Remedial Action Work Plan

Colgate Avenue Site
Buffalo, New York

June 2009
Revised May 2010

0100-001-200

Prepared For:

AMERON INTERNATIONAL

Prepared By:

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

2558 Hamburg Turnpike, Suite 300, Buffalo, New York | P: (716) 856-0599 | F: (716) 856-0583

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CERTIFICATION:

Thomas H. Forbes, P.E. — Date: 5-25-10

License No.: 070950-1

Registration State: New York

SEAL:

REMEDIAL ACTION WORK PLAN

COLGATE AVENUE SITE

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1.0 INTRODUCTION

1.1 Site Description

The Colgate Avenue Site encompasses approximately 3.2 acres in the southern portion of the City of Buffalo, New York (see Figure 1). The Site is generally bounded by Colgate Avenue to the north, residential properties along Colgate Avenue to the east, light industrial properties to the south (fronting on Okell Street), and commercial and industrial properties to the west (see Figure 2). Colgate Avenue terminates at the northwestern gate of the Ameron property. Due to a fire in November 2009 and subsequent emergency demolition, only foundations remain of the manufacturing building (Plant No. 1), warehouse, and Furan Building. The 2-story office building, which is in sound condition, remains and is currently leased for storage. Surrounding property is comprised primarily of residential housing and light industrial business.

1.2 Background

1.2.1 Historic Operations

Beginning in approximately 1960 and continuing to 1982, Ameron (or its predecessors) operated a protective coatings manufacturing facility on the subject property. During 1983 and 1984, environmental investigations revealed the presence of certain chemicals in soil and shallow groundwater beneath the western most portion of the former manufacturing building. As a result, in 1986 Ameron entered into an Order on Consent with the New York State Department of Environmental Conservation (NYSDEC), whereby Ameron installed, maintained, and operated a sub-floor soil vapor extraction (SVE) system for a 10-year period. The system was constructed and installed in 1988, approved by NYSDEC in 1989, and operated by Ameron through 1999.

At the conclusion of these remedial activities, Ameron sought delisting of the Site from NYSDEC's Registry of Inactive Hazardous Waste Sites. NYSDEC indicated that although the terms of the 1986 Order on Consent were completed to their satisfaction, insufficient data existed to establish that the remedial action goals had been attained. Consequently, NYSDEC denied the delisting and required further investigation of the property.

1.2.2 Previous Investigations and Remedial Measures

In 1985, Ameron signed an Order on Consent with the NYSDEC for remediation of the Site; specifically, contamination beneath the Plant No. 1 building slab. Although other minor remedial elements were completed, the primary requirement was installation of a soil vapor extraction (SVE) system under the two westernmost rooms of Plant No. 1. The SVE system was operated from approximately 1989 to 1999 within the concrete block and brick building located at the western edge of Plant No. 1. The Order on Consent required operation of the SVE system for a period of 10 years.

In November 2001, Ameron retained AFI Environmental to conduct a limited subsurface site investigation (Ref. 1) to confirm that SVE successfully remediated contaminants of concern to levels below the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #4046 Recommended Soil Cleanup Objectives (RSCOs). The investigation results were reported in AFI's report, Subsurface Soil Investigation and Water Analysis for MW-2, dated November 2001.

In June 2004, Ameron retained AFI to conduct a supplemental site investigation (Ref. 2) for the purposes of delisting the property prior to closing the USTs. Because no RCRA substances, listed hazardous substances, or contaminants of concern (other than petroleum) were identified, Ameron once again requested that the Site be delisted. The NYSDEC denied delisting of the property until the underground storage tank (UST) closure project was complete.

In August 2004, AFI prepared and submitted to the NYSDEC a Remedial Action Work Plan (RAWP) for the investigation and removal of the USTs (Ref. 3). The RAWP, which was approved by the NYSDEC, was implemented from October to December 2004. Remedial work involved the removal, cleaning, and recycling of 11 USTs and off-site landfill disposal of 2,839 tons of impacted soils from the western portion of the Site. The soil was disposed at a permitted landfill (Modern Landfill) under a "contained-in" hazardous waste management exclusion issued by NYSDEC. Post-excavation confirmatory sampling verified that TAGM 4046 RSCOs were achieved. In April 2005, AFI issued a Remedial Action Work Report describing the October to December 2004 UST and soil removal activities.

In December 2004, Ameron entered into an Order on Consent (Index #B9-0680-04-011) with NYSDEC to complete a records search for the property and a Remedial Investigation/Feasibility Study (RI/FS). The Site is currently listed in the New York State Registry of Inactive Hazardous Waste Disposal Sites as Site Number 915133 with a

Classification of "4" pursuant to ECL 27-1305. Class "4" sites are defined as sites that have been properly closed but require continued management. The Order on Consent requires completion of a site records search as well as preparation and implementation of an RI/FS Work Plan incorporating the elements of an RI/FS as set forth in the USEPA guidance document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA," dated October 1988.

1.3 Remedial Investigation

RI field activities were initially completed during the period of April 19 through May 3, 2006 in general accordance with the NYSDEC-approved RI/FS Work Plan (Ref. 4). Following review of the 2006 RI sample data, the NYSDEC required collection of additional samples for lead and PCBs in surface soils, as well as a supplemental groundwater sample for VOC analysis. The supplemental sampling work was performed on January 3, 2007. Between October 2008 and January 2009, Benchmark completed a supplemental boring and groundwater investigation in the northwestern portion of the Site, downgradient of the former UST field.

The RI and supplemental investigations generally revealed: PCBs above commercial SCOs in the vicinity of soil boring SB-5 and surface samples SS-1 and SS-2; elevated concentrations of lead in soils at soil borings SB-5 and SB-3 and surface soil sample SS-2; elevated aromatic VOCs in groundwater near temporary well TMW-3; and chlorinated VOCs in groundwater in the isolated area around TMW-2.

1.4 Building Demolition

On November 3, 2009, a fire destroyed portions of the buildings on-site. On November 13, 2009, Ameron conducted an emergency demolition of all on-site structures with the exception of the 2-story office building, which is in sound condition and currently leased for storage; only foundations remain of the manufacturing building (Plant No. 1), warehouse, and Furan Building. A Pre-Demolition Survey Report had already been performed in the fall of 2008, as per City of Buffalo Department of Economic Development, Permit & Inspections and New York State Department of Labor-Division of Asbestos, in preparation to demolish these structures. Due to this incident, all asbestos containing materials was removed and disposed under an emergency controlled demolition contract at a regulated asbestos disposal facility.

1.5 Remedial Action Objectives

The RI/FS Report (Ref. 5) was submitted to NYSDEC in May 2009, revised based on discussions with the NYSDEC and New York State Department of Health (NYSDOH), and resubmitted in January 2010. The Remedial Action Objectives (RAOs) for the Site include:

- Mitigate potential health risk resulting from contact with lead-contaminated soil/fill in vicinity of soil borings SB-5 and SB-3 and surface soil sample SS-2.
- Mitigate potential health risk resulting from contact with PCB-contaminated soil/fill in vicinity of surface soil samples SS-1 and SS-2.
- Mitigate potential health risk resulting from chlorinated VOCs in groundwater near temporary monitoring well TMW-2.
- Mitigate potential health risk resulting from aromatic VOCs organics in groundwater near temporary monitoring well TMW-3.
- Implement engineering and institutional controls to assure that the Site is not used in a manner inconsistent with the reasonably anticipated future use scenario.

The following remedial alternatives were evaluated in the RI/FS, in accordance with 6NYCRR Part 375-1.8(f), to determine whether they would satisfy the RAOs for the Site:

- No further action.
- Excavation of lead-and PCB-impacted soil/fill with off-site disposal.
- Asphalt cover system construction over impacted soil/fill areas.
- In-situ anaerobic bioremediation of chlorinated VOCs and in-situ aerobic bioremediation of aromatic VOCs in groundwater.

For this Site, the reuse assessment presented in the RI/FS concluded that a commercial or industrial end use would be the reasonably anticipated future use of the Site based on past use, zoning, and nearby property use. Accordingly, remedial alternatives for the impacted soil/fill were evaluated in the context of addressing soil/fill exceeding commercial health-based soil cleanup objectives (SCOs) per 6NYCRR Part 375-6, which are considered the applicable, relevant and appropriate requirements for soil media at the site. Groundwater alternatives were evaluated relative to Class GA groundwater quality standards and guidance criteria per NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1.

1.6 Remedial Measures

Based on the evaluation performed in the RI/FS, it was recommended that remedial activities include: focused excavation and off-site disposal of soils in areas exhibiting lead and PCB concentrations above commercial SCOs; injection of hydrogen release compound (HRC®) in the area surrounding temporary monitoring well TMW-2; and injection of oxygen release compound (ORC®) in the area surrounding temporary monitoring well TMW-3. This alternative is fully protective of human health and the environment; meets all RAOs and screening criteria; and poses minimal disruption or risk to the surrounding community. These would be considered final remedial measures to supplement the source area tank/soil removal and soil vapor extraction activities that have already been undertaken as interim remedial measures on the property.

The chlorinated organics detected in the isolated area surrounding TMW-2 are present at levels that may result in unacceptable indoor air concentrations and, therefore, the Site Management Plan will include a requirement for vapor intrusion mitigation during future redevelopment. At a minimum, this will involve construction of a barrier beneath any newly constructed buildings on the property. Other elements of the Site Management Plan will include an Environmental Easement to restrict redevelopment to commercial activities; post-remedial certification that the remedial measures remain in place and effective; and post-remedial groundwater monitoring activities.

Details of the planned remedial action are presented in Section 2.0.

1.7 Purpose and Scope

This Remedial Action (RA) Work Plan identifies the scope of planned remedial measures and the means by which they will be completed, as well as a site-specific Health and Safety Plan (Appendix A) and post-remedial requirements.

1.8 Project Organization and Responsibilities

The remedial activities will be completed by Benchmark under a design-build agreement with Ameron. The NYSDEC Division of Environmental Remediation will monitor the remedial activities to verify that the work is performed in accordance with the approved Remedial Action Work Plan and NYSDEC DER-10 guidance (Ref. 6).

Benchmark is a licensed professional engineering firm with extensive experience in design, construction, and operation of remedial measures at solid and hazardous waste facilities.

The designated Project Manager for the Colgate Site is Thomas H. Forbes, P.E. Mr. Forbes has over 20 years experience in the design, implementation, maintenance and monitoring of remedial measures, and has served as Project Manager for RI/FS work at the Colgate Site since 2005. Mr. Forbes shall be the primary contact for NYSDEC on all matters relating to Work at the Site and will be available for contact during all working days.

2.0 DESCRIPTION OF PLANNED REMEDIAL MEASURES

A detailed description of the planned remedial construction measures for the Site is presented in this section.

2.1 Mobilization

The remediation contractor's field operations at the Site will commence with mobilization, which will include mobilizing equipment and materials to the Site.

2.2 Excavation and Off-Site Disposal

As defined in the RI/FS Report, excavation of the PCB/lead-impacted soil/fill will be limited to 25 square yard (225 square foot) areas around sample locations SB-3, SB-5, SS-1, and SS-2 (see Figure 3). Excavation will proceed to a depth of 1.5 feet below ground surface (fbgs) at all locations with the exception of SB-5, which will terminate at a depth of 2 fbgs. The resultant volume of impacted soil/fill is approximately 55 cubic yards. Based on the extensive Site sampling data showing that the impacts in these areas are isolated and limited to the subject sample locations, confirmatory sampling will not be performed.

The excavated materials will be transported to and disposed at a permitted, off-site disposal facility. Supplemental sampling and analysis will be performed as necessary prior to excavation work to secure off-site disposal facility approval of the materials. This will likely require sampling the lead-impacted excavation areas for leachable lead via the toxicity characteristic leaching procedure (TCLP). In the event the soil/fill exceeds TCLP criteria for lead, Benchmark will evaluate use of a stabilizing agent (Portland cement) to reduce leachability below TCLP limits. This would involve trial, insitu blending of Portland cement within a portion of one of the lead-impacted areas at an approximate ratio of 3-5% Portland by weight. Blending would be performed via an excavator bucket followed by resampling for leachable lead.

If the testing indicates results below TCLP limits, the remaining materials will be stabilized in place as necessary and the excavated soil/fill will be disposed at a sanitary (RCRA Subtitle D) landfill facility. If the soil/fill fails TCLP criteria and cannot be cost-effectively stabilized on-site, it would need to be treated at an off-site Treatment, Storage and Disposal Facility (TSDF) to meet State and Federal Land Disposal Restriction (LDR) criteria prior to disposal. In that case the treatment step would involve off-site stabilization with a proprietary reagent to reduce lead leachability before disposal in a RCRA Subtitle C facility.

2.3 Backfill and Restoration

Following excavation, each of the resultant depressions will be backfilled to with clean topsoil and seeded to promote vegetative growth. The lower 8 inches of the depression will be compacted to minimize settling. Off-site topsoil will originate from a known source having no evidence of disposal or releases of hazardous substances; hazardous, toxic or radioactive wastes; or petroleum and will meet the criteria for backfill per 6NYCRR Part 375-6.7(d). Accordingly, a representative sample of the off-site topsoil will be collected in accordance with the FOP presented in Appendix B and analyzed for the parameters identified in 6NYCRR Part 376-6.8 (i.e., VOCs, SVOCs, pesticides/PCBs, cyanide and inorganic compounds) in accordance with USEPA SW-846 Methodology to confirm compliance with commercial SCOs and protection of groundwater quality concentrations per 6NYCRR Part 375-6.8. Sample test results and the source of the topsoil will be provided to the NSYDEC for review and approval prior to import of the material.

