:  
2**Additional information**

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

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**Key or legend to abbreviations and acronyms used in the safety data sheet**

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

ErC50 – Effective Concentration growth rate 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NIOSH – National Institute for Occupational Safety and Health

NTP – National Toxicology Program

OEL – Occupational Exposure Limit

PEL – Permissible Exposure Limit

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

UN – United Nations

h - hour

mg/m<sup>3</sup> - milligram/cubic meter

mm - millimeter

mmHg - millimeter mercury

w/w - weight/weight

d - day

**Key literature references and sources for data**

[www.ChemADVISOR.com/](http://www.ChemADVISOR.com/)

NZ CCID

**Disclaimer Statement**

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

**End of Safety Data Sheet**

# Safety Data Sheet

Hydrochloric Acid 10%

Revision Date: 6/15/15

## 1. PRODUCT AND COMPANY IDENTIFICATION

**Product name:** Hydrochloric Acid, 10%  
**Product code:** 400501

**Supplier:** HealthLink, Inc  
3611 St Johns Bluff Road, Suite 1  
Jacksonville, FL 32224  
800-638-2625  
Monday-Friday: 8:00 -5:00 PM

**Synonym:** None.  
**Material uses:** Laboratory Reagent.  
**Validation date:** 1/15/2015  
**In case of emergency:** 800-424-9300 CHEMTREC (USA)  
24 Hours/Day: 7 Days/Week

## 2. HAZARDS IDENTIFICATION

### GHS Classification

Skin Corrosion (Category 1A), H314  
Serious Eye Damage (Category 1), H318

H314 Cause severe skin and eye damage  
H318 Causes serious eye damage

### GHS Label Elements



### Pictogram

Signal Word                      Danger!

### Health Statement(s):

**H318:** Causes serious eye damage (Cat 1)  
**H314:** Causes severe skin burns and eye damage (Cat 1)  
**H370:** Causes damage to organs (Cat 1)  
**H305:** May be harmful if swallowed and enters airways (Cat 2)

### Precautionary statement(s):

**P280:** Wear protective gloves/ eye protection/ face protection.  
**P305+351+338:** If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

### Potential Acute Health Effects:

Very hazardous in case of contact with eye, skin, ingestion and inhalation. Liquid or spray mist may produce tissue damage especially mucous membranes of eyes, mouth and respiratory tract. Will burn eyes and skin on contact. Respiratory track characterized by coughing, choking and shortness of breath. Inflammation of eyes results in redness, watering and itching. Skin contact results in scaling, redness or blistering.

**Potential Chronic Health Effects:**

Carcinogenic Effects, NA; Mutagenic Effects, NA; Teratogenic Effects, NA; Developmental Toxicity, NA. May be toxic to kidneys, liver, mucous membranes, respiratory tract, skin and teeth.

**Target Organs**

Respiratory Tract

**NFPA Rating**

Health hazard: 3

Fire: 0

Reactivity Hazard: 1

**HMIS Classification**

Health hazard: 3

Flammability: 0

Physical hazards: 1

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

Name	CAS number	% by volume
Hydrochloric Acid	7647-01-0	~ 10
Water	7732-18-5	~ 90

**4. FIRST AID MEASURES**

- Eye contact:** Check for and remove any contact lenses. Immediately flush eyes with water for 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact:** Flush skin with water for 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
- Inhalation:** Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion:** Call medical doctor or poison control center immediately. Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

**5. FIRE-FIGHTING MEASURES**

**Flammability of the product:** Non-Flammable

**Extinguishing media:** Use suitable media for surrounding materials. If water use fog spray, avoid direct stream.

**Special exposure hazards:** Avoid contact with metal, hydrogen chloride gas can react with aluminum, tin, lead, zinc

**Decomposition products:** Decomposition products: hydrogen gas, hydrogen chloride gas

**Special protective**

**equipment for fire-fighters:** Use self-contained breathing apparatus with water spray.

**Explosion hazards:** hydrogen gas can form in fire situation which is flammable.

**6. ACCIDENTAL RELEASE MEASURES**

**Personal precautions:** Keep unnecessary and unprotected personnel from entering area. Avoid breathing vapors. Provide adequate ventilation. Do not touch or walk through spilled material. Beware of vapors accumulating to form explosive hydrogen gas mixtures. Full personal safety equipment (suit gloves, respirator, face shield) required.

**Environmental precautions:** Avoid dispersal of spilled material, runoff and contact with soil, waterways, drains and sewers. Contain spill area.

**Spill:** Corrosive liquid! Ventilate area. Prevent runoff. Contain and collect spillage with absorbent material e.g. sand, earth, vermiculite etc and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Dilute

with water and mop-up or absorb with an inert dry material and place in an appropriate waste disposal container. Avoid contact with strong oxidizers.

## 7. HANDLING AND STORAGE

- Handling:** Avoid breathing vapors or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Store in ventilated areas.
- Storage:** Store in a well-ventilated, cool area for corrosive liquids. Keep container tightly closed and sealed until ready for use.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### Exposure limits: For Concentrated Hydrochloric Acid

**ACGIH TLV:** TWA, 5 ppm, STEL1ppm

**OSHA PEL:** TWA: 5 ppm, STEL1ppm

**NIOSH REL:** TWA: 5 ppm ,STEL1ppm

**Carcinogenicity:** NA

**Engineering measures:** Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne concentrations below any recommended threshold limits. Full safety shower should be in close proximity to working area.

**Hygiene measures:** Wash hands, forearms and face thoroughly after handling chemical products, before eating and using the lavatory. Wash contaminated clothing before reusing.

### Personal protection

**Respiratory:** If used in poorly ventilated areas, use a properly fitted, air-purifying or air-fed respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels.

**Hands:** Chemical-resistant neoprene gloves

**Eyes:** Safety eyewear; splash goggles, face shield

**Skin:** Lab coats for personal protective equipment and should be approved by a specialist before handling this product. Depending on volume/conditions a full acid suit may be necessary.

### Environmental exposure

**controls:** Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

<b>Physical state:</b>	Liquid.	<b>Color:</b>	Clear, slight yellow tint
<b>Flash Point:</b>	NA	<b>Odor:</b>	Pungent, strong, chlorine
<b>pH:</b>	~1	<b>Boiling/condensation point:</b>	NA
<b>Melting/freezing point:</b>	NA	<b>Relative density:</b>	~1.09
<b>Vapor pressure:</b>	160mm Hg@20°C	<b>Vapor density: Air=1</b>	1.267
<b>Odor threshold:</b>	NA	<b>Evaporation rate: BuAc=1</b>	2.0
<b>VOC:</b>	NA		
<b>Solubility:</b>	Soluble in the following materials: water		

## 10. STABILITY AND REACTIVITY

**Chemical stability:** The product is stable under normal conditions.

**Possibility of hazardous** Very Corrosive

**reactions:** Under normal conditions of storage and use, hazardous reactions will not occur.

**Hazardous polymerization:** Under normal conditions of storage and use, hazardous polymerization will not occur.  
**Conditions to avoid:** Reaction with water is exothermic  
**Materials to avoid:** Reactive or incompatible with: oxidizing materials, metals and alkaline materials  
**Hazardous decomposition products:** Under normal conditions of storage and use, hazardous decomposition products should not occur. Explosive hydrogen chloride/gas may form if decomposition occurs.

## 11. TOXICOLOGICAL INFORMATION

### Acute toxicity

Oral LD50-Rabbit 900mg/kg

Inhalation LC50, Mouse 1hr - 1108ppm; Rat 1hr, 3124ppm

### Other information on acute toxicity

no data available

### Skin corrosion/irritation

Corrosive through skin absorption

### Serious eye damage/eye irritation

Eyes: very corrosive

### Respiratory or skin sensitization

Dryness, reddening, blistering

### Germ cell mutagenicity

no data available

### Specific target organ toxicity - single exposure (Globally Harmonized System)

Liver, respiratory/gastro tract, eyes and skin

### Specific target organ toxicity - repeated exposure (Globally Harmonized System)

Liver, respiratory/gastro tract, eyes, skin and general overall organs

### Aspiration hazard

Will burn mouth, throat and respiratory tract

### Potential health effects

**Inhalation** May be toxic if inhaled. Causes respiratory tract inflammation/burns.

**Ingestion** May be toxic if swallowed and causes burns/tissue destruction.

**Skin** Toxic if absorbed through skin. Causes skin irritation/blisters.

**Eyes** Will burn eyes on contact.

### Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

## 12. ECOLOGICAL INFORMATION

### Toxicity

LC50, fish 282mg/L 96 hr

### Persistence and degradability

Expected to be biodegradable

### Bioaccumulative potential

no data available

### Mobility in soil

Product absorbs weakly to most soil types

### PBT and vPvB assessment

no data available

### Other adverse effects

no data available

## 13. DISPOSAL CONSIDERATIONS

The information presented only applies to the material as supplied. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and

disposal methods in compliance with applicable regulations. Disposal should be in accordance with applicable regional, national and local laws and regulations.