Following placement, the topsoil will be seeded with 100 lbs/acre of seed conforming to the following:

Name of Grass (1,2,3)	Application Rate (lbs/acre)	Purity (%)	Germination (%)
Perennial Ryegrass	10	95	85
Kentucky Bluegrass	20	85	75
Strong Creeping Red Fescue	20	95	80
Chewings Fescue	20	95	80
Hard Fescue	20	95	80
White Clover	10	98	75

(1) Germination and purity percentages should equal or exceed the minimum seed standards listed. If it is necessary to use seed with a germination percentage less than the minimum recommended above, increase the seeding rate accordingly to compensate for the lower germinations.

(2) Weed seed content not over 0.25 percent and free of noxious weeds.

(3) All seed shall be rejected if the label lists any of the following grasses:
   1) Sheep Fescue
   2) Meadow Fescue
   3) Canada Blue
   4) Alta Fescue

5) Kentucky 31 Fescue
6) Bent Grass

2.4 In-Situ Groundwater Treatment

2.4.1 HRC® Injection

Remediation of the chlorinated VOCs in groundwater in the vicinity of temporary monitoring well TMW-2 will be accomplished through direct injection of Hydrogen Release Compound® (HRC®) to stimulate anaerobic bioremediation in this area of the Site. To determine the amount of HRC® necessary to effect bioremediation of the chlorinated organics in the TMW-2 source area, site-specific physical and chemical information was provided to Regenesis, Inc., the HRC® manufacturer. Contaminant concentration data for the TMW-2 groundwater as well as site-specific water quality information was provided. This included RI data for chemical oxygen demand (COD), dissolved oxygen, total and soluble iron and manganese, oxidation-reduction potential (ORP), and sulfate. TMW-2 boring lithology indicates that the saturated zone was encountered at approximately 10 fbgs and continued to the confining layer at 14 fbgs. Accounting for an additional foot of groundwater fluctuation, the impacted area was modeled by Regenesis as a 5-foot thick zone beginning at 9 fbgs and extending to 14 fbgs. Because nearby borings B-5, B-6, B-8 and B-9 did not yield evidence of impact, the areal extent of the source was assumed to be limited by these borings and was therefore conservatively modeled as an approximate 50-foot by 50-foot area.

The model results indicate that injection of 570 lbs of HRC® into the contaminated groundwater will result in plume degradation to acceptable levels at or near groundwater quality standards. As shown on Figure 4, approximately 16 delivery points spaced on 12.5-ft centers would be necessary to treat the area surrounding monitoring well TMW-2. Each point will receive approximately 7 lbs of HRC® per foot of saturation, for a total of approximately 35 lbs of HRC® delivered per point. Appendix C includes HRC® installation instructions.

2.4.2 ORC Advanced™ Injection

Remediation of the aromatic VOCs in groundwater in the vicinity of temporary monitoring well TMW-3 will be accomplished through injection of advanced formula Oxygen Release Compound (ORC *Advanced*™) to stimulate aerobic bioremediation in this area of the Site. To determine the amount of ORC *Advanced*™ necessary to effect

bioremediation of the chlorinated organics in the TMW-3 source area, site-specific physical and chemical information was provided to Regenesis, Inc., the manufacturer of this material. Contaminant concentration data for the TMW-3 groundwater as well as site-specific water quality information was provided. This included RI data for COD, dissolved oxygen, total and soluble iron and manganese, ORP, and sulfate from groundwater monitoring well MW-2R. TMW-3 boring lithology indicates that the saturated zone was encountered at approximately 6 fbgs and continued to the confining layer at 8 fbgs. Accounting for an additional foot of groundwater fluctuation, the impacted area was modeled by Regenesis as a 3-foot thick zone beginning at 6 fbgs and extending to 9 fbgs.

Because nearby borings B-6 and B-7 did not yield evidence of impact, the areal extent of the source was assumed to be limited by these borings and was therefore conservatively modeled as an approximate 70-foot by 70-foot area.

The model results indicate that injection of 750 lbs of ORC *Advanced*™ into the contaminated groundwater would be an appropriate quantity of material for the contaminant concentrations present in the saturated zone. As shown on Figure 4, approximately 49 delivery points spaced on 10-ft centers would be necessary to treat the area surrounding monitoring well TMW-3. Each point will receive approximately 5 lbs of ORC *Advanced*™ per foot of saturation, for a total of approximately 15 lbs of ORC *Advanced*™ delivered per point. Appendix D includes ORC *Advanced*™ installation instructions.

2.4.3 Injection Details

Injection of the ORC *Advanced*™ slurry will be accomplished using drive rods with an inner diameter of at least 5/8 of an inch. The grout pump used to inject the slurry must have a pumping rate of at least 3 gpm and a pressure rating of at least 500 pounds per square inch (psi). Recommended pumps include: [1] R.E. RUPE Company Model ORC/HRC 9-1500 mixing and pumping machine and [2] Geoprobe GS-2000 pump.

2.5 Off-Site Disposal of Investigation-Derived Waste

Activated carbon and investigation-derived soil cuttings (approximately 7 drums total) staged on-site, were damaged by the structure fire in November 2009. Damaged drums were removed with other regulated waste as part of the subsequent building demolition. The contents of the two remaining drums will be disposed off-site with impacted soil/fill; empty drums will be decontaminated and scraped off-site.

2.6 Building Demolition Debris

During the demolition work, all contaminated debris was removed off-site to a regulated waste disposal facility. Clean crushed concrete and brick was placed in the loading dock area of the former Plant No.1 building to alleviate a potential hazard as adjacent grades were higher. The City of Buffalo Department of Inspections has recommended this area be restored with cover materials to match surrounding grade and conditions. As part of the remedial measures, off-site topsoil (meeting the criteria presented in Section 2.3) will be placed over this berm face followed by approved off-site stone fill to blend in with the existing concrete slabs and match surrounding grades. Approximately 20 cubic yards of material will be used to complete this restoration.

2.7 Vapor Intrusion Mitigation

An Environmental Easement (see Section 4.2.1) will be filed for the property. The easement will require that all new buildings and structures designed for regular occupancy will be constructed with a foundation vapor barrier and/or subslab depressurization system to mitigate sub-slab vapor intrusion from residual chlorinated VOCs in groundwater. Vapor barriers will be comprised of a minimum 8-mil poly membrane placed beneath and in contact with the underside of the concrete floor slab at the lowest floor level(s) within the building. Subslab depressurization, if employed, will involve design and installation of an appropriately designed subslab collection system (typically porous stone media and collection piping) and outdoor-mounted continuous duty fan(s) to yield negative pressure beneath the floor slab. The mitigation measures will be designed and installed in accordance with the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006 (Ref. 7).

3.0 SUPPORT DOCUMENTS DURING REMEDIAL ACTIVITIES

3.1 Health and Safety Requirements

Benchmark has prepared a Site-Specific Health and Safety Plan (HASP) for use by its employees in accordance with 29 CFR 1910.120. The HASP will cover all on-site remediation activities. Benchmark's HASP is provided for informational purposes in Appendix A. The remediation subcontractor will be required to develop and enforce a HASP as or more stringent than Benchmark's. The HASP includes the following site-specific information:

- A hazard assessment.
- Training requirements.
- Definition of exclusion, contaminant reduction, and other work zones.
- Monitoring procedures for site operations.
- Safety procedures.
- Personal protective clothing and equipment requirements for various field operations.
- Disposal and decontamination procedures.

Health and safety activities will be monitored throughout the remedial field activities. A member of the field team will be designated to serve as the on-site Health and Safety Officer throughout the field program. This person will report directly to the Project Manager and the Corporate Health and Safety Coordinator. The HASP will be subject to revision as necessary, based on new information that is discovered during the remedial activities.

3.2 Community Air Monitoring Requirements

Real-time community air monitoring will be performed during remedial activities at the Site. A Community Air Monitoring Plan (CAMP) is included with Benchmark's HASP in Appendix A. Particulate monitoring will be performed continuously at the downwind location during all intrusive activities involving potentially impacted media (i.e., soil/fill excavation) in accordance with the CAMP.

The CAMP is consistent with the requirements for community air monitoring at remediation sites as established by the NYSDOH and NYSDEC. Accordingly, it follows procedures and practices outlined under NYSDOH's Generic Community Air Monitoring Plan (dated June 20, 2000) and NYSDEC Technical Assistance and Guidance Memorandum

(TAGM) 4031: Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites.

3.3 Erosion and Dust Controls

Mitigation and control of surface erosion from stormwater runoff and wind borne dust will be performed in conjunction with the remedial activities at the Site. Dust suppression techniques will be employed as necessary to mitigate fugitive dust from unvegetated or disturbed soil/fill to the extent practicable during construction. Dust suppression techniques will be initiated if the downwind PM-10 particulate level is 100 $\mu g/m^3$ above background (upwind perimeter). Techniques to be used may include one or more of the following:

- Applying water on access drives.
- Wetting equipment and excavation faces.
- Hauling materials in properly tarped containers or vehicles.
- Restricting vehicle speeds on-site.
- Covering exposed soil areas and materials during backfilling.

3.4 Remedial Activities Reporting

Benchmark will be on-site on a full-time basis to monitor remedial actions and document remedial activities. Such monitoring and documentation will include: construction stake-out, surveying, record drawings; daily reports of activities; community air monitoring results; and progress photographs and sketches.

3.4.1 Construction Monitoring

Standard daily reporting procedures will include preparation of a daily report and, when appropriate, problem identification and corrective measures reports. Appendix B contains sample project documentation forms. Information that may be included on the daily report form includes:

- Processes and locations of construction under way.
- Equipment and personnel working in the area, including subcontractors.
- Lateral and vertical extent of excavation areas.
- Number of truckloads of impacted soil/fill leaving the Site for disposal.
- Number and type of truckloads of materials imported to the Site.

- Amount and type of treatment chemicals applied and related treatment activities.
- Grid locations and depths being treated.

Photo documentation of the remedial activities will be prepared by a field representative throughout the duration of the project as necessary to convey typical work activities and whenever changed conditions or special circumstances arise.

The completed reports will be available on-site and submitted to the NYSDEC as part of the Final Engineering Report. The NYSDEC will be promptly notified of problems requiring modifications to this Work Plan prior to proceeding or completion of the construction item.

4.0 POST-REMEDIAL REQUIREMENTS

4.1 Final Engineering Report

A Final Engineering Report (FER) will be prepared at the conclusion of remedial activities. The FER will be prepared using the NYSDEC's Final Engineering Report template, and will include the following information and documentation:

- Introduction, background, and Site description.
- The remedial action objectives
- A description of the selected remedy
- A summary of the remedial actions performed
- Governing documents
- Remedial program elements
- A description of the contaminated materials removal
- Performance documentation and sampling
- Imported backfill characteristics
- Contamination remaining at the Site
- Deviations from the Work Plan
- A Site or area planimetric map showing the parcel remediated, including significant site features.
- Planimetric map showing location of all groundwater sampling locations with sample identification labels/codes.
- Copies of daily inspection reports and, if applicable, problem identification and corrective measure reports.
- Photo documentation of remedial activities.

4.2 Site Management Plan

A Site Management Plan (SMP) will be prepared and submitted concurrent with completion of the remedial construction activities. The purpose of the Site Management Plan is to assure that proper procedures are in place to provide for long-term protection of human health and the environment after remedial construction is complete. The SMP is comprised of four main components:

- An Engineering and Institutional Control Plan.

- Inspection, Reporting and Certification Requirements, including Institutional Control and Engineering Control (IC/EC) Certification.
- A Site Monitoring Plan
- An Operation & Maintenance Plan

4.2.1 Engineering and Institutional Control Plan

An institutional control in the form of an Environmental Easement will be necessary to: limit future use of the Site to restricted (commercial or industrial) applications; prevent groundwater use for potable purposes; and eliminate sub-slab vapor mitigation by requiring a vapor barrier beneath any new structures erected on the property. The easement will be filed concurrent with remedy implementation.

Benchmark will prepare an Engineering and Institutional Control Plan that will include a complete description of all institutional and/or engineering controls employed at the site, including the mechanisms that will be used to continually implement, maintain, monitor, and enforce such controls. Plans for implementation of the engineering and institutional controls may include:

- Soil management that details procedures for handling soil excavated during maintenance or redevelopment of the site (e.g., a soils management plan).
- Installation/operation of the vapor barrier and, if necessary, a sub-slab vapor depressurization system to address vapor intrusion.
- Engineering control inspection plans, for the remedy as implemented or to be installed as part of the site development, such as for a cap or cover system.
- A periodic review report that includes the IC/EC certification as well as all other reporting of the IC/ECs, site monitoring, and/or operation and maintenance of the remedy.

4.2.2 Site Monitoring Plan

The Site Monitoring Plan will consist of a sampling and analysis plan for monitoring groundwater designed to:

- Assess the remedy's compliance with groundwater standards.
- Evaluate site information periodically to confirm that the remedy continues to be effective for the protection of public health and the environment.
- Prepare the necessary reports of the results of this monitoring for a period determined by the NYSDEC.

Groundwater monitoring and reporting will be performed on a semi-annual basis for two years following completion of remedial construction activities.

4.2.3 Operation & Maintenance Plan

The Site remedy does not rely on any mechanical systems, such as sub-slab depressurization systems or air sparge/soil vapor extraction systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in the SMP.

4.2.4 Inspection, Reporting, and Certification Requirements

Ameron International will complete and submit to the NYSDEC a routine Periodic Review Report that will summarize Site monitoring activities and inspections required by the Site Monitoring Plan. The frequency of the Periodic Review Report will be established in the Site Management Plan. In addition, Ameron will retain a Qualified Environmental Professional to prepare an IC/EC Certification to certify that:

- The institutional controls and/or engineering controls employed at the site are:
  - Unchanged from the date the control was put in place, unless otherwise approved by the NYSDEC;
  - In place and effective;
  - Performing as designed;
  - Nothing has occurred that would impair the ability of the controls to protect the public health and environment; and
  - Nothing has occurred that constitutes a violation or failure to comply with any operation and maintenance plan for such controls.
- Use of the site complies with the environmental easement.
- Access to the site will be provided to the NYSDEC to evaluate the remedy and verify continued maintenance of such controls.
- If a financial assurance mechanism is required, the mechanism remains valid and sufficient for the intended purpose.

The IC/EC Certification will be provided coincidental with the Periodic Review Report.

5.0 PROJECT SCHEDULE

Figure 5 presents an overall project schedule for the performance of remedial action activities. As indicated, the schedule anticipates substantial completion of focused soil/fill excavation and in-situ HRC®/ORC *Advanced*™ injection in July-August 2010. This is predicated on timely review and approval of the RA Work Plan and receipt of necessary approvals within the timeframes shown. The NYSDED will be informed of field activities in advance of mobilization.

6.0 REFERENCES

1. AFI Environmental. *Letter Report on Subsurface Soil Investigation and Water Analysis MW2 at Ameron Site, 111 Colgate Avenue, Buffalo, New York*. November 30, 2001.

2. AFI Environmental. *Supplemental Site Investigation and Closure Report, Ameron Site, City of Buffalo, Erie County, New York*. July 21, 2004.

3. AFI Environmental. *Remedial Action Work Plan, Ameron Site, City of Buffalo, Erie County, New York*. August 2004.

4. Benchmark Environmental Engineering & Science, PLCC. *Remedial Investigation/ Feasibility Study (RI/FS) Work Plan, Colgate Avenue Site, Buffalo, New York*. January 2006.

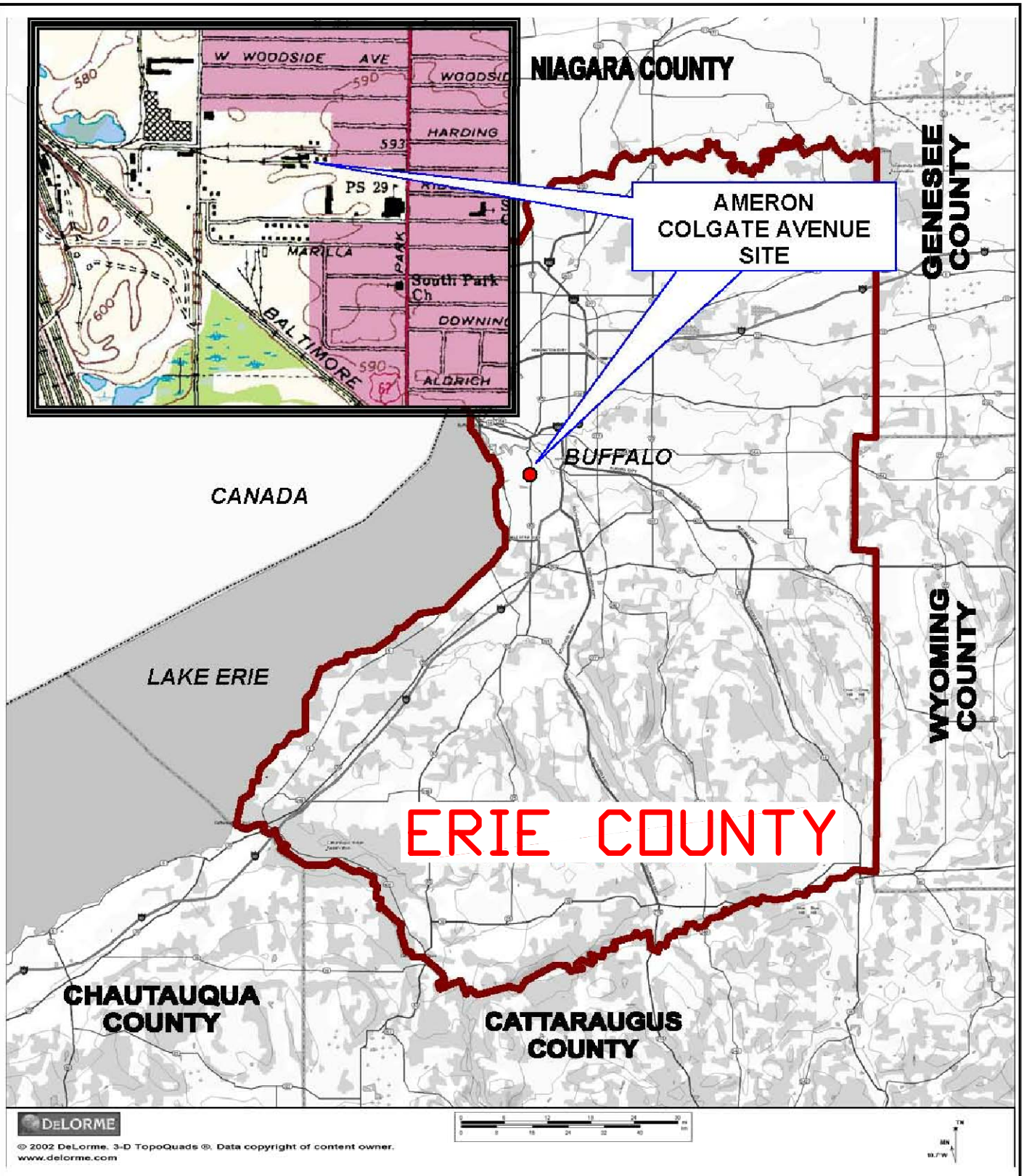
5. Benchmark Environmental Engineering & Science, PLCC. *Remedial Investigation/ Feasibility Study (RI/FS) Report, Colgate Avenue Site, Buffalo, New York*. May 2009.

6. New York State Department of Environmental Conservation. *Draft DER-10; Technical Guidance for Site Investigation and Remediation*. December 2002.

7. New York State Department of Health. *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*. October 2006.

FIGURES

FIGURE 1



BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC
2558 HAMBURG TURNPIKE
SUITE 300
LACKAWANNA, NY 14218
(716) 856-0599

PROJECT NO.: 0100-001-200

DATE: MAY 2009

DRAFTED BY: AJZ

SITE LOCATION AND VICINITY MAP

REMEDIAL ACTION WORK PLAN

COLGATE AVENUE SITE
BUFFALO, NEW YORK

PREPARED FOR
AMERON INTERNATIONAL

F:\CAD\Benchmark\Ameron International\Colgate Avenue\RA WORK PLAN\Figure 1; Site Location and Vicinity Map.dwg, 6/1/2009 1:44:07 PM

F:\CAD\Benchmark\Ameron International\Colgate Avenue\RA WORK PLAN\Figure 1; site location and vicinity map.dwg

READING STREET

COLGATE AVENUE (abandoned)

COLGATE AVENUE

South Buffalo Railroad

MW-2

MW-4

MW-7A

MW-3

119 FZ-1

Plant No. 1

Warehouse

Furan Bldg.

MW-6

MW-5

113
(Ameron International)

MW-1

117
(Philip Dickinson Gordon)

110
(Niagara Cold Drawn)

109

141

143

77

131

145

157

179

195

211

2133

99

97

120

122
(Nukem Products Corp)

138

142

146

156

158

162

182

186

206

2141

88

95

121 125 127 129 131 135 139 141 145 149 151 155 157 161 163 167 169 171 175 179 185 187 193 195 199 203 209 211

2157

2163

2167

95
(Rubenstein Jacob & One)

42

59

57

53

12 14 16

18

LARRABEE STREET

9

15

26 24 22

14

88
(Consumers Beverage, Inc.)

90
(Philip Dickinson Gordon)

92
(City of Buffalo - Parks & Recreation)

2175

2191

2193

40

HOPKINS STREET

CARTER STREET

OKELL STREET

SOUTH PARK AVENUE

11

1

17

27 33 37 43 47 53 57 63 67 73 77 83 87 91 97 103 107 111 117 121 135 137 143 145 149 157

2227

232 234 236 238 240 242 244 250 252 254 256 258 274 276 278 280 288 292 296 300 304 308 312 316 320 324 328 332 336 340 344 348 352 356 362 366 368 372 376 378 382 386 390 392 396 400 402 404 406 410 412 416 420 422

111

MARILLA STREET

207

NEVILLY CT EAST

NEVILLY CT WEST

ZOLLARS AVENUE

B&O Railroad

2

109
(Steelfields - Marilla St, LF)

B&O Railroad

N

200' 0' 200' 400'

SCALE: 1 INCH = 200 FEET
SCALE IN FEET
(approximate)

LEGEND:

PROPERTY BOUNDARY

MW-1 EXISTING MONITORING WELL

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SUITE 300
LACKAWANNA, NY 14218
(716) 856-0599

BENCHMARK
ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

JOB NO.: 0100-001-200

SITE PLAN

REMEDIAL ACTION WORK PLAN

COLGATE AVENUE SITE
BUFFALO, NEW YORK

PREPARED FOR
AMERON INTERNATIONAL

FIGURE 2

F:\CAD\Benchmark\Ameron International\Colgate Avenue\RA WORK PLAN\Figure 2; Site Plan.dwg, 6/1/2009 2:46:49 PM

DATE: MAY 2007
DRAFTED BY: BCH

F:\CAD\Benchmark\Ameron International\Colgate Avenue\RA WORK PLAN\Figure 3; SOIL-FILL EXCAVATION PLAN.dwg

LEGEND:

- PROPERTY BOUNDARY
- MW-4 MONITORING WELL
- MW-2R REPLACEMENT MONITORING WELL
- SB-1 PLANNED SUPPLEMENTAL BORING
- TP-1 RI TEST PIT LOCATION (7)
- SS-1 RI SURFACE SOIL SAMPLE (2)
- PZ-1 RI PIEZOMETER (1)
- DEMOLISHED STRUCTURE
- 15' X 15' EXCAVATION AREA

COLGATE AVENUE (abandoned)

COLGATE AVENUE

MW-2R

MW-7A

PZ-1

Former Plant No. 1

2-STORY OFFICE

121

125

SB-6

SB-5

SB-4

SB-3

SS-1

SS-2

Former Warehouse

Former Furan Bldg.

SB-1

SB-2

TP-7

TP-4

TP-5

TP-6

MW-6

South Buffalo Railroad
(abandoned)

TP-1

TP-2

TP-3

MW-5

Former AST Cradle

88
(Consumers Beverage, Inc.)

N

50' 0' 50' 100'

SCALE: 1 INCH = 50 FEET
SCALE IN FEET
(approximate)

DATE: FEBRUARY 2010
DRAFTED BY: AJZ

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SUITE 300
BUFFALO, NEW YORK 14218
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FOCUSED SOIL/FILL EXCAVATION PLAN

REMEDIAL ACTION WORK PLAN

COLGATE AVENUE SITE
BUFFALO, NEW YORK

PREPARED FOR
AMERON INTERNATIONAL

FIGURE 3

F:\CAD\Benchmark\Ameron International\Colgate Avenue\RA WORK PLAN\Figure 4; HRC AND ORC Injection Plan.dwg

LEGEND:

- PROPERTY BOUNDARY
- MW-4 EXISTING MONITORING WELL
- MW-2R REPLACEMENT MONITORING WELL
- MW-5 RI MONITORING WELL
- PZ-1 RI PIEZOMETER
- B-3 BORING
- TMW-2 TEMPORARY WELL
- MW-7A SUPPLEMENTAL MONITORING WELL
- 499 GROUNDWATER CONTOUR (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION
- HRC DIRECT-PUSH INJECTION POINT
- ORC DIRECT-PUSH INJECTION POINT

South Buffalo Railroad (abandoned)

122 (Nukem Products Corp)

138

142

146

COLGATE AVENUE (abandoned)

COLGATE AVENUE

MW-2R (496.8)

MW-4 (496.3)

MW-7A

B-4

TMW-4

B-1

TMW-1

PZ-1 (498.3)

B-9

B-2

TMW-2

B-6

B-3

TMW-3

B-7

B-5

Former Plant No. 1

2-STORY OFFICE

MW-3R (495.9)

121

125

127

129

131

135

139

141

145

South Buffalo Railroad (abandoned)

496

Former Warehouse

Former Furan Bldg.

117 (Philip Dickinson Gordon)

MW-1 499.3

MW-6 (498.6)

497

MW-5 (498.7)

Former AST Cradle

498

88 (Consumers Beverage, Inc.)