## 14. TRANSPORT INFORMATION

**DOT (US)** UN 1789, Hydrochloric acid, 8, II

**IMDG** UN 2789, UN 1789, Hydrochloric acid, 8, II

**IATA** UN 2789, UN 1789, Hydrochloric acid, 8, II

## 15. REGULATORY INFORMATION

**TSCA 8 (b):** Listed on inventory

**SARA 302/311/312/313/:** Extremely hazardous material; RQ5000lbs, TPQ500lbs gas

**OSHA** Hazardous by definition (29CFR 1910.1200)

**EINECS:** This product is on the European Inventory of Existing Commercial Chemical Substances

**WHMIS (Canada):** Class D-2A Material causing other toxic effects; Class E: Corrosive liquid

**DEA List I Chemicals**

**Precursor Chemicals):** Not listed

**DEA List II Chemicals**

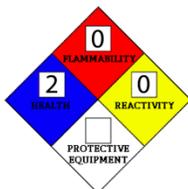
**Essential Chemicals):**

**RTK:** Hydrochloric Acid Concentrated, CAS 7647-01-0, Listed, CA, CT, FL, MA, MN, NJ, PA, RI

**California Prop 65 Components:** No components listed for causing cancer, birth defects or any reproductive harm.

## 16. OTHER INFORMATION

**National Fire Protection Association (U.S.A.)**



### Notice to reader

The above information is believed to be correct but does not purport to be all-inclusive and shall be used only as a guide. Healthlink shall not be liable for any damage resulting from handling of contact with this product.

# MATERIAL SAFETY DATA SHEET

## Hydrogen Peroxide (40 to 60%)



MSDS Ref. No.: 7722-84-1-4

Date Approved: 04/27/2006

Revision No.: 10

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This document has been prepared to meet the requirements of the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200; the Canada's Workplace Hazardous Materials Information System (WHMIS) and, the EC Directive, 2001/58/EC.

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## 1. PRODUCT AND COMPANY IDENTIFICATION

- PRODUCT NAME:** Hydrogen Peroxide (40 to 60%)
- ALTERNATE PRODUCT NAME(S):** Durox® Reg. & LR 50%, Oxypure® 50%, Hi Ox-TG, Hi Ox-SG, Semiconductor Reg & Seg 50%, Standard 50%, Technical 50%, Chlorate Grade 50%, Super D® 50%, OHP 50%, UP-HTP 50%, HTP 50%, HTP 59%
- GENERAL USE:**
- Durox® 50% Reg. and LR - meets the Food Chemical Codex requirements for aseptic packaging and other food related applications.
  - Oxypure® 50%, Hi Ox-TG and Hi Ox-SG - certified by NSF to meet NSF/ANSI Standard 60 requirements for drinking water treatment.
  - Semiconductor Reg. & Seg. 50% - conforms to ACS and Semi Specs., for wafer etching and cleaning, and applications requiring low residues.
  - Standard 50% - most suitable for industrial bleaching, processing, pollution abatement and general oxidation reactions.
  - Technical 50% - essentially free of inorganic metals, suitable for chemical synthesis.
  - Chlorate Grade 50% - specially formulated for use in chlorate manufacture or processing.
  - Super D® 50% - meets US Pharmacopoeia specifications for 3% topical solutions when diluted with proper quality water. While manufactured to the USP standards or purity and to FMC's demanding ISO 9002 quality standards, FMC does not claim that its Hydrogen Peroxide is manufactured in accordance with all pharmaceutical cGMP conditions.
  - OHP 50% - specially formulated for OHP process, advanced oxidation, and activated peroxide applications.
  - UP-HTP 50% - unstabilized product for semi-conductor applications.

HTP 50% and HTP 59% - specially formulated for aerospace or other special applications.

SynergOx™ - combination of a proprietary catalyst and 50% hydrogen peroxide, at the point of use, for environmental applications.

## MANUFACTURER

FMC CORPORATION  
FMC Peroxygens  
1735 Market Street  
Philadelphia, PA 19103  
(215) 299-6000 (General Information)

FMC of Canada Ltd.  
FMC Peroxygens  
PG Pulp Mill Road  
Prince George, BC V2N2S6  
(250) 561-4200 (General Information)

## EMERGENCY TELEPHONE NUMBERS

(281) 474-8750 (Plant: Pasadena, TX, US - Call Collect)  
(250) 561-4221 (Plant: Prince George, BC, Canada - Call Collect)  
(303) 595-9048 (Medical - U.S. - Call Collect)

For leak, fire, spill, or accident emergencies, call:  
(800) 424-9300 (CHEMTREC - U.S.A.)  
(613) 996-6666 (CANUTEC - Canada)

## 2. HAZARDS IDENTIFICATION

### EMERGENCY OVERVIEW:

- Clear, colorless, odorless liquid
- Oxidizer.
- Contact with combustibles may cause fire.
- Decomposes yielding oxygen that supports combustion of organic matters and can cause overpressure if confined.
- Corrosive to eyes, nose, throat, lungs and gastrointestinal tract.

**POTENTIAL HEALTH EFFECTS:** Corrosive to eyes, skin, nose, throat and lungs. May cause irreversible tissue damage to the eyes including blindness.

## 3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS#	Wt. %	EC No.	EC Class
Hydrogen Peroxide	7722-84-1	40 - 60	231-765-0	C; R20/22-34, O; R8
Water	7732-18-5	40 - 60	231-791-2	Not classified

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## 4. FIRST AID MEASURES

**EYES:** Immediately flush with water for at least 15 minutes, lifting the upper and lower eyelids intermittently. See a medical doctor or ophthalmologist immediately.

**SKIN:** Immediately flush with plenty of water while removing contaminated clothing and/or shoes, and thoroughly wash with soap and water. See a medical doctor immediately.

**INGESTION:** Rinse mouth with water. Dilute by giving 1 or 2 glasses of water. Do not induce vomiting. Never give anything by mouth to an unconscious person. See a medical doctor immediately.

**INHALATION:** Remove to fresh air. If breathing difficulty or discomfort occurs and persists, contact a medical doctor.

**NOTES TO MEDICAL DOCTOR:** Hydrogen peroxide at these concentrations is a strong oxidant. Direct contact with the eye is likely to cause corneal damage especially if not washed immediately. Careful ophthalmologic evaluation is recommended and the possibility of local corticosteroid therapy should be considered. Because of the likelihood of corrosive effects on the gastrointestinal tract after ingestion, and the unlikelihood of systemic effects, attempts at evacuating the stomach via emesis induction or gastric lavage should be avoided. There is a remote possibility, however, that a nasogastric or orogastric tube may be required for the reduction of severe distension due to gas formation.

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## 5. FIRE FIGHTING MEASURES

**EXTINGUISHING MEDIA:** Flood with water.

**FIRE / EXPLOSION HAZARDS:** Product is non-combustible. On decomposition releases oxygen which may intensify fire.

**FIRE FIGHTING PROCEDURES:** Any tank or container surrounded by fire should be flooded with water for cooling. Wear full protective clothing and self-contained breathing apparatus.

**FLAMMABLE LIMITS:** Non-combustible

**SENSITIVITY TO IMPACT:** No data available

**SENSITIVITY TO STATIC DISCHARGE:** No data available

## 6. ACCIDENTAL RELEASE MEASURES

**RELEASE NOTES:** Dilute with a large volume of water and hold in a pond or diked area until hydrogen peroxide decomposes. Hydrogen peroxide may be decomposed by adding sodium metabisulfite or sodium sulfite after diluting to about 5%. Dispose according to methods outlined for waste disposal.

Combustible materials exposed to hydrogen peroxide should be immediately submerged in or rinsed with large amounts of water to ensure that all hydrogen peroxide is removed. Residual hydrogen peroxide that is allowed to dry (upon evaporation hydrogen peroxide can concentrate) on organic materials such as paper, fabrics, cotton, leather, wood or other combustibles can cause the material to ignite and result in a fire.

## 7. HANDLING AND STORAGE

**HANDLING:** Wear chemical splash-type monogoggles and full-face shield, impervious clothing, such as rubber, PVC, etc., and rubber or neoprene gloves and shoes. Avoid cotton, wool and leather. Avoid excessive heat and contamination. Contamination may cause decomposition and generation of oxygen gas which could result in high pressures and possible container rupture. Hydrogen peroxide should be stored only in vented containers and transferred only in a prescribed manner (see FMC Technical Bulletins). Never return unused hydrogen peroxide to original container, empty drums should be triple rinsed with water before discarding. Utensils used for handling hydrogen peroxide should only be made of glass, stainless steel, aluminum or plastic.

**STORAGE:** Store drums in cool areas out of direct sunlight and away from combustibles. For bulk storage refer to FMC Technical Bulletins.

**COMMENTS:** VENTILATION: Provide mechanical general and/or local exhaust ventilation to prevent release of vapor or mist into the work environment.

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE LIMITS

Chemical Name	ACGIH	OSHA	Supplier
Hydrogen Peroxide	1 ppm (TWA)	1 ppm (PEL)	

**ENGINEERING CONTROLS:** Ventilation should be provided to minimize the release of hydrogen peroxide vapors and mists into the work environment. Spills should be minimized or confined immediately to prevent release into the work area. Remove contaminated clothing immediately and wash before reuse.

## PERSONAL PROTECTIVE EQUIPMENT

**EYES AND FACE:** Use chemical splash-type monogoggles and a full-face shield made of polycarbonate, acetate, polycarbonate/acetate, PETG or thermoplastic.

**RESPIRATORY:** If concentrations in excess of 10 ppm are expected, use NIOSH/DHHS approved self-contained breathing apparatus (SCBA), or other approved atmospheric-supplied respirator (ASR) equipment (e.g., a full-face airline respirator (ALR)). DO NOT use any form of air-purifying respirator (APR) or filtering facepiece (AKA dust mask), especially those containing oxidizable sorbants such as activated carbon.

**PROTECTIVE CLOTHING:** For body protection wear impervious clothing such as an approved splash protective suit made of SBR Rubber, PVC (PVC Outershell w/Polyester Substrate), Gore-Tex (Polyester trilaminate w/Gore-Tex), or a specialized HAZMAT Splash or Protective Suite (Level A, B, or C). For foot protection, wear approved boots made of NBR, PVC, Polyurethane, or neoprene. Overboots made of Latex or PVC, as well as firefighter boots or specialized HAZMAT boots are also permitted. DO NOT wear any form of boot or overboots made of nylon or nylon blends. DO NOT use cotton, wool or leather, as these materials react RAPIDLY with higher concentrations of hydrogen peroxide. Completely submerge hydrogen peroxide contaminated clothing or other materials in water prior to drying. Residual hydrogen peroxide, if allowed to dry on materials such as paper, fabrics, cotton, leather, wood or other combustibles can cause the material to ignite and result in a fire.

**GLOVES:** For hand protection, wear approved gloves made of nitrile, PVC, or neoprene. DO NOT use cotton, wool or leather for these materials react RAPIDLY with higher concentrations of hydrogen peroxide. Thoroughly rinse the outside of gloves with water prior to removal. Inspect regularly for leaks.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

<b>ODOR:</b>	Odorless
<b>APPEARANCE:</b>	Clear, colorless liquid
<b>AUTOIGNITION TEMPERATURE:</b>	Non-combustible
<b>BOILING POINT:</b>	110°C (229°F) (40%); 114°C (237°F) (50%)
<b>COEFFICIENT OF OIL / WATER:</b>	Not available
<b>DENSITY / WEIGHT PER VOLUME:</b>	Not available
<b>EVAPORATION RATE:</b>	Above 1 (Butyl Acetate = 1)
<b>FLASH POINT:</b>	Non-combustible
<b>FREEZING POINT:</b>	-41.4°C (-42.5°F) (40%); -52°C (-62°F) (50%)
<b>ODOR THRESHOLD:</b>	Not available
<b>OXIDIZING PROPERTIES:</b>	Strong oxidizer
<b>PERCENT VOLATILE:</b>	100%
<b>pH:</b>	(as is) < / = 3.0
<b>SOLUBILITY IN WATER:</b>	(in H <sub>2</sub> O % by wt) 100%

<b>SPECIFIC GRAVITY:</b>	(H <sub>2</sub> O = 1) 1.15 @ 20°C/4°C (40%); 1.19 @ 20°C/4°C (50%)
<b>VAPOR DENSITY:</b>	Not available (Air = 1)
<b>VAPOR PRESSURE:</b>	22 mmHg @ 30°C (40%); 18.3 mmHg @ 30°C (50%)
<b>COMMENTS:</b>	
	pH (1% solution) : 5.0 - 6.0

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## 10. STABILITY AND REACTIVITY

<b>CONDITIONS TO AVOID:</b>	Excessive heat or contamination could cause product to become unstable.
<b>STABILITY:</b>	Stable (heat and contamination could cause decomposition)
<b>POLYMERIZATION:</b>	Will not occur
<b>INCOMPATIBLE MATERIALS:</b>	Reducing agents, wood, paper and other combustibles, iron and other heavy metals, copper alloys and caustic.
<b>HAZARDOUS DECOMPOSITION PRODUCTS:</b>	Oxygen which supports combustion.
<b>COMMENTS:</b>	Materials to Avoid : Dirt, organics, cyanides and combustibles such as wood, paper, oils, etc.

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## 11. TOXICOLOGICAL INFORMATION

**EYE EFFECTS:** 70% hydrogen peroxide: Severe irritant (corrosive) (rabbit) [FMC Study Number: ICG/T-79.027]

**SKIN EFFECTS:** 50% hydrogen peroxide: Severe irritant (corrosive) (rabbit) [FMC Study Number: I89-1079]

**DERMAL LD<sub>50</sub>:** 70% hydrogen peroxide: > 6.5 g/kg (rabbit) [FMC Study Number: ICG/T-79.027]

**ORAL LD<sub>50</sub>:** 50% hydrogen peroxide: > 225 mg/kg (rat) [FMC Study Number: I86-914]

**INHALATION LC<sub>50</sub>:** 50% hydrogen peroxide: > 0.17 mg/l (rat) [FMC Study Number: I89-1080]

**TARGET ORGANS:** Eye, skin, nose, throat, lungs

**ACUTE EFFECTS FROM OVEREXPOSURE:** Severe irritant/corrosive to eyes, skin and gastrointestinal tract. May cause irreversible tissue damage to the eyes including blindness. Inhalation of mist or vapors may be severely irritating to nose, throat and lungs.

**CHRONIC EFFECTS FROM OVEREXPOSURE:** The International Agency for Research on Cancer (IARC) has concluded that there is inadequate evidence for carcinogenicity of hydrogen peroxide in humans, but limited evidence in experimental animals (Group 3 - not classifiable as to its carcinogenicity to humans). The American Conference of Governmental Industrial Hygienists (ACGIH) has concluded that hydrogen peroxide is a 'Confirmed Animal Carcinogen with Unknown Relevance to Humans' (A3).

**CARCINOGENICITY:**

Chemical Name	IARC	NTP	OSHA	Other
Hydrogen Peroxide	Not listed	Not listed	Not listed	(ACGIH) Listed (A3, Animal Carcinogen)

## 12. ECOLOGICAL INFORMATION

**ECOTOXICOLOGICAL INFORMATION:** Channel catfish 96-hour  $LC_{50}$  = 37.4 mg/L  
 Fathead minnow 96-hour  $LC_{50}$  = 16.4 mg/L  
 Daphnia magna 24-hour  $EC_{50}$  = 7.7 mg/L  
 Daphnia pulex 48-hour  $LC_{50}$  = 2.4 mg/L  
 Freshwater snail 96-hour  $LC_{50}$  = 17.7 mg/L  
 For more information refer to ECETOC "Joint Assessment of Commodity Chemicals No. 22, Hydrogen Peroxide." ISSN-0773-6339, January 1993

**CHEMICAL FATE INFORMATION:** Hydrogen peroxide in the aquatic environment is subject to various reduction or oxidation processes and decomposes into water and oxygen. Hydrogen peroxide half-life in freshwater ranged from 8 hours to 20 days, in air from 10-20 hrs. and in soils from minutes to hours depending upon microbiological activity and metal contaminants.

## 13. DISPOSAL CONSIDERATIONS

**DISPOSAL METHOD:** An acceptable method of disposal is to dilute with a large amount of water and allow the hydrogen peroxide to decompose followed by discharge into a suitable treatment system in accordance with all regulatory agencies. The appropriate regulatory agencies should be contacted prior to disposal.

## 14. TRANSPORT INFORMATION

**U.S. DEPARTMENT OF TRANSPORTATION (DOT)**

**PROPER SHIPPING NAME:** Hydrogen peroxide, aqueous solutions with more than 40% but not more than 60% hydrogen peroxide.

**PRIMARY HAZARD CLASS / DIVISION:** 5.1 (Oxidizer)

**UN/NA NUMBER:** UN 2014

**PACKING GROUP:** II

**LABEL(S):** Oxidizer, Corrosive

**PLACARD(S):** 5.1 (Oxidizer)

**ADDITIONAL INFORMATION:** DOT Marking: Hydrogen Peroxide, aqueous solution with more than 40%, but not more than 60% Hydrogen Peroxide, UN 2014  
Hazardous Substance/RQ: Not applicable  
49 STCC Number: 4918775  
DOT Spec: stainless steel/high purity aluminum cargo tanks and rail cars. UN Spec: HDPE drums. Contact FMC for specific details.