90 (Philip Dickinson Gordon)

499

N

70' 0' 70' 140'

SCALE: 1 INCH = 70 FEET
SCALE IN FEET
(approximate)

DATE: FEBRUARY 2009
DRAFTED BY: THF/JCT/NTM

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SUITE 300
BUFFALO, NEW YORK 14218
(716) 856-0599

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JOB NO.: 0100-001-200

HRC AND ORC INJECTION PLAN

REMEDIAL ACTION WORK PLAN

COLGATE AVENUE SITE

BUFFALO, NEW YORK

PREPARED FOR

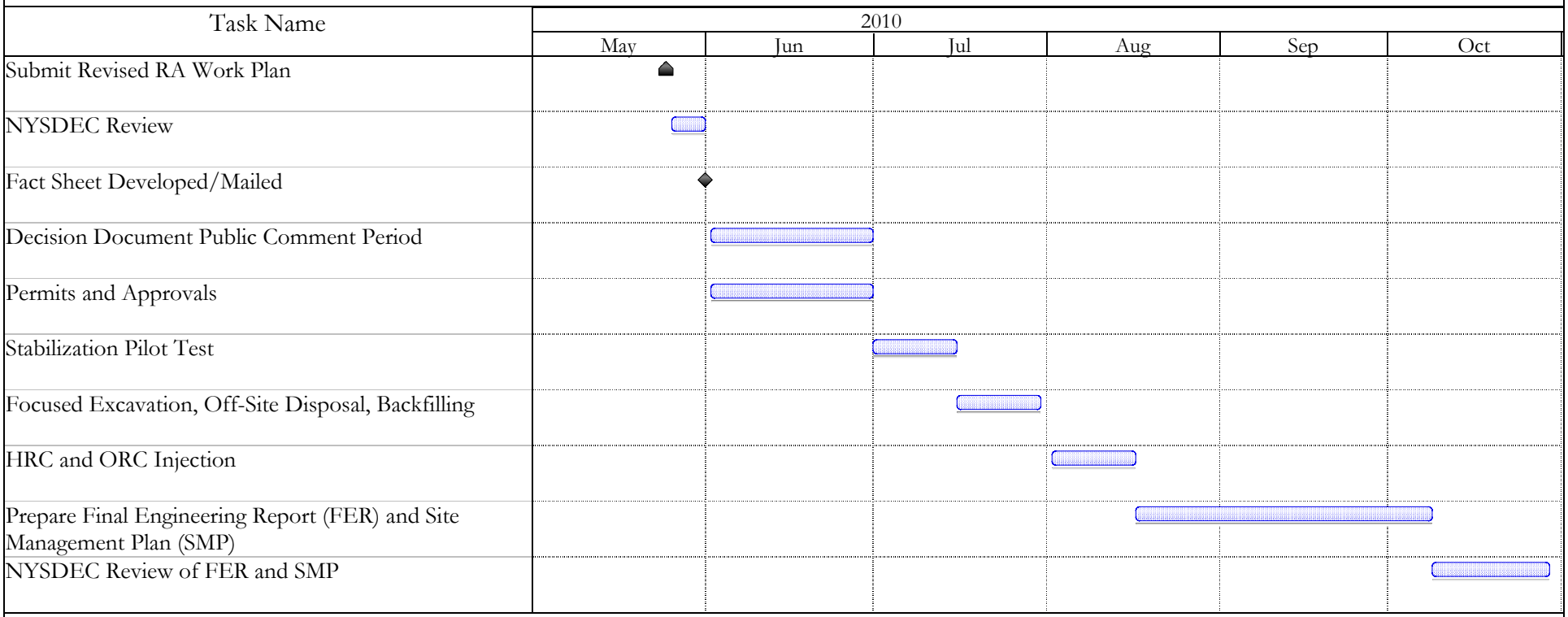
AMERON INTERNATIONAL

FIGURE 4

FIGURE 5
PROJECT SCHEDULE

REMEDIAL ACTION WORK PLAN
COLGATE AVENUE SITE

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC



APPENDIX A

HEALTH AND SAFETY PLAN

REMEDIAL ACTION WORK PLAN
APPENDIX A

HEALTH AND SAFETY PLAN (HASP)

COLGATE AVENUE SITE
BUFFALO, NEW YORK

June 2009 0100-001-200
Revised January 2010
Revised May 2010

Prepared for:

AMERON INTERNATIONAL

REMEDIAL ACTION WORK PLAN
APPENDIX A

HEALTH AND SAFETY PLAN FOR REMEDIAL ACTIVITIES
COLGATE AVENUE SITE

Plan Reviewed by (initial):

Corporate Health and Safety Director: Thomas H. Forbes

Project Manager: Thomas H. Forbes

Designated Site Safety and Health Officer: Bryan C. Hann

Acknowledgement:

I acknowledge that I have reviewed the information contained in this site-specific Health and Safety Plan, and understand the hazards associated with performance of the field activities described herein. I agree to comply with the requirements of this plan.

NAME (PRINT)	SIGNATURE	DATE

REMEDIAL ACTION WORK PLAN
APPENDIX A

HEALTH AND SAFETY PLAN FOR REMEDIAL ACTIVITIES
COLGATE AVENUE SITE

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REMEDIAL ACTION WORK PLAN
APPENDIX A

HEALTH AND SAFETY PLAN FOR REMEDIAL ACTIVITIES
COLGATE AVENUE SITE

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REMEDIAL ACTION WORK PLAN
APPENDIX A

HEALTH AND SAFETY PLAN FOR REMEDIAL ACTIVITIES
COLGATE AVENUE SITE

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Attachment A-2	NYSDOH Generic Community Air Monitoring Plan
Attachment A-3	Hot Work Permit Form

1.0 INTRODUCTION

1.1 General

In accordance with OSHA requirements contained in 29 CFR 1910.120 and USEPA Standard Operating Safety Guidelines, this Health and Safety Plan (HASP) describes the specific health and safety practices and procedures to be employed by Benchmark Environmental Engineering & Science, PLLC and TurnKey Environmental Restoration, LLC employees (referred to jointly hereafter as Benchmark-TurnKey) during remedial activities at the Colgate Avenue Site located in Buffalo, New York. This HASP presents information and procedures for Benchmark-TurnKey employees who will be involved with field activities, including the assignment of responsibilities, personnel protection requirements, work practices and emergency response procedures. It is not intended to cover the activities of other contractors or subcontractors on the Site; these firms will be required to develop and enforce their own HASPs as discussed below. In order to ensure that proper coordination on such key issues as emergency notification and decontamination exists between Benchmark-TurnKey and other contractors or subcontractors, Benchmark-TurnKey will review all HASPs and coordinate procedures where appropriate.

This HASP presents information on known Site health and safety hazards using available historical information for previously investigated areas of the Site, and identifies the equipment, materials and procedures that will be used to eliminate or control these hazards. Environmental monitoring will be performed during the course of field activities to provide real-time data for on-going assessment of potential hazards. This HASP will be updated as new investigation data becomes available.

All Benchmark-TurnKey personnel involved with the field activities associated with Site work will be required to comply with this HASP and any field modifications as directed by the Site Safety and Health Officer.

1.2 Site Location and Description

The Colgate Avenue Site encompasses approximately 3.2 acres in the City of Buffalo, New York. The Site is generally bounded by Colgate Avenue to the north, residential properties along Colgate Avenue to the east, light industrial properties to the south (fronting on Okell Street), and commercial and industrial properties to the west (see Figure 1 of the

Remedial Action Work Plan). Colgate Avenue terminates at the western gate of the Ameron property. Buildings within the Site are vacant, with Site structures generally limited to a portion of a former office and manufacturing building referred to as Plant No. 1; a warehouse; and production building referred to as the Furan Building. Surrounding property is comprised primarily of residential housing and light industrial business.

1.3 Site History

Beginning in approximately 1960 and continuing to 1982, Ameron (or its predecessors) operated a protective coatings manufacturing facility on the subject property. During 1983 and 1984, environmental investigations revealed the presence of certain chemicals in soil and perched water beneath the westernmost portion of the former manufacturing building. As a result, in 1986 Ameron entered into an Order on Consent with the New York State Department of Environmental Conservation (NYSDEC), whereby Ameron installed, maintained and operated a sub-floor soil vapor extraction (SVE) system for a 10-year period. The system was constructed and installed in 1988, approved by NYSDEC in 1989, and operated by Ameron through 1999.

At the conclusion of these remedial activities, Ameron sought delisting of the site from NYSDEC's Registry of Inactive Hazardous Waste Sites. NYSDEC indicated that although the terms of the 1986 Order on Consent were completed to their satisfaction, insufficient data existed to establish that the remedial action goals had been attained. Consequently, NYSDEC denied the delisting and required further investigation of the property.

1.4 Previous Investigations

A summary of the Site investigations and pertinent environmental activities at the Site is presented in Section 1.2.2 of the Remedial Action Work Plan.

1.5 Overview of Site Remedial Activities

Benchmark-TurnKey personnel will be on-site to observe remedial activities. The field activities to be completed are listed below and more fully described in the RA Work Plan for the Site (Ref. 1):

- Site preparation.
- Excavation of impacted soil/fill and backfilling of excavations.
- Injection of Hydrogen Release Compound® and Oxygen Release Compound®.
- Sampling of monitoring wells including measurement of field parameters.
- Community air monitoring.

2.0 ORGANIZATIONAL STRUCTURE

This chapter of the HASP describes the lines of authority, responsibility, and communication as they pertain to health and safety functions at the Site. The purpose of this chapter is to identify the personnel who will impact the development and implementation of the HASP and to describe their roles and responsibilities. This chapter also identifies other contractors and subcontractors involved in work operations and establishes the lines of communication among them for heath and safety matters. The organizational structure described in this chapter is consistent with the requirements of 29 CFR 1910.120(b)(2). This section will be reviewed by the Project Manager and updated as necessary to reflect the current organizational structure at this Site.

2.1 Roles and Responsibilities

All Benchmark-TurnKey personnel on the Site must comply with the minimum requirements of this HASP. The specific responsibilities and authority of management, safety and health, and other personnel on this Site are detailed in the following paragraphs.

2.1.1 Corporate Health and Safety Director

The Benchmark-TurnKey Corporate Health and Safety Director is **Mr. Thomas H. Forbes**. The Corporate Health and Safety Director is responsible for developing and implementing the Health and Safety program and policies for Benchmark Environmental Engineering & Science PLLC and TurnKey Environmental Restoration, LLC, and consulting with corporate management to ensure adequate resources are available to properly implement these programs and policies. The Corporate Health and Safety Director coordinates Benchmark-TurnKey's Health and Safety training and medical monitoring programs, and assists project management and field staff in developing site-specific health and safety plans.

2.1.2 Project Manager

The Project Manager for this Site is **Mr. Thomas H. Forbes**. The Project Manager has the responsibility and authority to direct all Benchmark-TurnKey work operations at the Site. The Project Manager coordinates safety and health functions with the Site Safety and Health Officer, and bears ultimate responsibility for proper implementation of this HASP.

He may delegate authority to expedite and facilitate any application of the program, including modifications to the overall project approach as necessary to circumvent unsafe work conditions. Specific duties of the Project Manager include:

- Preparing and coordinating the Site Work Plan.
- Providing Benchmark-TurnKey workers with work assignments and overseeing their performance.
- Coordinating health and safety efforts with the Site Safety and Health Officer.
- Reviewing the emergency response coordination plan to assure its effectiveness.
- Serving as the primary liason with Site contractors and the property owner.

2.1.3 Site Safety and Health Officer

The Site Safety and Health Officer (SSHO) for this Site is **Mr. Bryan H. Hann**. The qualified alternate SSHO is **Mr. Richard L. Dubisz**. The SSHO reports to the Project Manager. The SSHO is on-site or readily accessible to the Site during all work operations and has the authority to halt work if unsafe conditions are detected. The specific responsibilities of the SSHO are:

- Managing the safety and health functions for Benchmark-TurnKey personnel on the Site.
- Serving as the point of contact for safety and health matters.
- Ensuring that Benchmark-TurnKey field personnel working on the Site have received proper training (per 29 CFR Part 1910.120(e)), that they have obtained medical clearance to wear respiratory protection (per 29 CFR Part 1910.134), and that they are properly trained in the selection, use and maintenance of personal protective equipment, including qualitative respirator fit testing.
- Performing or overseeing Site monitoring as required by the HASP.
- Assisting in the preparation and review of the HASP.
- Maintaining site-specific safety and health records as described in this HASP.
- Coordinating with the Project Manager, Site Workers and Contractor's SSHO as necessary for safety and health efforts.
- Conducting daily tailgate Health and Safety meetings

2.1.4 Site Workers

Site workers are responsible for: complying with this HASP or a more stringent HASP, if appropriate (i.e., Contractor's and Subcontractor's HASP); using proper personal protective equipment (PPE); reporting unsafe acts and conditions to the SSHO; and following the safety and health instructions of the Project Manager and SSHO.

2.1.5 Other Site Personnel

Other Site personnel with health and safety responsibilities include the remediation contractor, who will be responsible for developing, implementing and enforcing a Health and Safety Plan equally stringent or more stringent than Benchmark-TurnKey's HASP. Benchmark-TurnKey assumes no responsibility for the health and safety of anyone outside its direct employ. Each Contractor's HASP shall cover all non-Benchmark-TurnKey site personnel. Each Contractor shall assign a SSHO who will coordinate with Benchmark-TurnKey's SSHO as necessary to ensure effective lines of communication and consistency between contingency plans.

In addition to Benchmark-TurnKey and Contractor personnel, other individuals who may have responsibilities in the work zone include subcontractors and governmental agencies performing site inspection work (e.g., the New York State Department of Environmental Conservation). The Contractor shall be responsible for ensuring that these individuals have received OSHA-required training (29 CFR 1910.120(e)), including initial, refresher and site-specific training, and shall be responsible for the safety and health of these individuals while they are on-site.

3.0 HAZARD EVALUATION

The possibility exists that workers will be exposed to hazardous substances during surface/subsurface soil sampling, installation of monitoring wells using a drill rig, well development, groundwater monitoring, and slug testing. The principal points of exposure would be through direct contact with impacted media or vapors during sample collection and handling activities. In addition, the use of large equipment will also present conditions for potential physical injury to workers. Adherence to the medical evaluations, worker training relative to chemical hazards, safe work practices, proper personal protection, environmental monitoring, establishment work zones and site control, appropriate decontamination procedures and contingency planning outlined herein will reduce the potential for chemical exposures and physical injuries.

3.1 Chemical Hazards

The nature and distribution of chemical constituents in soil/fill and groundwater at the Colgate Avenue Site were described during several historic investigations:

- November 2001 Limited Subsurface Soil Investigation conducted by AFI Environmental (Ref. 2).
- June 2004 Supplemental Site Investigation conducted by AFI Environmental (Ref. 3).
- April 2005 Remedial Action Work Report prepared by AFI Environmental (Ref. 4).
- May 2009 (Revised January 2010) Remedial Investigation/Feasibility Study Report by Benchmark (Ref. 5).