### **INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)**

**PROPER SHIPPING NAME:** Hydrogen peroxide, aqueous solutions with not less than 20%, but not more than 60% hydrogen peroxide.

### **INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO) / INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)**

**PROPER SHIPPING NAME:** Hydrogen peroxide (40 - 60%) is forbidden on Passenger and Cargo Aircraft, as well as Cargo Only Aircraft.

### **OTHER INFORMATION:**

Protect from physical damage. Keep drums in upright position. Drums should not be stacked in transit. Do not store drum on wooden pallets.

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## **15. REGULATORY INFORMATION**

### **UNITED STATES**

**SARA TITLE III (SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT)**

**SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355, APPENDIX A):**

Hydrogen Peroxide > 52%, RQ: 1000 lbs. Planning Threshold: 10,000 lbs.

**SECTION 311 HAZARD CATEGORIES (40 CFR 370):**

Fire Hazard, Immediate (Acute) Health Hazard

**SECTION 312 THRESHOLD PLANNING QUANTITY (40 CFR 370):**

The Threshold Planning Quantity (TPQ) for this product, if treated as a mixture, is 10,000 lbs; however, this product contains the following ingredients with a TPQ of less than 10,000 lbs.:  
None, (conc. <52%) (hydrogen peroxide, 1000 lbs. when conc is >52%)

**SECTION 313 REPORTABLE INGREDIENTS (40 CFR 372):**

Not listed

**CERCLA (COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT)**

**CERCLA DESIGNATION & REPORTABLE QUANTITIES (RQ) (40 CFR 302.4):**

Unlisted (Hydrogen Peroxide); RQ = 100 lbs.; Ignitability, Corrosivity

**TSCA (TOXIC SUBSTANCE CONTROL ACT)**

**TSCA INVENTORY STATUS (40 CFR 710):**

Listed

**RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)**

**RCRA IDENTIFICATION OF HAZARDOUS WASTE (40 CFR 261):**

Waste Number: D001, D002

**CANADA**

**WHMIS (WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM):**

Product Identification Number: 2014

Hazard Classification / Division: Class C (Oxidizer), Class D, Div. 2, Subdiv. B (Toxic), Class E (Corrosive)

Ingredient Disclosure List: Listed

**INTERNATIONAL LISTINGS**

Hydrogen peroxide:

China: Listed

Japan (ENCS): (1)-419

Korea: KE-20204

Philippines (PICCS): Listed

**HAZARD, RISK AND SAFETY PHRASE DESCRIPTIONS:**

Hydrogen Peroxide, (Index #008-003-00-9):

EC Symbols: C (Corrosive)  
O (Oxidizer)

EC Risk Phrases:	R20/22 (Harmful by inhalation and if swallowed.)
	R34 (Causes burns)
	R8 (Contact with combustible material may cause fire)
EC Safety Phrases:	S1/2 (Keep locked up and out of reach of children.)
	S3 (Keep in a cool place.)
	S17 (Keep away from combustible material.)
	S26 (In case of contact with eyes, rinse immediately with plenty of water and seek medical advice)
	S28 (After contact with skin, wash immediately with plenty of water and soap.)
	S36/37/39 (Wear suitable protective clothing, gloves and eye/face protection.)
	S45 (In case of accident or if you feel unwell, seek medical advice immediately - show the label where possible.)

## 16. OTHER INFORMATION

### HMIS

Health	3
Flammability	0
Physical Hazard	1
Personal Protection (PPE)	H

Protection = H (Safety goggles, gloves, apron, the use of a supplied air or SCBA respirator is required in lieu of a vapor cartridge respirator)

HMIS = Hazardous Materials Identification System

Degree of Hazard Code:

- 4 = Severe
- 3 = Serious
- 2 = Moderate
- 1 = Slight
- 0 = Minimal

### NFPA

Health	3
Flammability	0
Reactivity	1
Special	OX

SPECIAL = OX (Oxidizer)

NFPA = National Fire Protection Association

Degree of Hazard Code:

4 = Extreme  
3 = High  
2 = Moderate  
1 = Slight  
0 = Insignificant

**REVISION SUMMARY:**

This MSDS replaces Revision #9, dated April 05, 2005.

Changes in information are as follows:

Section 1 (Product and Company Identification)

Section 16 (Other Information)

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NOTE: NFPA Reactivity is 3 - when greater than 52%

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## SAFETY DATA SHEET

### QUIK-TROL® GOLD LV

Product Trade Name:

Revision Date: 12-Jun-2015

Revision Number: 14

#### 1. Identification

##### 1.1. Product Identifier

**Product Trade Name:** QUIK-TROL® GOLD LV  
**Synonyms:** None  
**Chemical Family:** Carbohydrate  
**Internal ID Code** HM006782

##### 1.2 Recommended use and restrictions on use

**Application:** Viscosifier Filtrate Reducer  
**Uses Advised Against** No information available

##### 1.3 Manufacturer's Name and Contact Details

**Manufacturer/Supplier** Baroid Fluid Services  
Product Service Line of Halliburton  
P.O. Box 1675  
Houston, TX 77251  
Telephone: (281) 871-4000  
Emergency Telephone: (281) 575-5000

**Prepared By** Chemical Stewardship  
Telephone: 1-580-251-4335  
e-mail: fdunexchem@halliburton.com

##### 1.4. Emergency telephone number

**Emergency Telephone Number** (281) 575-5000

#### 2. Hazard(s) Identification

##### 2.1 Classification in accordance with paragraph (d) of §1910.1200

Combustible dust

Combustible dust

##### 2.2. Label Elements

**Hazard Pictograms**

**Signal Word** Warning

**Hazard Statements**

May form combustible dust concentrations in air.

**Precautionary Statements**

**Prevention** None

<b>Response</b>	None
<b>Storage</b>	None
<b>Disposal</b>	None

**Contains Substances**  
Polysaccharide

**CAS Number**  
Proprietary

**2.3 Hazards not otherwise classified**

None known

**3. Composition/information on Ingredients**

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Polysaccharide	Proprietary	60 - 100%	Combustible Dust

The specific chemical identity of the composition has been withheld as proprietary. The exact percentage (concentration) of the composition has been withheld as proprietary.

**4. First-Aid Measures**

**4.1. Description of first aid measures**

**Inhalation** If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

**Eyes** In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

**Skin** Wash with soap and water. Get medical attention if irritation persists.

**Ingestion** Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

**4.2 Most important symptoms/effects, acute and delayed**

No significant hazards expected.

**4.3. Indication of any immediate medical attention and special treatment needed**

**Notes to Physician** Treat symptomatically.

**5. Fire-fighting measures**

**5.1. Extinguishing media**

**Suitable Extinguishing Media**

Water fog, carbon dioxide, foam, dry chemical.

**Extinguishing media which must not be used for safety reasons**

None known.

**5.2 Specific hazards arising from the substance or mixture**

**Special Exposure Hazards**

Organic dust in the presence of an ignition source can be explosive in high concentrations. Good housekeeping practices are required to minimize this potential.

**5.3 Special protective equipment and precautions for fire-fighters**

**Special Protective Equipment for Fire-Fighters**

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

**6. Accidental release measures**

**6.1. Personal precautions, protective equipment and emergency procedures**

Use appropriate protective equipment. Avoid creating and breathing dust. Slippery when wet. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.  
See Section 8 for additional information

**6.2. Environmental precautions**

Prevent from entering sewers, waterways, or low areas.

**6.3. Methods and material for containment and cleaning up**

Scoop up and remove.

**7. Handling and storage**

**7.1. Precautions for Safe Handling**

**Handling Precautions**

Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust. Avoid dust accumulations. Ensure adequate ventilation. Slippery when wet. Wash hands after use. Launder contaminated clothing before reuse. Do NOT consume food, drink, or tobacco in contaminated areas.

**Hygiene Measures**

Handle in accordance with good industrial hygiene and safety practice.

**7.2. Conditions for safe storage, including any incompatibilities**

**Storage Information**

Store away from oxidizers. Keep container closed when not in use. Store in a cool, dry location. Store away from direct sunlight. Keep from heat, sparks, and open flames. Store in a well ventilated area. Product has a shelf life of 36 months.

**8. Exposure Controls/Personal Protection**

**8.1 Occupational Exposure Limits**

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Polysaccharide	Proprietary	Not applicable	Not applicable

**8.2 Appropriate engineering controls**

**Engineering Controls**

A well ventilated area to control dust levels. Local exhaust ventilation should be used in areas without good cross ventilation.

**8.3 Individual protection measures, such as personal protective equipment**

**Personal Protective Equipment**

If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

**Respiratory Protection**

Not normally needed. But if significant exposures are possible then the following respirator is recommended:

Dust/mist respirator. (N95, P2/P3)

**Hand Protection**

Normal work gloves.

**Skin Protection**

Normal work coveralls.

**Eye Protection**

Wear safety glasses or goggles to protect against exposure.

**Other Precautions**

None known.

**9. Physical and Chemical Properties**

**9.1. Information on basic physical and chemical properties**

<b>Physical State:</b> Powder	<b>Color:</b> White to off white
<b>Odor:</b> Odorless	<b>Odor Threshold:</b> No information available

<u>Property</u> <u>Remarks/ - Method</u>	<u>Values</u>
<b>pH:</b>	5-9 (1%)
<b>Freezing Point/Range</b>	No data available
<b>Melting Point/Range</b>	No data available
<b>Boiling Point/Range</b>	No data available
<b>Flash Point</b>	No data available
<b>Flammability (solid, gas)</b>	No data available
upper flammability limit	No data available
lower flammability limit	No data available
<b>Evaporation rate</b>	No data available
<b>Vapor Pressure</b>	No data available
<b>Vapor Density</b>	No data available
<b>Specific Gravity</b>	No data available
<b>Water Solubility</b>	Soluble in water
<b>Solubility in other solvents</b>	No data available
<b>Partition coefficient: n-octanol/water</b>	No data available
<b>Autoignition Temperature</b>	No data available
<b>Decomposition Temperature</b>	No data available
<b>Viscosity</b>	No data available
<b>Explosive Properties</b>	No information available
<b>Oxidizing Properties</b>	No information available

**9.2. Other information**

**VOC Content (%)** No data available

**10. Stability and Reactivity**

**10.1. Reactivity**  
Not expected to be reactive.

**10.2. Chemical Stability**  
Stable

**10.3. Possibility of Hazardous Reactions**  
Will Not Occur

**10.4. Conditions to Avoid**  
None anticipated

**10.5. Incompatible Materials**  
Strong oxidizers.

**10.6. Hazardous Decomposition Products**  
Carbon monoxide and carbon dioxide.

**11. Toxicological Information**

**11.1 Information on likely routes of exposure**  
**Principle Route of Exposure** Eye or skin contact, inhalation.

**11.2 Symptoms related to the physical, chemical and toxicological characteristics**

**Acute Toxicity**

**Inhalation** May cause mild respiratory irritation.  
**Eye Contact** May cause mild eye irritation.  
**Skin Contact** May cause mild skin irritation.  
**Ingestion** None known.

**Chronic Effects/Carcinogenicity** No data available to indicate product or components present at greater than 0.1% are chronic health hazards.

**11.3 Toxicity data**

**Toxicology data for the components**

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Polysaccharide	Proprietary	27000 mg/kg (Rat)	2000 mg/kg (Rabbit)	5800 mg/m <sup>3</sup> (Rat) 4h

Substances	CAS Number	Skin corrosion/irritation
Polysaccharide		Not irritating to skin in rabbits.

Substances	CAS Number	Eye damage/irritation
Polysaccharide		Non-irritating to rabbit's eye

Substances	CAS Number	Skin Sensitization
Polysaccharide		Did not cause sensitization on laboratory animals

Substances	CAS Number	Respiratory Sensitization
Polysaccharide		No information available

Substances	CAS Number	Mutagenic Effects
Polysaccharide		In vitro tests did not show mutagenic effects In vivo tests did not show mutagenic effects. (similar substances)

Substances	CAS Number	Carcinogenic Effects
Polysaccharide		Did not show carcinogenic effects in animal experiments (similar substances)

Substances	CAS Number	Reproductive toxicity
Polysaccharide		Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Polysaccharide		No information available

Substances	CAS Number	STOT - repeated exposure
Polysaccharide		No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	Aspiration hazard
Polysaccharide		Not applicable

**12. Ecological Information**

**12.1. Toxicity**

**Ecotoxicity Effects**

**Product Ecotoxicity Data**

No data available

**Substance Ecotoxicity Data**

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Polysaccharide	Proprietary	No information available	TLM96: 10000 ppm (Oncorhynchus mykiss) LC50 (96h) 20000 mg/L (Oncorhynchus mykiss)	No information available	EC50 (48h) 1000-3300 mg/L (Crangon crangon)

**12.2. Persistence and degradability**

Readily biodegradable

Substances	CAS Number	Persistence and Degradability
Polysaccharide	Proprietary	No information available

**12.3. Bioaccumulative potential**

Does not bioaccumulate

Substances	CAS Number	Log Pow
Polysaccharide	Proprietary	No information available

**12.4. Mobility in soil**

Substances	CAS Number	Mobility
Polysaccharide	Proprietary	No information available

**12.5 Other adverse effects**

No information available

**13. Disposal Considerations**

**13.1. Waste treatment methods**

**Disposal Method** Disposal should be made in accordance with federal, state, and local regulations.  
**Contaminated Packaging** Follow all applicable national or local regulations.

**14. Transport Information**

**US DOT**

**UN Number:** Not restricted  
**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards:** Not applicable

**US DOT Bulk**

**DOT (Bulk)** Not applicable

**Canadian TDG**

**UN Number:** Not restricted  
**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards:** Not applicable

**IMDG/IMO**

UN Number: Not restricted  
 UN Proper Shipping Name: Not restricted  
 Transport Hazard Class(es): Not applicable  
 Packing Group: Not applicable  
 Environmental Hazards: Not applicable

**IATA/ICAO**

UN Number: Not restricted  
 UN Proper Shipping Name: Not restricted  
 Transport Hazard Class(es): Not applicable  
 Packing Group: Not applicable  
 Environmental Hazards: Not applicable

**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:** Not applicable

**Special Precautions for User:** None

**15. Regulatory Information**

**US Regulations**

**US TSCA Inventory** All components listed on inventory or are exempt.

**EPA SARA Title III Extremely Hazardous Substances** Not applicable

**EPA SARA (311,312) Hazard Class** None

**EPA SARA (313) Chemicals** This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).

**EPA CERCLA/Superfund Reportable Spill Quantity** Not applicable.

**EPA RCRA Hazardous Waste Classification** If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.

**California Proposition 65** All components listed do not apply to the California Proposition 65 Regulation.

**MA Right-to-Know Law** Does not apply.

**NJ Right-to-Know Law** One or more components listed.

**PA Right-to-Know Law** Does not apply.

**Canadian Regulations**

**Canadian DSL Inventory** All components listed on inventory or are exempt.

**16. Other information**

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**Preparation Information**

**Prepared By** Chemical Stewardship  
Telephone: 1-580-251-4335  
e-mail: fdunexchem@halliburton.com

**Revision Date:** 12-Jun-2015

**Reason for Revision** SDS sections updated:  
2

**Additional information**

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

**Key or legend to abbreviations and acronyms**

bw – body weight  
CAS – Chemical Abstracts Service  
EC50 – Effective Concentration 50%  
ErC50 – Effective Concentration growth rate 50%  
LC50 – Lethal Concentration 50%  
LD50 – Lethal Dose 50%  
LL50 – Lethal Loading 50%  
mg/kg – milligram/kilogram  
mg/L – milligram/liter  
NIOSH – National Institute for Occupational Safety and Health  
NTP – National Toxicology Program  
OEL – Occupational Exposure Limit  
PEL – Permissible Exposure Limit  
ppm – parts per million  
STEL – Short Term Exposure Limit  
TWA – Time-Weighted Average  
UN – United Nations  
h - hour  
mg/m<sup>3</sup> - milligram/cubic meter  
mm - millimeter  
mmHg - millimeter mercury  
w/w - weight/weight  
d - day

**Key literature references and sources for data**

[www.ChemADVISOR.com/](http://www.ChemADVISOR.com/)

**Disclaimer Statement**

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

**End of Safety Data Sheet**

**APPENDIX D**

**NCDEQ NOTIFICATION TO CONSTRUCT OR OPERATE INJECTION WELLS AND  
AUTHORIZATION**

## Renn, Timothy

---

**From:** Rogers, Michael <michael.rogers@ncdenr.gov>  
**Sent:** Monday, August 22, 2016 4:24 PM  
**To:** Renn, Timothy  
**Cc:** Knight, Sherri; Smith, George; Shrestha, Shristi R  
**Subject:** RE: WI0400456 NOI Robert Bosch Tool corporation

If you don't hear anything more from us or the Regional office, you are good to go 2 weeks after submittal.

---

**From:** Renn, Timothy [mailto:Timothy.Renn@amecfw.com]  
**Sent:** Monday, August 22, 2016 1:54 PM  
**To:** Rogers, Michael <michael.rogers@ncdenr.gov>  
**Subject:** RE: WI0400456 NOI Robert Bosch Tool corporation  
**Importance:** High

Mr. Rogers:

My client received this from Ms. Shrestha on Friday. Does this constitute approval of the NOI? Or is it still being reviewed? I believe two weeks from the submittal date of 8/15/16 will be 8/29/16.