Based on this work, the constituents of potential concern include chlorinated and aromatic organics in groundwater and lead in soil. Table A-1 identifies concentration ranges for the constituents of potential concern detected during previous investigations at the Site. Table A-2 lists toxicity and exposure data for these constituents. Brief descriptions of the toxicology of these constituents and related health and safety guidance and criteria are provided below.

- **Benzene (CAS #71-43-2)** poisoning occurs most commonly through inhalation of the vapor; however, benzene poisoning can also occur by penetrating the skin. Locally, benzene has a comparatively strong irritating effect, producing erythema

and burning and, in more severe cases, edema and blistering. Exposure to high concentrations of the vapor (i.e., >3,000 ppm) may result in acute poisoning characterized by the narcotic action of benzene on the central nervous system. In acute poisoning, symptoms include confusion, dizziness, tightening of the leg muscles, and pressure over the forehead. Chronic exposure to benzene (i.e., long-term exposure to concentrations of <100 ppm) may lead to damage of the blood-forming system. Benzene is very flammable when exposed to heat or flame and can react vigorously with oxidizing materials.

- **Ethylbenzene (CAS #100-41-4)** is a component of automobile gasoline. Over-exposure may cause kidney, skin, liver, and/or respiratory disease. Signs of exposure may include dermatitis, irritation of the eyes and mucus membranes, and headache. Narcosis and coma may result in more severe cases.

- **Xylenes (o, m, and p) (CAS #95-47-6, 108-38-3, and 106-42-3)** are colorless, flammable liquids present in paint thinners and fuels. Acute exposure may cause central nervous system depression, resulting in headache, dizziness, fatigue, muscular weakness, drowsiness, and coordination loss. Repeated exposure may also cause removal of lipids from the skin, producing dry, fissured dermatitis. Exposure to high concentrations of vapor may cause eye irritation and damage, as well as irritation of the mucus membranes.
- **1,2-Dichloroethene (cis and trans)** are used as intermediates in the production of other chlorinated solvents and compounds, as well as low temperature extraction solvents for dyes, perfumes, and lacquers; commercial use of these compounds is not extensive. They are highly volatile by reaction with alkalis, potassium hydroxide, sodium, and sodium hydroxide. Direct exposure is mostly by inhalation resulting in heart and liver damage.
- **Tetrachloroethene (PCE)** is used a solvent for greases, waxes and rubbers. It is harmful by ingestion inhalation and skin absorption. Exposure can cause dermatitis, dizziness, nausea, liver and kidney damage. This compound is a suspected carcinogen.
- **Trichloroethene (TCE)** was formally widely used in dry cleaning operations and metal degreasing. It is toxic by inhalation and skin absorption. It is an irritant to the skin, eyes and mucous membranes. Symptoms of exposure may include headache, dizziness and nausea. Exposure may cause liver and kidney damage. TCE is a suspected human carcinogen.
- **Vinyl Chloride** is used primarily as an intermediate in the manufacture of polyvinyl chloride; limited quantities are used as a refrigerant and as an intermediate in the production of chlorinated compounds. It is a biodegradation product of trichloroethene, tetrachloroethene, and 1,1,1-trichloroethene.

Inhalation exposure may result in damage to the liver, kidneys, lungs and other organs. In addition to liver cancer, exposure has also been linked to an increased risk of lung, brain, hematopoietic, and digestive tract cancers.

- **Lead** can affect almost every organ and system in our bodies. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the immune system. The effects are the same whether it is breathed or swallowed. Lead may decrease reaction time, cause weakness in fingers, wrists or ankles and possibly affect memory. Lead may cause anemia.
- **Polychlorinated biphenyls (PCBs),** a series of compounds that were commonly used in transformer oil, are suspected carcinogens. PCBs may vary in form from oily liquids to white solids. Exposure may cause nausea, vomiting, weight loss, jaundice, edema and abdominal pain.

With respect to the anticipated activities defined in Section 1.4, possible routes of exposure to the above-mentioned contaminants are presented in Table A-3. The use of proper respiratory equipment, as outlined in Section 7.0, will minimize the potential for exposure to airborne contamination. Further, exposure to contaminants through dermal and other routes will also be minimized through the use of protective clothing (Section 7.0), safe work practices (Section 6.0), and proper decontamination procedures (Section 12.0).

3.2 Physical Hazards

Site remedial activities may present the following physical hazards:

- The potential for physical injury during heavy equipment use.
- The potential for slip and fall injuries due to slippery terrain.

These hazards represent only some of the possible means of injury that may be present during remedial and sampling activities at the Site. Since it is impossible to list all potential sources of injury, it shall be the responsibility of each individual to exercise proper care and caution during all phases of the work.

4.0 TRAINING

4.1 Site Workers

All personnel performing remedial activities (such as, but not limited to, equipment operators and general laborers) and who may be exposed to hazardous substances, health hazards, or safety hazards and their supervisors/managers responsible for the site shall receive training in accordance with 29 CFR 1910.120(e) before they are permitted to engage in operations in the exclusion zone or contaminant reduction zone. This training includes an initial 40-hour Hazardous Waste Site Worker Protection Course, an 8-hour Annual Refresher Course subsequent to the initial 40-hour training, and 3 days of actual field experience under the direct supervision of a trained, experienced supervisor. Additional site-specific training shall also be provided by the SSHO prior to the start of field activities. A description of topics to be covered by this training is provided below.

4.1.1 Initial and Refresher Training

Initial and refresher training is conducted by a qualified instructor as specified under OSHA 29 CFR 1910.120(e)(5), and is specifically designed to meet the requirements of OSHA 29 CFR 1910.120(e)(3) and 1910.120(e)(8). The training covers, as a minimum, the following topics:

- OSHA HAZWOPER regulations.
- Site safety and hazard recognition, including chemical and physical hazards.
- Medical monitoring requirements.
- Air monitoring, permissible exposure limits, and respiratory protection level classifications.
- Appropriate use of PPE, including chemical compatibility and respiratory equipment selection and use.
- Work practices to minimize risk.
- Work zones and Site control.
- Safe use of engineering controls and equipment.
- Decontamination procedures.
- Emergency response and escape.
- Confined space entry procedures.

- Heat and cold stress monitoring.
- Elements of a Health and Safety Plan.
- Spill containment.

Initial training also incorporates workshops for PPE and respiratory equipment use (Levels A, B and C), and respirator fit testing. Records and certification received from the course instructor documenting each employee's successful completion of the training identified above are maintained on file at Benchmark Environmental Engineering and Science, PLLC's Buffalo, NY office. Contractors and Subcontractors are required to provide similar documentation of training for all their personnel who will be involved in on-site work activities.

Any employee who has not been certified as having received health and safety training in conformance with 29 CFR 1910.120(e) is prohibited from working in the exclusion and contamination reduction zones, or to engage in any on-site work activities that may involve exposure to hazardous substances or wastes.

4.1.2 Site Training

Site workers are given a copy of the HASP and provided a site-specific briefing prior to the commencement of work to ensure that employees are familiar with the HASP and the information and requirements it contains. The site briefing shall be provided by the SSHO prior to initiating field activities and shall include:

- Names of personnel and alternates responsible for Site safety and health.
- Safety, health and other hazards present on the Site.
- The Site lay-out including work zones and places of refuge.
- The emergency communications system and emergency evacuation procedures.
- Use of PPE.
- Work practices by which the employee can minimize risks from hazards.
- Safe use of engineering controls and equipment on the Site.
- Medical surveillance, including recognition of symptoms and signs of over-exposure (see Section 5).
- Decontamination procedures (see Section 12).
- The Emergency Response Plan (see Attachment A-1).

- Confined space entry procedures, if required (see Section 13).
- The spill containment program (see Section 9).
- Site control (see Section 11).

Supplemental health and safety briefings will also be conducted by the SSHO on an as-needed basis during the course of the work. Supplemental briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during on-going Site characterization and analysis. Conditions for which the SSHO may schedule additional briefings include, but are not limited to: a change in Site conditions (i.e., based on monitoring results); changes in the work schedule/plan; newly discovered hazards; and safety incidents occurring during Site work.

4.2 Supervisor Training

On-site safety and health personnel who are directly responsible for or who supervise the safety and health of workers engaged in hazardous waste operations (i.e., SSHO) shall receive, in addition to the appropriate level of worker training described in Section 4.1, above, 8 additional hours of specialized supervisory training, in compliance with 29 CFR 1910.120(e)(4).

4.3 Emergency Response Training

Emergency response training is addressed in the Emergency Response Plan included as Attachment A-1 of this HASP.

4.4 Site Visitors

Benchmark-TurnKey's SSHO will provide a site-specific briefing to all Site visitors and other non-Benchmark-TurnKey personnel who enter the Site beyond the Site entry point. The site-specific briefing will provide information about Site hazards, the Site lay-out including work zones and places of refuge, the emergency communications system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate.

Site visitors will not be permitted to enter the exclusion zone or contaminant reduction zones unless they have received the level of training required for Site workers as described in Section 4.1.

5.0 MEDICAL MONITORING

Medical monitoring examinations are provided to Benchmark-TurnKey employees as stipulated under 29 CFR Part 1910.120(f). These exams include initial employment and termination physicals for all Benchmark-TurnKey employees involved in hazardous waste Site field operations. Annual exams are provided for those employees who are engaged in hazardous waste site field operations for more than 30 days per year, or who meet other specific criteria listed in 29 CFR 1910.120(f). Post-exposure examinations are also provided for employees who may have been injured, received a health impairment, or developed signs or symptoms of over-exposure to hazardous substances or were accidentally exposed to substances at concentrations above the permissible exposure limits without necessary personal protective equipment. Such exams are performed as soon as possible following development of symptoms or the known exposure event.

Medical evaluations are performed by ADP Screening & Selection Services, an occupational health care provider under contract with Benchmark-TurnKey. ADP's local facility is Health Works WNY, Seneca Square Plaza, 1900 Ridge Road, West Seneca, New York 14224. The facility can be reached at (716) 823-5050 to schedule routine appointments or post-exposure examinations.

Medical evaluations are conducted according to the Benchmark-TurnKey Medical Monitoring Program and include an evaluation of the workers' ability to use respiratory protective equipment. The examinations include:

- Occupational/medical history review.
- Physical exam, including vital sign measurement.
- Spirometry testing.
- Eyesight testing.
- Audio testing (minimum baseline and exit, annual for employees routinely exposed to greater than 85db).
- EKG (for employees >40 yrs age or as medical conditions dictate).
- Chest X-ray (baseline and exit, and every 5 years).
- Blood biochemistry (including blood count, white cell differential count, serum multiplastic screening).

- Medical certification of physical requirements (i.e.., sight, musculoskeletal, cardiovascular) for safe job performance and to wear respiratory protection equipment.

The purpose of the medical evaluation is to determine an employee's fitness for duty on hazardous waste sites; and to establish baseline medical data.

In conformance with OSHA regulations, Benchmark-TurnKey will maintain and preserve medical records for a period of 30 years following termination of employment. Employees are provided a copy of the physician's post-exam report, and have access to their medical records and analyses.

6.0 SAFE WORK PRACTICES

All Benchmark-TurnKey employees shall conform to the following safe work practices during all on-site work activities conducted within the exclusion and contamination reduction zones:

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth contact is strictly prohibited.
- The hands and face must be thoroughly washed upon leaving the work area and prior to engaging in any activity indicated above.
- Respiratory protective equipment and clothing must be worn by all personnel entering the Site as required by the HASP or as modified by the Site Safety Officer. Excessive facial hair (i.e., beards, long mustaches or sideburns) that interferes with the satisfactory respirator-to-face seal is prohibited.
- Contact with surfaces/materials either suspected or known to be contaminated will be avoided to minimize the potential for transfer to personnel, cross contamination and need for decontamination.
- Due to possible contraindications, use of prescribed drugs should be reviewed with the Benchmark-TurnKey occupational physician.
- Alcoholic beverage and illegal drug intake are strictly forbidden during the work day.
- All personnel shall be familiar with standard operating safety procedures and additional instructions contained in this Health and Safety Plan.
- On-site personnel shall use the "buddy" system. No one may work alone (i.e., out of earshot or visual contact with other workers) in the exclusion zone.
- Personnel and equipment in the contaminated area shall be minimized, consistent with effective Site operations.
- All employees have the obligation to immediately report and if possible, correct unsafe work conditions.
- Use of contact lenses on-site will not be permitted. Spectacle kits for insertion into full-face respirators will be provided for Benchmark-TurnKey employees, as requested and required.

The recommended specific safety practices for working around the subcontractor's equipment (e.g., drill rig, backhoe, site truck.) are as follows:

- Although the subcontractors are responsible for their equipment and safe operation of the Site, Benchmark-TurnKey personnel are also responsible for their own safety.
- Subsurface work will not be initiated without first clearing underground utility services.
- Heavy equipment should not be operated within 20 feet of overhead wires. This distance may be increased if windy conditions are anticipated or if lines carry high voltage. The Site should also be sufficiently clear to ensure the project staff can move around the heavy machinery safely.
- Care should be taken to avoid overhead wires when moving heavy-equipment from location to location.
- Hard hats, safety boots and safety glasses should be worn at all times in the vicinity of heavy equipment. Hearing protection is also recommended.
- The work Site should be kept neat. This will prevent personnel from tripping and will allow for fast emergency exit from the Site.
- Proper lighting must be provided when working at night.
- Work activities should be discontinued during an electrical storm or severe weather conditions.
- The presence of combustible gases should be checked before igniting any open flame.
- Personnel shall stand upwind of remedial activities when not immediately involved in sampling/logging/observing activities.
- Personnel will not approach the edge of an unsecured trench/excavation closer than 2 feet.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 Equipment Selection

Personal protective equipment (PPE) will be donned when work activities may result in exposure to physical or chemical hazards beyond acceptable limits, and when such exposure can be mitigated through appropriate PPE. The selection of PPE will be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the Site, the task-specific conditions and duration, and the hazards and potential hazards identified at the Site.