I am asking as I am in the process of scheduling subcontractors for this injection work in September, and I want to ensure that things are approved before setting a final date.

Also, will the client receive formal notice of approval of this NOI or does the email from Ms. Shrestha constitute approval?

Thanks,

**Timothy S. Renn, P.E.**

Senior Remediation Engineer, Environment & Infrastructure, Amec Foster Wheeler  
37 Villa Road, Suite 201, Greenville, SC 29615  
T 864-552-9624 D 864-752-0158 M 864-561-3414  
[timothy.renn@amecfw.com](mailto:timothy.renn@amecfw.com) amecfw.com

---

**From:** Shrestha, Shristi R [mailto:shristi.shrestha@ncdenr.gov]  
**Sent:** Friday, August 19, 2016 1:40 PM  
**To:** [scott.pihlaja@us.bosch.com](mailto:scott.pihlaja@us.bosch.com); Renn, Timothy <[Timothy.Renn@amecfw.com](mailto:Timothy.Renn@amecfw.com)>  
**Cc:** Rogers, Michael <[michael.rogers@ncdenr.gov](mailto:michael.rogers@ncdenr.gov)>; Knight, Sherri <[sherri.knight@ncdenr.gov](mailto:sherri.knight@ncdenr.gov)>  
**Subject:** WI0400456 NOI Robert Bosch Tool corporation

Thank you for submitting the Notice of Intent to Construct or Operate Injection Wells (NOI) for the **above referenced site**.

Please remember to submit the following regarding this injection activity:

- 1) **Well Construction Records (GW-1) and Abandonment Records (GW-30) when completed.** Please provide copies of the GW-1s and GW-30s if not already submitted (originals go the address printed on the form). **NOTE:** Direct push or Geoprobe wells are considered wells and require construction (GW-1) and abandonment forms (GW-30). If well construction/abandonment information is the same for the wells, only one form needs to be completed- just indicate total number of injection points in the Comments/Remarks section of form. These forms can be found on our website at

<http://deg.nc.gov/about/divisions/water-resources/water-resources-permits/wastewater-branch/ground-water-protection/ground-water-reporting-forms>

2) **Injection Event Records (IER).** All injections, including air and passive systems require an IER. The IER can be modified for air sparge wells (e.g., air flow ‘continuous’ for date or rate of injection, etc.).

You can scan and send these forms directly to me at [Shristi.shrestha@ncdenr.gov](mailto:Shristi.shrestha@ncdenr.gov) or via regular mail to address below. When submitting the above forms, you will need to enter the nine-digit alpha-numeric number on the form (i.e., W10XXXXXX) that has been assigned to the injection activity at this site. This notification has been given the deemed permit number **W10400456**. *This number is also referenced in the subject line of this email.* You may if you wish, scan and send back as attachments in reply to this email, as it will already have the assigned deemed permit number in the subject line.

Thank you for your cooperation.

Shristi

**Shristi R. Shrestha**

Hydrogeologist  
Water Quality Regional Operations Section  
Animal Feeding Operations & Groundwater Protection Branch  
North Carolina Department of Environmental Quality

919 807-6406 office  
[shristi.shrestha@ncdenr.gov](mailto:shristi.shrestha@ncdenr.gov)

512N. Salisbury Street  
1636 Mail Service Center  
Raleigh, NC 27699 1636



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## Renn, Timothy

---

**From:** Renn, Timothy  
**Sent:** Monday, August 15, 2016 9:47 AM  
**To:** 'michael.rogers@ncdenr.gov'  
**Cc:** Johnstone, Paul S; Afiegbe Aromake (PTNA/FCM); Pihlaja Scott (PT/FCM-NA PT/QMM-NA); John Young (John.Young@us.bosch.com)  
**Subject:** RBTC-Boone NONCD0001139 - Notification of Intent to Construct or Operate Injection Wells for a Small-Scale Injection Operation -  
**Attachments:** 1020.01.02 Final Soil UIC Permit Application\_2016-08-15.pdf  
**Importance:** High

Michael:

I have attached one (1) electronic copy of a Notification of Intent to Construct or Operate Injection Wells for a Small-Scale Injection Operation for the Robert Bosch Tool Corporation, Former Boone Manufacturing Division, located at 482 State Farm Road in Boone, North Carolina (NONCD0001139).

One hard copy and an electronic copy on compact disk is also being sent to your attention via FedEx Standard Overnight service.

If you have any questions or comments regarding this submittal, please direct them to my attention.

Regards,

**Timothy S. Renn, P.E.**

Senior Remediation Engineer, Environment & Infrastructure, Amec Foster Wheeler  
37 Villa Road, Suite 201, Greenville, SC 29615  
T 864-552-9624 D 864-752-0158 M 864-561-3414  
timothy.renn@amecfw.com amecfw.com

**APPENDIX E**

**NCDEQ DIVISION OF AIR QUALITY NOTIFICATION AND DETERMINATION**

June 15, 2016



Ms. Lisa Edwards  
Regional Supervisor  
North Carolina Department of Environmental Quality  
Division of Air Quality  
450 West Hanes Mill Road, Suite 300  
Winston-Salem, North Carolina 27105

Subject: **Request for Air Quality Permitting Applicability Determination for One (1) Soil Vapor Extraction System  
Robert Bosch Tool Corporation - Former Boone Division  
482 State Farm Road  
Boone, North Carolina 28607**

Dear Ms. Edwards:

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), on behalf of Robert Bosch Tool Corporation (RBTC), is tasked with conducting soil remediation efforts at the property identified above. This work is being conducted under the North Carolina Department of Environmental Quality (NCDEQ), Inactive Hazardous Sites Branch (IHSB), Registered Environmental Consultant (REC) program. As part of these efforts, this project will require the future installation of a soil vapor extraction (SVE) system that utilizes a rotary claw blower. We have evaluated the anticipated operation of the SVE system and have concluded that the system should be classified as an insignificant source in accordance with North Carolina Administrative Code (NCAC), Title 15A 2Q.0102(c)(2)(E)(i). As such, RBTC would not be required to obtain an air permit to install and operate the SVE system and blower.

### **Description of SVE System and Remediation Operations**

Soil contamination is present at RBTC's Former Boone Division facility located at 482 State Farm Road in Boone, North Carolina (the "site"). In order to meet project remedial goals and objectives for soil, Amec Foster Wheeler plans to incorporate the use of an SVE system. The SVE system and a rotary claw blower unit will draw air through two separate horizontal vacuum extraction wells and 13 separate vertical vacuum extraction wells causing the volatile organic compounds (VOCs) present within the soil to volatilize. During this process, volatile constituents in the soil will be extracted and subsequently emitted to the atmosphere. Specifications for the proposed SVE system are included as **Appendix A** to this letter.

### **Calculation of Air Emissions**

Remedial Investigation (RI) activities conducted at the site between 2011 and 2013 confirmed the presence of soils that had been impacted by historical releases of VOCs. Subsequent investigations were conducted at the site in October and December 2015 to determine the final

horizontal and vertical extent of VOCs present in site soils. Upon completion of the 2015 soil delineation activities, the extent of soil contamination at the site had been fully delineated.

Nine VOCs and nine hazardous air pollutants (HAPs) were detected in site soils above their respective NCDEQ, IHSB Protection of Groundwater (POG) Preliminary Soil Remediation Goals (PSRGs). In addition to the HAPs detected in soil, sampling data demonstrated that toxic air pollutants (TAPs) are also present in site soil. A specific source area for impacted site soils was not identified during the RI or subsequent investigation activities; however, based on historical facility operations, a release or releases of vapor degreasing solvents as evidenced by concentrations of tetrachloroethene, trichloroethene, 1,1,1-trichloroethane, and fuel oil to site soils has previously occurred. A Proposed Remedial Action Plan (RAP) for Site Soils was subsequently prepared, certified, and submitted to the REC program staff that proposed a combination of in situ chemical oxidation and SVE to remediate impacted site soils.

In order to calculate the potential air emissions that would be generated by the proposed SVE system, all volatile constituents detected in site soils above their respective IHSB POG PSRGs were assumed to be emitted during the vapor extraction process. Because detection of these volatile constituents occurred over a large vertical interval, impacted vadose zone soils were divided into three depth intervals: 0 to 5 feet below ground surface (bgs), 5 to 15 feet bgs, and 15 to 30 feet bgs. For each of the volatile constituents, all detections above IHSB POG PSRGs were added together and divided by the number of detections to get an average concentration for each individual constituent. The volume of the vadose zone was estimated using the lateral extent of soil contamination and the associated vadose zone depth interval (i.e., 5 feet, 10 feet, and 15 feet). Based on the silty clay encountered in the vadose zone at the site during previous investigation activities, an estimated soil density of 130 pounds per cubic foot was then used to determine the mass of each vadose zone interval. The average constituent concentrations were multiplied by the mass of each vadose zone interval to determine the constituent mass within the interval. Finally, the results from each of the three soil depth intervals were combined together to determine the total mass for each of the volatile constituents present in site soils as shown on **Table 1**. The RI soil sampling data, additional soil sampling data from 2015, and figures showing the lateral extent of soil contamination by depth interval can be made available upon request.

The SVE system will be operated for as little as one year and for as long as three years. Over this time period, the pollutant mass in the soil will decrease as the pollutants are extracted and emitted to the atmosphere by the SVE system. If we conservatively assume that the entire mass of each pollutant present in the soil is emitted to the atmosphere during a single year, then the data presented in **Table 1** may be viewed as the maximum emission rates for each pollutant. To calculate the maximum emission rate in pounds per day, the SVE system was assumed to operate 365 days per year, 24 hours per day. To calculate the maximum emission rate in pounds per hour, the SVE system was assumed to operate 8,760 hours per year. Using these assumptions, the emission rates for each constituent of concern (CoC) are less than the corresponding rates that would require an air pollution permit.

## Regulatory Analysis

**Table 2** provides the summary data regarding the identity of each CoC and their corresponding emission rates in comparison to the total VOC, HAP, and TAP emission rates that, if exceeded, would require an air quality permit. As shown on **Table 2**, the treatment of impacted soil present at the RBTC facility in Boone, North Carolina will not emit any HAPs, TAPs or VOCs at rates that

exceed the applicable permitting requirements. Total VOC emissions are less than 10,000 pounds per year, and potential HAP and TAP emissions are below applicable permitting requirements. Based on this information, we believe that the proposed SVE system and associated rotary claw blower unit should be classified as an insignificant activity in accordance with NCAC, Title 15A 2Q .0102(c)(2)(E)(i).

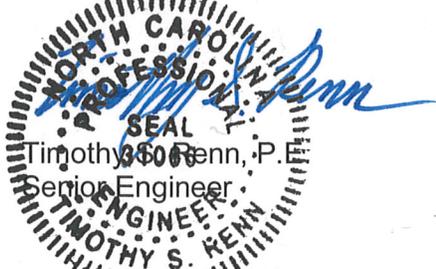
**Conclusions**

We believe that an air permit is not required for the installation and operation of the proposed SVE system and rotary claw blower at the former RBTC facility in Boone, North Carolina. We ask that you review the information presented herein and provide a written response (concurrence or disagreement) to our conclusion.

If you have any questions or require further information, please do not hesitate to contact the air permitting consultant that assisted us with the evaluation of the SVE system operations, Ms. Kate Morrison, or the Registered Site Manager, Mr. Paul Johnstone of Amec Foster Wheeler. Ms. Morrison may be reached at (919) 768-9922 and Mr. Johnstone at (864) 552-9624.

Sincerely,

**Amec Foster Wheeler Environment & Infrastructure, Inc.**



Timothy S. Penn, P.E.  
Senior Engineer

Paul S. Johnstone, L.G.  
Principal Geologist  
Registered Site Manager

Attachments: Appendix A  
Tables

**APPENDIX A**

## **SVE System Specifications, RBTC - Boone, North Carolina**

The SVE vacuum blower system is designed using a rotary claw blower, permitting operation at low vacuum and high flow during the initial phases of operation and transitioning to a higher vacuum and lower flow during later stages of treatment. Major system components include:

- SVE blower: rotary claw blower, 7.5 horsepower with capacity of 90 standard cubic feet per minute (SCFM) at 135 inches of water (Rietschle C-VLR300 or equivalent). While the design operating point is 90 SCFM at 135 inches of water, the blower is capable of achieving a vacuum of 272 inches of water (20 inches of mercury) if deemed beneficial to achieve soil remediation objectives during the later stages of treatment.
- Vapor-liquid separator: carbon steel or stainless steel air water separator, 90 gallon tank, 56 gallon liquid capacity, 4-inch MNPT inlet connection, sight glass, and integral low level, high level, and high, high level float tree with vacuum relief valve and particulate filter;
- Three-inch diameter manifold with four 3-inch branches;
- Ambient air dilution valve between moisture separator and particulate filter;
- Transfer pump to transfer liquid from vapor-liquid separator to a condensate collection tank;
- Condensate collection tank;
- Vacuum gauges on the vapor-liquid separator inlet and blower inlet;
- Blower silencer.
- Pressure gauge on the blower silencer outlet;
- Temperature gauge on the blower silencer outlet;
- Air flow meters and vacuum gauges on each SVE well inlet branch (4 total branches);
- Various sampling ports to confirm SVE system operation efficiency; and
- Controls, interlocks, and alarms as follows:
  - Manual and automatic equipment operation modes.
  - Adjustable low inlet vacuum switch on moisture separator inlet to generate alarm.
  - Vapor-liquid separator high liquid level switch to shut off blower and generate alarm.
  - High vacuum switch on blower inlet to shut off blower and generate alarm.
  - High temperature interlock on blower outlet to shut off blower and generate alarm.
  - Blower run time totalizer.
  - Remote telemetry system.

## TABLES

TABLE 1

Soil Vapor Extraction - Estimate of Total Soil CoC Mass and Total Emissions Produced  
 Robert Bosch Tool Corporation, Former Boone Division  
 Boone, North Carolina  
 Amec Foster Wheeler Project 6251121001.03.01

CoC	Total Constituent Mass in Soil (lb)	Total Constituent Mass in Soil (kg)	Total Emission Rate (lb/day)	Total Emission Rate (lb/hr)
1,1-dichloroethane	5.6	2.5	1.53E-02	6.39E-04
cis-1,2-dichloroethene	5.9	2.7	1.61E-02	6.73E-04
1,4-dioxane	0.7	0.3	2.01E-03	8.36E-05
ethylbenzene	100.1	45.5	2.74E-01	1.14E-02
naphthalene	10.0	4.5	2.74E-02	1.14E-03
tetrachloroethene	11.0	5.0	3.00E-02	1.25E-03
1,1,1-trichloroethane	36.6	16.7	1.00E-01	4.18E-03
trichloroethene	1.9	0.9	5.24E-03	2.18E-04
vinyl chloride	0.1	0.0	2.40E-04	1.00E-05
total xylenes	382.4	173.8	1.05E+00	4.37E-02
<b>Total VOCs:</b>	<b>518</b>	<b>235</b>	<b>1.42</b>	<b>5.91E-02</b>
<b>Total HAPs:</b>	<b>548</b>	<b>249</b>	<b>1.50</b>	<b>6.26E-02</b>

**Notes:**

CoC - constituent of concern

HAP = Hazardous Air Pollutant

VOC = Volatile Organic Compound

lb = pound

kg = kilogram

lb/day = pounds per day

lb/hr = pounds per hour

TABLE 2

**Potential Air Emissions from SVE System Operation**  
**Robert Bosch Tool Corporation, Former Boone Division**  
**Boone, North Carolina**  
**Amec Foster Wheeler Project 6251121001.03.01**

CoC	Mass of Pollutant in Soil (lb)	Emission Rate (lb/yr)	Emission Rate (lb/day)	Emission Rate (lb/hr)	Total VOC Emission Rate Requiring a Permit	Constituent HAP Emission Rates Requiring a Permit	15A NCAC 2Q .0711 TAP Emission Rates Requiring a Permit	Requires Air Pollution Permit (Y or N)
1,1-Dichloroethane	5.6	5.6	1.53E-02	6.39E-04		20,000 lb/yr	NA	N
cis-1,2-Dichloroethene	5.9	5.9	6.10E-02	6.73E-04		NA	NA	N
1,4-Dioxane	0.7	0.7	2.01E-03	8.36E-05		20,000 lb/yr	12 lb/day	N
Ethylbenzene	100.1	100.1	2.74E-01	1.14E-02		20,000 lb/yr	NA	N
Napthalene	10	10	2.74E-02	1.14E-03		20,000 lb/yr	NA	N
Tetrachloroethene	11	11	3.00E-02	1.25E-03		20,000 lb/yr	13,000 lb/yr	N
1,1,1-Trichloroethane	36.6	36.6	1.00E-02	4.18E-03		20,000 lb/yr	250 lb/day; 64 lb/hr	N
Trichloroethene	1.9	1.9	5.24E-03	2.18E-04		20,000 lb/yr	4,000 lb/yr	N
Vinyl Chloride	0.1	0.1	2.40E-04	1.00E-05		20,000 lb/yr	25 lb/yr	N
Total Xylenes	382.4	382.4	1.05E+00	4.37E-02		20,000 lb/yr	57 lb/day; 16.4 lb/hr	N
<b>Total VOC</b>	518	518	1.42	5.91E-02		10,000 lb/yr		
<b>Total HAP</b>	548	548	1.5	6.26E-02		50,000 lb/yr		N

**Notes:**

CoC = constituent of concern

VOC = volatile organic compound

HAP = Hazardous Air Pollutant

NCAC = North Carolina Administrative Code

lb = pounds

lb/yr = pounds per year

lb/day = pounds per day

lb/hr = pounds per hour

Y = Yes

N = No

NA = not applicable



PAT MCCRORY  
*Governor*

DONALD R. VAN DER VAART  
*Secretary*

SHEILA C. HOLMAN  
*Director*

June 21, 2016

Timothy Renn, P.E.  
Senior Engineer  
Amec Foster Wheeler Environment & Infrastructure, Inc.  
37 Villa Road  
Suite 201  
Greenville, SC 29615

SUBJECT: Permit Applicability Determination  
Applicability Determination Application No. 2865  
Robert Bosch Tool Corporation  
482 State Farm Road  
Boone, Watauga County, North Carolina 28607  
Facility ID No.: N/A

Dear Mr. Renn:

The Division of Air Quality received your letter and supporting documentation on June 16, 2016 requesting that this Office determine whether an Air Quality Permit is necessary for the implementation of a Soil Vapor Extraction System, utilizing a rotary claw blower, to be operated at the subject site.