Equipment designed to protect the body against contact with known or suspect chemical hazards are grouped into four categories according to the degree of protection afforded. Categories A through D consistent with United States Environmental Protection Agency (USEPA) Level of Protection are:

- **Level A:** Should be selected when the highest level of respiratory, skin and eye protection is needed.
- **Level B:** Should be selected when the highest level of respiratory protection is needed, but a lesser level of skin protection is required. Level B (or Level A) is also necessary for oxygen-deficient atmospheres.
- **Level C:** Should be selected when the types of airborne substances are known, the concentrations have been measured and the criteria for using air-purifying respirators are met. In atmospheres where no airborne contaminants are present, Level C provides dermal protection only.
- **Level D:** Should not be worn on any site with elevated respiratory or skin hazards. This is generally a work uniform providing minimal protection.

OSHA requires the use of certain PPE under conditions where an immediate danger to life and health (IDLH) may be present. Specifically, OSHA 29 CFR 1910.120(g)(3)(iii) requires use of a positive pressure self-contained breathing apparatus, or positive pressure air-line respirator equipped with an escape air supply when chemical exposure levels present a substantial possibility of immediate serious injury, illness or death, or impair the ability to escape. Similarly, OSHA 29 CFR 1910.120(g)(3)(iv) requires donning totally encapsulating chemical protective suits (with a protection level equivalent to Level A protection) in conditions where skin absorption of a hazardous substance may result in a substantial possibility of immediate serious illness, injury or death, or impair the ability to escape.

In situations where the types of chemicals, concentrations, and possibilities of contact are unknown, the appropriate level of protection must be selected based on professional experience and judgment until the hazards can be further characterized. The individual components of clothing and equipment must be assembled into a full protective ensemble to protect the worker from site-specific hazards, while at the same time minimizing hazards and drawbacks of the personal protective gear itself. Ensemble components are detailed below for levels A/B, C, and D protection.

7.2 Protection Ensembles

7.2.1 Level A/B Protection Ensemble

Level A/B ensembles include similar respiratory protection, however Level A provides a higher degree of dermal protection than Level B. Use of Level A over Level B is determined by: comparing the concentrations of identified substances in the air with skin toxicity data, and assessing the effect of the substance (by its measured air concentrations or splash potential) on the small area of the head and neck unprotected by Level B clothing. The recommended PPE for level A/B is:

- Pressure-demand, full-face piece self-contained breathing apparatus (MSHA/-NIOSH approved) or pressure-demand supplied-air respirator with escape self-contained breathing apparatus (SCBA).
- Chemical-resistant clothing. For Level A, clothing consists of totally-encapsulating chemical resistant suit. Level B incorporates hooded one-or two-piece chemical splash suit.
- Inner and outer chemical resistant gloves.
- Chemical-resistant safety boots/shoes.
- Hardhat.

7.2.2 Level C Protection Ensemble

Level C protection is distinguished from Level B by the equipment used to protect the respiratory system, assuming the same type of chemical-resistant clothing is used. The main selection criterion for Level C is that conditions permit wearing an air-purifying device. The device (when required) must be an air purifying respirator (MSHA/NIOSH approved)

equipped with filter cartridges. Cartridges must be able to remove the substances encountered. Respiratory protection will be used only with proper fitting, training and the approval of a qualified individual. In addition, an air-purifying respirator can be used only if: oxygen content of the atmosphere is at least 19.5% in volume; substances are identified and concentrations measured; substances have adequate warning properties; the individual passes a qualitative fit-test for the mask; and an appropriate cartridge/canister is used, and its service limit concentration is not exceeded. Recommended PPE for Level C conditions includes:

- Full-face piece, air-purifying respirator equipped with MSHA and NIOSH approved organic vapor/acid gas/dust/mist combination cartridges or as designated by the SSHO.
- Chemical-resistant clothing (hooded, one or two-piece chemical splash suit or disposable chemical-resistant one-piece suit).
- Inner and outer chemical-resistant gloves.
- Chemical-resistant safety boots/shoes.
- Hardhat.

An air monitoring program is part of all response operations when atmospheric contamination is known or suspected. It is particularly important that the air be monitored thoroughly when personnel are wearing air-purifying respirators. Continual surveillance using direct-reading instruments is needed to detect any changes in air quality necessitating a higher level of respiratory protection.

7.2.3 Level D Protection Ensemble

As indicated above, Level D protection is primarily a work uniform. It can be worn in areas where only boots can be contaminated, where there are no inhalable toxic substances and where the atmospheric contains at least 19.5% oxygen. Recommended PPE for Level D includes:

- Coveralls.
- Safety boots/shoes.
- Safety glasses or chemical splash goggles.
- Hardhat.

- Optional gloves; escape mask; face shield.

7.2.4 Recommended Level of Protection for Site Tasks

Based up current information regarding both the contaminants suspected to be present at the Site and the various remedial tasks to be implemented, the minimum required levels of protection for these tasks shall be as identified in Table A-4.

8.0 EXPOSURE MONITORING

8.1 General

Based on the results of historic sample analysis and the nature of the proposed work activities at the Site, the possibility exists that particulates may be released to the air during work activities. Ambient breathing zone concentrations may at times, exceed the permissible exposure limits (PEL) established by OSHA for the individual compounds (see Table A-2), in which case respiratory protection will be required. Respiratory and dermal protection may be modified (upgraded or downgraded) by the SSHO based upon real-time field monitoring data.

8.1.1 Work Area Monitoring

Routine, real-time monitoring of the atmosphere within the work area will be conducted by Benchmark-TurnKey during all intrusive activities (e.g., drilling, test pitting, well development, excavating, etc.). The work area will be monitored at regular intervals using a photo-ionization detector (PID), combustible gas meter and a particulate meter. Observed values will be recorded and maintained as part of the permanent field record.

Additional air monitoring measurements may be made by Benchmark-TurnKey personnel to verify field conditions during subcontractor oversight activities. Monitoring instruments will be protected from surface contamination during use. Additional monitoring instruments may be added if the situations or conditions change.

8.1.2 Off-Site Community Monitoring

In addition to on-site monitoring within the work zone(s), monitoring at the down-wind portion of the Site perimeter will be conducted when any ground intrusive or non-intrusive activities are performed. Ground intrusive activities are defined by NYSDOH Appendix 1A Generic Community Air Monitoring Plan (Attachment A-2). Ground intrusive activities include soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells. Non-intrusive activities include the collection of soil and sediment samples or the collection of groundwater samples from existing wells. Continuous monitoring is required for ground intrusive activities and periodic monitoring is required for non-intrusive activities. This will provide a real-time method for determination

of substantial vapor and/or particulate releases to the surrounding community as a result of intrusive activities.

Periodic monitoring is required during non-intrusive activities. Periodic monitoring consists of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring while bailing a well, and taking a reading prior to leaving a sampling location. This may be upgraded to continuous if the sampling location is in close proximity to a individuals not involved in the site activity (i.e. on a curb of a busy street). The action levels below can be used during periodic monitoring.

8.2 Monitoring Action Levels

8.2.1 On-Site Levels

The PID or other appropriate instrument(s) will be used as specified in this Health and Safety Plan. Methane gas will be monitored with the "combustible gas" option on the combustible gas meter or other appropriate instrument(s) in accordance with this plan. In addition, fugitive dust/particulate concentrations will be monitored using a real-time particulate monitor as specified in this plan. Readings obtained in the breathing zone may be interpreted (with regard to other site conditions) as follows for on-site Benchmark-TurnKey personnel:

- Total atmospheric concentrations of unidentified vapors or gases ranging from 0 to background on the PID) - Continue operations under Level D.
- Total atmospheric concentrations of unidentified vapors or gases yielding sustained readings above background to 5 ppm on the PID (vapors not suspected of containing high levels of chemicals toxic to the skin) - Continue operations under Level C.
- Total atmospheric concentrations of unidentified vapors or gases yielding sustained readings of 5 to 50 ppm above background on the PID - Continue operations under Level B, re-evaluate and alter (if possible) construction methods to achieve lower vapor concentrations.
- Total atmospheric concentrations of unidentified vapors or gases above 50 ppm on the PID - Discontinue operations and exit the work zone immediately.

The explosimeter will be used to monitor levels of both combustible gases and oxygen during construction activities. Action levels based on the instrument readings shall be as follows:

- Less than 10% LEL - Continue engineering operations with caution.
- 10-25% LEL - Continuous monitoring with extreme caution, determine source/cause of elevated reading.
- Greater than 25% LEL - Explosion hazard, evaluate source and leave the Work Zone.
- 19.5% - 21% oxygen - Proceed with extreme caution; attempt to determine potential source of oxygen displacement.
- Less than 19.5% oxygen - Leave work zone immediately.
- 21-25% oxygen - Continue engineering operations with caution.
- Greater than 25% oxygen - Fire hazard potential, leave Work Zone immediately.

The particulate monitor will be used to monitor respirable dust concentrations during all intrusive activities. Action levels based on the instrument readings shall be as follows:

- Less than 50 mg/m^3 - Continue field operations.
- 50-150 mg/m^3 - Don dust/particulate mask or equivalent
- Greater than 150 mg/m^3 - Don dust/particulate mask or equivalent. Initiate engineering controls to reduce respirable dust concentration (i.e.., wetting of excavated soils or tools at discretion of Site Safety and Health Officer).

Readings with the combustible gas meter, particulate monitor and organic vapor analyzers will be recorded and documented in the Health and Safety Logbook. All instruments will be calibrated before use and the procedure will be documented in the Health and Safety Logbook.

8.2.2 Community Air Monitoring

In addition to the action levels prescribed in Section 8.2.1 for Benchmark-TurnKey personnel on-site, the following criteria shall also be adhered to for the protection of the nearby community.

Organic Vapor Community Air Monitoring:

Community air monitoring will be performed at the downwind perimeter of the exclusion zone on a continuous basis during intrusive activities performed outdoors that may be reasonably expected to potentially release organic vapors, or when sustained readings are detected in the work zone (i.e, proximate to the source of the intrusive activity). Otherwise, the monitoring will be performed on an hourly basis. A photoionization detector or other equipment will be suitable to the types of contaminants known or suspected to be present will be used, and will be capable of calculating 15-minute running average concentrations. All air monitoring equipment will be calibrated at least daily and an upwind concentration will be taken at least daily to establish background conditions. The 15-minute average concentrations will be compared to the levels specified below.

- If the 15-minute ambient air concentration of organic vapors at the downwind perimeter of the exclusion zone exceeds *5* ppm above background, work activities will be halted and monitoring continued. If the organic vapor decreases (per instantaneous readings) below *5* ppm over background, work activities can resume with continued monitoring.
- If the ambient air concentration of organic vapors at the downwind perimeter of the exclusion zone persists at levels above 5 ppm over background but less than 25 ppm, activities must be halted, the source of vapors identified, corrective actions to abate the emissions taken, and monitoring continued. After these steps, work activities can resume provided that: the organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest off-site potential receptor or residential or commercial structure, whichever is less - but in no case less than 20 feet - is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the exclusion zone, work activities must be shut down and the following activities will be performed:
  - All Emergency Response Contacts as listed in this Health and Safety Plan and the Emergency Response Plan (Attachment A-1) will be advised.
  - The local police authorities will immediately be contacted by the Site Health and Safety Officer and advised of the situation.
  - Air monitoring will be continued at 1/2 the distance from the exclusion zone to the nearest receptor.

All readings will be recorded and will be available for New York State Department of Environmental Conservation (DEC) and Department of Health (DOH) personnel to review.

Explosive Vapor Community Air Monitoring

Explosive vapor community air monitoring will be performed at the downwind perimeter of the Site on a continuous basis whenever sustained atmospheric concentrations of greater than 10% of the LEL are recorded in the exclusion zone. If sustained atmospheric concentrations of greater than 10% LEL are recorded at the downwind site perimeter, the local Fire Department will be contacted (see Attachment A-1 for phone number).

Airborne Particulate Community Air Monitoring

Respirable (PM-10) particulate monitoring will be performed on a continuous basis at the upwind and downwind perimeter of the exclusion zone. The monitoring will be performed using real-time monitoring equipment capable of measuring PM-10 and integrating over a period of 15-minutes for comparison to the airborne particulate action levels. The equipment will be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities. All readings will be recorded and will be available for NYSDEC and NYSDOH review. Readings will be interpreted as follows:

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (ug/m^3) greater than the background (upwind perimeter) reading for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression provided that the downwind PM-10 particulate levels do not exceed 150 ug/m^3 above the upwind level and that visible dust is not migrating from the work area.
- If, after implementation of dust suppression techniques downwind PM-10 levels are greater than 150 ug/m^3 above the upwind level, work activities must be stopped and dust suppression controls re-evaluated. Work can resume provided that supplemental dust suppression measures and/or other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m^3 of the upwind level and in preventing visible dust migration.

9.0 SPILL RELEASE/RESPONSE

This chapter of the HASP describes the potential for and procedures related to spills or releases of known or suspected petroleum and/or hazardous substances on the Site. The purpose of this Section of the HASP is to plan appropriate response, control, counter-measures and reporting, consistent with OSHA requirements in 29 CFR 1910.120(b)(4)(ii)(J) and (j)(1)(viii). The spill containment program addresses the following elements:

- Potential hazardous material spills and available controls.
- Initial notification and evaluation.
- Spill response.
- Post-spill evaluation.