In view of the information provided, the Division of Air Quality has determined the following relative to Air Quality Permit applicability:

The proposed Soil Vapor Extraction System, utilizing a rotary claw blower, is considered exempt from permitting under Regulation 15A NCAC 02Q .0102(d)...  
*“Any facility whose actual emissions of particulate matter (PM<sub>10</sub>), sulfur dioxide, nitrogen oxides, volatile organic compounds, carbon monoxide, hazardous air pollutants, and toxic air pollutants are each less than five tons per year and whose actual total aggregate emissions are less than 10 tons per year...”*

Therefore, this Office has determined that an Air Quality Permit is not required for the aforementioned Soil Vapor Extraction System. Please note that this exemption from the permitting requirement does not exempt Robert Bosch Tool Corporation from complying with the applicable emission control standards.

Timothy S. Renn, P.E.

June 21, 2016

Page 2

Should you decide to modify this activity such that the result is an increase of emissions of air pollutants including toxic air pollutants, an Air Quality Permit may be required and Robert Bosch Tool Corporation should submit a permit application to this Office prior to such actions.

This exemption from the permitting requirement is based upon your representations that the subject equipment will be operated under the threshold levels as outlined in the cited Regulation. Please be advised that the operation of any air pollution emission sources which results in emissions in excess of the threshold levels without an Air Quality Permit is a violation of 15A NCAC 2Q.0101, "Required Air Quality Permits." If this facility is required to obtain an Air Quality Permit for this equipment in the future because of required emissions, each day of operation of the emission sources without an Air Quality Permit represents a separate violation. Such violations may be subject to enforcement action pursuant to NCGS 143-215.114A.

Should you have any questions with regard to the above matter, please contact Leo L. Governale, P.E. at 336-776-9638.

Sincerely,



Lisa Edwards, P.E., Regional Supervisor  
Division of Air Quality, NCDEQ

cc: Winston-Salem Regional Office

**APPENDIX F**  
**DOCUMENT CERTIFICATION STATEMENTS**

IHSB SITE NAME Vermont American (NONCD0001139), Boone, NC

DATE & NAME OF DOCUMENT Remedial Action Preconstruction Report for Site Soils 08/18/16

TYPE OF SUBMITTAL (circle all that apply): Report, Work plan, Work Phase Comp. Statement, Schedule Change

**REMEDIATING PARTY DOCUMENT CERTIFICATION STATEMENT (.0306(B)(2))**

"I certify under penalty of law that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this certification, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material and information contained herein is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information."

Aromake Afiegbe  
Name of Remediating Party

[Signature]  
Signature of Remediating Party

08/31/16  
Date

**NOTARIZATION**

ILLINOIS (Enter State)

COOK COUNTY

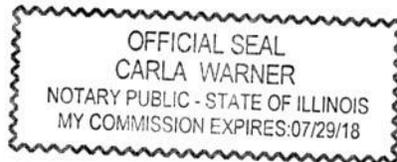
I, CARLA WARNER, a Notary Public of said County and State, do hereby certify that Aromake Afiegbe did personally appear and sign before me this day, produced proper identification in the form of Company ID, was duly sworn or affirmed, and declared that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certification is true and accurate, and he or she then signed this Certification in my presence.

WITNESS my hand and official seal this 31 day of AUGUST, 2016.

Carla Warner  
Notary Public (signature)

(OFFICIAL SEAL)

My commission expires: 7/29/18



IHSB SITE NAME Vermont American (NONCD0001139), Boone, NC

DATE & NAME OF DOCUMENT Remedial Action Preconstruction Report for Site Soil 08/18/16

TYPE OF SUBMITTAL (circle all that apply): Report, Work plan, Work Phase Comp. Statement, Schedule Change

**REGISTERED SITE MANAGER CERTIFICATION OF SIGNATURES**

As the Registered Environmental Consultant for the Site for which this filing is made, I certify that the signatures included herewith are genuine and authentic original handwritten signatures and/or true, accurate, and complete copies of the genuine and authentic original handwritten signatures of the persons who purport to sign for this filing. I further certify that I have collected through reliable means the originals and/or copies of said signatures from the persons authorized to sign for this filing who, in fact, signed the originals thereof. Those persons and I understand and agree that any copies of signatures have the same legally binding effect as original handwritten signatures, and I certify that any person for whom I am submitting a copy of their signature has provided me with their express consent to submit said copy. Additionally, I certify that I am authorized to attest to the genuineness and authenticity of the signatures, both originals and any copies, being submitted herewith and that by signing below, I do in fact attest to the genuineness and authenticity of all the signatures, both originals and copies, being submitted for this filing.

Paul S. Johnstone

Name of Registered Site Manager

*Paul S. Johnstone*

Signature of Registered Site Manager

9/1/16

Date

**REGISTERED SITE MANAGER DOCUMENT CERTIFICATION STATEMENT (.0306(b)(1))**

"I certify under penalty of law that I am personally familiar with the information contained in this submittal, including any and all supporting documents accompanying this certification, and that the material and information contained herein is, to the best of my knowledge and belief, true, accurate and complete and complies with the Inactive Hazardous Sites Response Act G.S. 130A-310, et seq, and the remedial action program Rules 15A NCAC 13C .0300. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information."

Paul S. Johnstone

Name of Registered Site Manager

*Paul S. Johnstone*

Signature of Registered Site Manager

9/1/16

Date

**NOTARIZATION**

South Carolina (Enter State)

Greenville COUNTY

I, *Serah J. Roy*, a Notary Public of said County and State, do hereby certify that Paul S. Johnstone did personally appear and sign before me this day, produced proper identification in the form of SC Drivers License, was duly sworn or affirmed, and declared that, he or she is the duly authorized environmental consultant of the remediating party of the property referenced above and that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certifications is true and accurate, and he or she then signed these Certifications in my presence.

WITNESS my hand and official seal this 1 day of September, 2016.

*Serah J. Roy*  
Notary Public (signature)

(OFFICIAL SEAL)

My commission expires: 1/22/20



**APPENDIX G**

**REMEDIAL DESIGN COMPLETION CERTIFICATION**

**REMEDIAL DESIGN COMPLETION CERTIFICATION  
15A NCAC 13C.0306(b)(5)(D)**

Media (check all that apply):  All Media  Soil  Ground water  Surface water  Sediment

REC is in compliance with both 15A NCAC 13C .0305(b)(2) and .0305(b)(3): [check]

Site Name Robert Bosch Tool Corporation Street Address 482 State Farm Road  
County Watauga Boone, NC  
Site ID No. NONCD0001139

The remedial design, which is the subject of this certification has, to the best of my knowledge, been completed in compliance with the Inactive Hazardous Sites Response Act N.C.G.S. 130A-310, et seq. and the remedial action program Rules 15A NCAC 13C .0300. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information.

Paul S. Johnstone 8/29/16  
RSM Signature Date  
Paul S. Johnstone  
RSM Name Amec Foster Wheeler Environment & Infrastructure, Inc. 4021 Stirrup Creek Drive, Suite 100  
REC Name 00089 Mailing Address  
REC No. Durham, NC 27703  
City, State, ZIP

**NOTARIZATION**

South Carolina (Enter State)

Greenville COUNTY

I, Serah J. Roy, a Notary Public of said County and State, do hereby certify that Paul S. Johnstone did personally appear and sign before me this day, produced proper identification in the form of SC Drivers License, was duly sworn or affirmed, and declared that, he or she is the duly authorized environmental consultant of the remediating party of the property referenced above and that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certification is true and accurate, and he or she then signed this Certification in my presence.

WITNESS my hand and official seal this 29 day of August, 2016.

Serah J. Roy  
Notary Public (signature)

(OFFICIAL SEAL)

My commission expires: 1/22/20