9.1 Potential Spills and Available Controls

An evaluation was conducted to determine the potential for hazardous material and oil/petroleum spills at this Site. For the purpose of this evaluation, hazardous materials posing a significant spill potential are considered to be:

- CERCLA Hazardous Substances as identified in 40 CFR Part 302, where such materials pose the potential for release in excess of their corresponding Reportable Quantity (RQ).
- Extremely Hazardous Substances as identified in 40 CFR Part 355, Appendix A, where such materials pose the potential for release in excess of their corresponding Reportable Quantity (RQ).
- Hazardous Chemicals as defined under Section 311(e) of the Emergency Planning and Community Right-To-Know Act of 1986, where such chemicals are present or will be stored in excess of 10,000 lbs.
- Toxic Chemicals as defined in 40 CFR Part 372, where such chemicals are present or will be stored in excess of 10,000 lbs.
- Chemicals regulated under 6NYCRR Part 597, where such materials pose the potential for release in excess of their corresponding Reportable Quantity (RQ).

Oil/petroleum products are considered to pose a significant spill potential whenever the following situations occur:

- The potential for a "harmful quantity" of oil (including petroleum and non-petroleum-based fuels and lubricants) to reach navigable waters of the U.S. exists (40 CFR Part 112.4). Harmful quantities are considered by USEPA to be volumes of 1,000 gallons or more, or lesser quantities that either form a visible sheen on the water or violate applicable water quality standards.
- The potential for any amount of petroleum to reach any waters of NY State, including groundwater, exists. Petroleum, as defined by NY State in 6NYCRR Part 612, is a petroleum-based heat source, energy source, or engine lubricant/ maintenance fluid.
- The potential for any release, to soil or water, of petroleum from a bulk storage facility regulated under 6NYCRR Part 612. A regulated petroleum storage facility is defined by NY State as a Site having stationary tank(s) and intra-facility piping, fixtures and related equipment with an aggregate storage volume of 1,100 gallons or greater.

The evaluation indicates that, based on Site history and the scope of work, a hazardous material spill is not likely to occur during remedial efforts. However, the procedures identified below will be followed in the event of an unanticipated release.

9.2 Initial Spill Notification and Evaluation

Any worker who discovers a hazardous substance or oil/petroleum spill will immediately notify the Project Manager and SSHO. The worker will, to the best of his/her ability, report the material involved, the location of the spill, the estimated quantity of material spilled, the direction/flow of the spill material, related fire/explosion incidents, if any, and any associated injuries. The Emergency Response Plan presented in Attachment A-1 of this HASP will immediately be implemented if an emergency release has occurred.

Following initial report of a spill, the Project Manager will make an evaluation as to whether the release exceeds RQ levels. If an RQ level is exceeded, the Project Manager will notify the Site owner who will in turn notify NYSDEC at 1-800-457-7362 within 2 hours of spill discovery. The Project Manager will also determine what additional agencies are to be contacted regarding the release, and will follow-up with written reports as required by the applicable regulations.

9.3 Spill Response

For all spill situations, the following general response guidelines will apply:

- Only those personnel involved in overseeing or performing containment operations will be allowed within the spill area. If necessary, the area will be roped, ribboned or otherwise blocked off to prevent unauthorized access.
- Appropriate PPE, as specified by the SSHO, will be donned before entering the spill area.
- Ignition points will be extinguished/removed if fire or explosion hazards exist.
- Drains or drainage in the spill area will be blocked to prevent inflow of spilled materials or applied materials.

For minor spills, the Benchmark-TurnKey will maintain a Spill Control and Containment Kit in the Field Office or other readily accessible storage location. The kit will consist of, at a minimum, a 50 lb. bag of "speedy dry" granular absorbent material, absorbent pads, shovels, empty 5-gallon pails and an empty open-top 55-gallon drum. Spilled materials will be absorbed, and shoveled into a 55-gallon drum for proper disposal (USEPA approval will be secured for on-site treatment of the impacted soils/absorbent materials, if applicable). Impacted soils will be hand-excavated to the point that no visible signs of contamination remains, and will be drummed with the absorbent.

In the event of a major release or a release that threatens surface water, a spill response contractor will be called to the Site. The response contractor may use heavy equipment (e.g., excavator, backhoe, etc.) to berm the soils surrounding the spill site or create diversion trenching to mitigate overland migration or release to navigable waters. Where feasible, pumps will be used to transfer free liquid to storage containers. Spill control/cleanup contractors in the Western New York area that may be contacted for assistance (in order of preference) include:

- The Environmental Service Group of NY, Inc.: (716) 695-6720
- Op-Tech: (716) 873-7680
- Environmental Products & Services of Vermont, Inc.: (716) 597-0001

9.4 Post-Spill Evaluation

If a reportable quantity of hazardous material or oil/petroleum is spilled as determined by the Project Manager, a written report will be prepared as indicated in Section 9.2. The report will identify the root cause of the spill, type and amount of material released, date/time of release, response actions, agencies notified and/or involved in cleanup, and procedures to be implemented to avoid repeat incidents. In addition, all re-useable spill cleanup and containment materials will be decontaminated, and spill kit supplies/disposable items will be replenished.

10.0 HEAT/COLD STRESS MONITORING

Site remedial activities will occur outdoors where measures will be required to be taken to minimize heat/cold stress to Benchmark-TurnKey employees. The Site Safety and Health Officer and/or his or her designee will be responsible for monitoring Benchmark-TurnKey field personnel for symptoms of heat/cold stress.

10.1 Heat Stress Monitoring

Personal protective equipment may place an employee at risk of developing heat stress, a common and potentially serious illnesses often encountered at construction, landfill, waste disposal, industrial or other unsheltered sites. The potential for heat stress is dependent on a number of factors, including environmental conditions, clothing, workload, physical conditioning and age. Personal protective equipment may severely reduce the body's normal ability to maintain temperature equilibrium (via evaporation and convection), and require increased energy expenditure due to its bulk and weight.

Proper training and preventive measures will mitigate the potential for serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress, the following steps should be taken:

- Adjust work schedules.
- Modify work/rest schedules according to monitoring requirements.
- Mandate work slowdowns as needed.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat (i.e., eight fluid ounces must be ingested for approximately every 1 lb of weight lost). The normal thirst mechanism is not sensitive enough to ensure that enough water will be consumed to replace lost perspiration. When heavy sweating occurs, workers should be encouraged to drink more.
- Train workers to recognize the symptoms of heat related illness.

Heat-Related Illness - Symptoms:

- Heat rash may result from continuous exposure to heat or humid air.
- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include: muscle spasms; pain in the hands, feet and abdomen.
- Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include: pale, cool, moist skin; heavy sweating; dizziness; nausea; fainting.
- Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are: red, hot, usually dry skin; lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse; coma.

The monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70 degrees Fahrenheit or above. For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism.

- Heart rate may be measured by the radial pulse for 30 seconds as early as possible in the resting period. The rate at the beginning of the rest period should not exceed 100 beats per minute. If the rate is higher, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest periods stay the same, If the pulse rate is 100 beats per minute at the beginning of the nest rest period, the following work cycle should be further shortened by 33%.
- Body temperature may be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature at the beginning of the rest period should not exceed 99.6 degrees Fahrenheit. If it does, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period remains the same. However, if the oral temperature exceeds 99.6 degrees Fahrenheit at the beginning of the next period, the work cycle may be further shortened by 33%. Oral temperature should be measured at the end of the rest period to make sure that it has dropped below 99.6 degrees Fahrenheit. No Benchmark-TurnKey employee will be permitted to continue wearing semi-permeable or impermeable garments when his/her oral temperature exceeds 100.6 degrees Fahrenheit.

10.2 Cold Stress Monitoring

Exposure to cold conditions may result in frostbite or hypothermia, each of which progresses in stages as shown below.

- **Frostbite** occurs when body tissue (usually on the extremities) begins to freeze. The three states of frostbite are:

  1) **Frostnip** - This is the first stage of the freezing process. It is characterized by a whitened area of skin, along with a slight burning or painful sensation. Treatment consists of removing the victim from the cold conditions, removal of boots and gloves, soaking the injured part in warm water (102 to 108 degrees Fahrenheit) and drinking a warm beverage. Do not rub skin to generate friction/ heat.

  2) **Superficial Frostbite** - This is the second stage of the freezing process. It is characterized by a whitish gray area of tissue which will be firm to the touch but will yield little pain. The treatment is identical for Frostnip.

  3) **Deep Frostbite** - In this final stage of the freezing process the affected tissue will be cold, numb and hard and will yield little to no pain. Treatment is identical to that for Frostnip.

- **Hypothermia** is a serious cold stress condition occurring when the body loses heat at a rate faster than it is produced. If untreated, hypothermia may be fatal. The stages of hypothermia may not be clearly defined or visible at first, but generally include:

  1) Shivering

  2) Apathy (i.e., a change to an indifferent or uncaring mood)

  3) Unconsciousness

  4) Bodily freezing

  Employees exhibiting signs of hypothermia should be treated by medical professionals. Steps that can be taken while awaiting help include:

  1) Remove the victim from the cold environment and remove wet or frozen clothing. (Do this carefully as frostbite may have started.)

  2) Perform active re-warming with hot liquids for drinking (Note: do not give the victim any liquid containing alcohol or caffeine) and a warm water bath (102 to 108 degrees Fahrenheit).

  3) Perform passive re-warming with a blanket or jacket wrapped around the victim.

In any potential cold stress situation, it is the responsibility of the SSHO to encourage the following:

- Education of workers to recognize the symptoms of frostbite and hypothermia.
- Workers should dress warmly, with more layers of thin clothing as opposed to one thick layer.
- Personnel should remain active and keep moving.
- Personnel should be allowed to take shelter in a heated areas, as necessary.
- Personnel should drink warm liquids (no caffeine or alcohol if hypothermia has set in).
- For monitoring the body's recuperation from excess cold, oral temperature recordings should occur:
    - At the Site Safety Technicians discretion when suspicion is based on changes in a worker's performance or mental status.
    - At a workers request.
    - As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind chill less than 20 degrees Fahrenheit or wind chill less than 30 degrees Fahrenheit with precipitation).
    - As a screening measure whenever anyone worker on Site develops hypothermia.

Any person developing moderate hypothermia (a core body temperature of 92 degrees Fahrenheit) will not be allowed to return to work for 48 hours without the recommendation of a qualified medical doctor.

11.0 WORK ZONES AND SITE CONTROL

Work zones around the areas designated for work activities will be established by Benchmark-TurnKey on a daily basis and communicated to all employees and other Site users by the SSHO. It shall be the SSHO's responsibility to ensure that all Site workers are aware of the work zone boundaries and to enforce proper procedures in each area. The zones will include:

- Exclusion Zone ("Hot Zone") - The area where contaminated materials may be exposed, excavated or handled and all areas where contaminated equipment or personnel may travel. The zone will be delineated by flagging tape. All personnel entering the Exclusion Zone must wear the prescribed level of personal protective equipment identified in Section 7.
- Contaminant Reduction Zone - The zone where decontamination of personnel and equipment takes place. Any potentially contaminated clothing, equipment and samples must remain in the Contaminant Reduction Zone until decontaminated.
- Support Zone - The part of the Site that is considered non-contaminated or "clean." Support equipment will be located in this zone, and personnel may wear normal work clothes within this zone.

In the absence of other task-specific work zone boundaries established by the SSHO, the following boundaries will apply to all work activities involving disruption or handling of Site soils, sediment or groundwater:

- Exclusion Zone: 50 foot radius from the outer limit of the sampling activity.
- Contaminant Reduction Zone: 100 foot radius from the outer limit of the sampling activity.
- Support Zone: Areas outside the Contaminant Reduction Zone.

Access of non-essential personnel to the Exclusion and Contaminant Reduction Zones will be strictly controlled by Benchmark-TurnKey. Only personnel who are essential to the completion of the task will be allowed access to these areas and only if they are wearing the prescribed level of protection. Entrance of all personnel must be approved by the SSHO.

The Contractor will maintain a Health and Safety Logbook containing the names of workers and their level of protection. The zone boundaries may be changed by the SSHO as environmental conditions warrant, and to respond to the necessary changes in work locations on-site.

12.0 DECONTAMINATION

12.1 Decontamination for Benchmark-TurnKey Employees

The degree of decontamination required is a function of a particular task and the environment within which it occurs. The following decontamination procedure will remain flexible, thereby allowing the decontamination crew to respond appropriately to the changing environmental conditions which may arise at the Site. All Benchmark-TurnKey personnel on-site shall follow the procedure below.

Station 1 - Equipment Drop: Deposit visibly contaminated (if any) re-useable equipment used in the contamination reduction and exclusion zones (tools, containers, monitoring instruments, radios, clipboards, etc.) on plastic sheeting.

Station 2 - Boots and Gloves Wash and Rinse: Scrub outer boots and outer gloves. Deposit tape and gloves in waste disposal container.

Station 3 - Tape, Outer Boot and Glove Removal: Remove tape, outer boots and gloves. Deposit tape and gloves in waste disposal container.

Station 4 - Canister or Mask Change: If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot cover donned, and worker returns to duty.

Station 5 - Outer Garment/Face Piece Removal: Protective suit removed and deposited in separate container provided by Contractor. Face piece or goggles are removed if used. Avoid touching face with fingers. Face piece and/or goggles deposited on plastic sheet. Hard hat removed and placed on plastic sheet.

Station 6 - Inner Glove Removal: Inner gloves are the last personal protective equipment to be removed. Avoid touching the outside of the gloves with bare fingers. Dispose of these gloves in waste disposal container.

Following PPE removal, personnel shall wash hands, face and forearms with absorbent wipes. If field activities proceed for six consecutive months or longer, shower facilities will be provided for worker use in accordance with OSHA 29 CFR 1910.120(n).

12.2 Decontamination for Medical Emergencies

In the event of a minor, non-life threatening injury, personnel should follow the decontamination procedures as defined, and then administer first-aid.

In the event of a major injury or other serious medical concern (e.g., heat stroke), immediate first-aid is to be administered and the victim transported to the hospital in lieu of further decontamination efforts unless exposure to a Site contaminant would be considered "Immediately Dangerous to Life or Health."

12.3 Decontamination of Field Equipment

Decontamination of heavy equipment will be conducted by the subcontractor in accordance with his approved Health and Safety Plan in the Contamination Reduction Zone. As a minimum, this will include manually removing heavy soil clods, followed by high pressure water and detergent or steam cleaning.

Decontamination of all tools used for sample collection purposes will be conducted by Benchmark-TurnKey personnel. It is expected that all tools will be constructed of nonporous, nonabsorbent materials (i.e., metal) which will aid in the decontamination effort. Any tool or part of a tool made of porous, absorbent material (i.e., wood) will be placed into suitable containers and prepared for disposal.

13.0 CONFINED SPACE ENTRY

OSHA 29 CFR 1910.146 identifies a confined space as a space which is large enough and so configured that an employee can physically enter and do assigned work, has limited or restricted means for entry and exit, and is not intended for continuous employee occupancy. Confined spaces include, but are not limited to, trenches, storage tanks, process vessels, pits, sewers, tunnels, underground utility vaults, pipelines, sumps, wells, and excavations.

Confined space entry by Benchmark-TurnKey employees is not anticipated to be necessary to complete the Site remedial activities identified in Section 1.4. In the event that the scope of work changes or confined space entry appears necessary, the Project Manager will be consulted to determine if feasible engineering alternatives to confined space entry can be implemented. If confined space entry by Benchmark-TurnKey employees cannot be avoided through reasonable engineering measures, task-specific confined space entry procedures will be developed and a confined-space entry permit will be issued through Benchmark-TurnKey's corporate Health and Safety Director. Benchmark-TurnKey employees shall not enter a confined space without these procedures and permits in place.

14.0 FIRE PREVENTION AND PROTECTION

14.1 General Approach

Recommended practices and standards of the National Fire Protection Association (NFPA) and other applicable regulations will be followed in the development and application of Project Fire Protection Programs. When required by regulatory authorities, the project management will prepare and submit a Fire Protection Plan for the approval of the contracting officers, authorized representative or other designated official. Essential considerations for the Fire Protection Plan will include:

- Proper Site preparation and safe storage of combustible and flammable materials.
- Availability of coordination with private and public fire authorities.
- Adequate job-site fire protection and inspections for fire prevention.
- Adequate indoctrination and training of employees.

14.2 Equipment and Requirements

Fire extinguishers will be provided by Benchmark-TurnKey and are required to be provided by the subcontractor on all heavy equipment brought on-site. Fire extinguishers will be inspected, serviced, and maintained in accordance with the manufacturer's instructions. As a minimum, all extinguishers shall be checked monthly and weighed semi-annually, and recharged if necessary. Recharge or replacement shall be mandatory immediately after each use.

14.3 Flammable and Combustible Substances

All storage, handling or use of flammable and combustible substances will be under the supervision of qualified persons. All tanks, containers and pumping equipment, whether portable or stationary, which are used for the storage and handling of flammable and combustible liquids, will meet the recommendations of the National Fire Protection Association.

14.4 Hot Work

If the scope of work necessitates welding or blow torch operation, the hot work permit presented in Attachment A-3 will be completed by the SSHO and reviewed/issued by the Project Manager.

15.0 EMERGENCY INFORMATION

In accordance with OSHA 29 CFR Part 1910, an Emergency Response Plan is attached to this HASP as Attachment A-1.

16.0 REFERENCES

1. Benchmark Environmental Engineering & Science, PLCC. *Remedial Action Work Plan, Colgate Avenue Site, Buffalo, New York.* May 2009.

2. AFI Environmental. *Letter Report on Subsurface Soil Investigation and Water Analysis MW2 at Ameron Site, 111 Colgate Avenue, Buffalo, New York.* November 30, 2001.

3. AFI Environmental. *Supplemental Site Investigation and Closure Report, Ameron Site, City of Buffalo, Erie County, New York.* July 21, 2004.

4. AFI Environmental. *Remedial Action Work Report, Former Ameron Site, City of Buffalo, Erie County, New York.* April 2005.

5. Benchmark Environmental Engineering & Science, PLCC. *Remedial Investigation/ Feasibility Study (RI/FS) Report, Colgate Avenue Site, Buffalo, New York.* May 2009.

TABLES

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

TABLE A-1

CONSTITUENTS OF POTENTIAL CONCERN & OBSERVED CONCENTRATIONS BY MEDIA

Health & Safety Plan For Remedial Action Work Plan
Colgate Avenue Site
Buffalo, New York

Parameter	Soil [1] (mg/kg)	Groundwater [2] (µg/L)
Benzene	ND	11
1,1- Dichloroethane	ND	6 J
cis-1,2-Dichloroethene	ND	1600 D
trans-1,2-Dichloroethene	ND	300 D
Ethylbenzene	ND	670 DJ
Tetrachloroethene	ND	42
Trichloroethene	ND	870 D
Vinyl chloride	ND	510 D
Xylene	ND	3300 DJ
Lead	50300	29 (MW-3R)
PCB Aroclor 1254	3.1	NA
PCB Aroclor 1260	3.8	NA

Notes:

[1] Maximum concentrations detected during the 2006 RI; lead concentration from SB-3.

[2] Concentrations detected in temporary wells TMW-2 and TMW-3.

ND = Not detected.

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

TABLE A-2

TOXICITY AND EXPOSURE DATA FOR CONSTITUENTS OF POTENTIAL CONCERN

Health & Safety Plan For Remedial Action Work Plan
Colgate Avenue Site
Buffalo, New York

Constituents of Potential Concern	Inhalation Hazard		IDLH
	PEL	TLV	
Volatile Organic Compounds (ppm):			
Benzene	50	0.5	500, Ca
1,1- Dichloroethane	100	100	3000
cis-1,2-Dichloroethene	200	200	1000
trans-1,2-Dichloroethene	200	200	1000
Ethylbenzene	100	20	800
Isopropylbenzene (Cumene)	50	50	900
Tetrachloroethene	100	25	150, Ca
Trichloroethene	100	50	1000, Ca
Vinyl Chloride	1	1	Ca
Xylene	100	100	900
Inorganic Compounds (mg/m^3):			
Lead	0.05	0.15	100
Polychorinated Biphenyls (PCBs) : ppm			
Aroclors 1254 and 1260	--	--	--

Notes:

PEL - Permissible Exposure Limit, established by OSHA, equals the maximium exposure concentration allowable for 8 hours per day @ 40 hours per week.

TLV - Threshold Limit Value, established by ACGIH, equals the maximum exposure concentration allowable for 8 hours per day @ 40 hours per week.

C - Ceiling Level equals the maximum exposure concentration allowable during the work day.

IDLH - Immediately Dangerous to Life or Health

Ca - NIOSH considers constituent to be a potential occupational carcinogen.

NA - IDLH has not yet been established.

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

TABLE A-3

POTENTIAL ROUTES OF EXPOSURE TO CONSTITUENTS OF POTENTIAL CONCERN

Health & Safety Plan For Remedial Action Work Plan
Colgate Avenue Site
Buffalo, New York

Activity	Direct Contact with Subsurface Soils	Direct Contact with Groundwater	Inhalation of Vapors or Dust
Contaminated Soil Excavation	X		X
Subsurface Soil Borings (HRC/ORC Injections)	X		X
Monitoring Well Sampling		X	

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

TABLE A-4

REMEDIAL ACTION WORK PLAN
COLGATE AVENUE SITE
BUFFALO, NEW YORK

REQUIRED PERSONAL PROTECTIVE EQUIPMENT (PPE)[1] LEVELS

Activity	Respiratory Protection[2]	Clothing	Gloves	Boots	Other Required PPE/Modifications[3]
Excavation and Backfilling	Level D; upgrade to Level C if necessary	Work Uniform or Tyvek	L	L outer, steel-toed safety boot inner	Hardhat, Safety glasses w/ side shields
Subsurface Soil Borings (HRC/ ORC Injections)	Level D; upgrade to Level C if necessary	Work Uniform or Tyvek	L	L outer, steel-toed safety boot inner	Hardhat, Safety glasses w/ side shields
Monitoring Well Sampling	Level D; upgrade to Level C if necessary	Poly-coated Tyvek or S	L	L outer, steel-toed safety boot inner	Safety glasses w/ side shields

Notes:

1. T = Tyvek; L= Latex; N = Nitrile;, S = Saranex
2. Respiratory equipment shall conform to guidelines presented in Section 8. The Level C requirement is an air-purifying respirator equipped with organic compound/acid gas/dust cartridge.
3. Dust masks shall be donned as directed by the site health and safety officer or site safety technician whenever potentially contaminated airborne particulates (i.e., dust) are present in significant amounts in the breathing zone. Goggles may be substituted with safety glasses w/side-shields whenever contact with contaminated liquids is not anticipated.

ATTACHMENT A-1

EMERGENCY RESPONSE PLAN

EMERGENCY RESPONSE PLAN
for
REMEDIAL ACTION WORK PLAN

COLGATE AVENUE SITE
BUFFALO, NEW YORK

June 2009
Revised January 2010
Revised May 2010

0100-001-200

Prepared for:

HEALTH AND SAFETY PLAN FOR RA WORK PLAN
ATTACHMENT A-1: EMERGENCY RESPONSE PLAN

COLGATE AVENUE SITE

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Figure A-1 Hospital Route Map

1.0 GENERAL

This report presents the site-specific Emergency Response Plan (ERP) referenced in the Site Health and Safety Plan (HASP) prepared for the Remedial Action (RA) Work Plan activities at Ameron International's Colgate Avenue Site in Buffalo, New York. This appendix of the HASP describes potential emergencies that may occur at the Site; procedures for responding to those emergencies; roles and responsibilities during emergency response; and training all workers must receive in order to follow emergency procedures. This ERP also describes the provisions this Site has made to coordinate its emergency response planning with other contractors on-site and with off-site emergency response organizations.

This ERP is consistent with the requirements of 29 CFR 1910.120(l) and provides the following site-specific information:

- Pre-emergency planning.
- Personnel roles, lines of authority, and communication.
- Emergency recognition and prevention.
- Safe distances and places of refuge.
- Evacuation routes and procedures.
- Decontamination procedures.
- Emergency medical treatment and first aid.
- Emergency alerting and response procedures.
- Critique of response and follow-up.
- Emergency personal protective equipment (PPE) and equipment.

2.0 PRE-EMERGENCY PLANNING

This Site has been evaluated for potential emergency occurrences, based on Site hazards, the required work tasks, the site topography, and prevailing weather conditions. The results of that evaluation indicate the potential for the following site emergencies to occur at the locations indicated.

Type of Emergency:

1. Medical, due to physical injury
2. Fire

Source of Emergency:

1. Slip/trip/fall
2. Fire

Location of Source:

1. Non-specific

3.0 ON-SITE EMERGENCY RESPONSE EQUIPMENT

Emergency procedures may require specialized equipment to facilitate worker rescue, contamination control and reduction, or post-emergency clean up. Emergency response equipment available on the Site is listed below. The equipment inventory and storage locations are based on the potential emergencies described above. This equipment inventory is designed to meet on-site emergency response needs and any specialized equipment needs that off-site responders might require because of the hazards at this Site but not ordinarily stocked.

Any additional personal protective equipment (PPE) required and stocked for emergency response is also listed in below. During an emergency, the Emergency Response Coordinator (ERC) is responsible for specifying the level of PPE required for emergency response. At a minimum, PPE used by emergency responders will comply with Section 7.0, Personal Protective Equipment, of this HASP. Emergency response equipment is inspected at regular intervals and maintained in good working order. The equipment inventory is replenished as necessary to maintain response capabilities.

Emergency Equipment	Quantity	Location
First Aid Kit	1	Site Vehicle
Chemical Fire Extinguisher	2 (minimum)	All heavy equipment and Site Vehicle

Emergency PPE	Quantity	Location
Full-face respirator	1 for each worker	Site Vehicle
Chemical-resistant suits	4 (minimum)	Site Vehicle

4.0 EMERGENCY PLANNING MAPS

An area-specific map of the Site will be developed on a daily basis during performance of field activities. The map will be marked to identify critical on-site emergency planning information, including: emergency evacuation routes, a place of refuge, an assembly point, and the locations of key site emergency equipment. Site zone boundaries will be shown to alert responders to known areas of contamination. There are no major topographical features, however the direction of prevailing winds/weather conditions that could affect emergency response planning are also marked on the map. The map will be posted at site-designated place of refuge and inside the Benchmark-TurnKey personnel field vehicle.

5.0 EMERGENCY CONTACTS

The following identifies the emergency contacts for this ERP.

Emergency Telephone Numbers:

Project Manager: *Thomas H. Forbes*
Work: (716) 856-0599
Mobile: (716) 864-1730

Corporate Health and Safety Director: *Thomas H. Forbes*
Work: (716) 856-0599
Mobile: (716) 864-1730

Site Safety and Health Officer (SSHO): *Bryan C. Hann*
Work: (716) 856-0635
Mobile: (716) 870-1165

Alternate SSHO: *Richard L. Dubisz*
Work: (716) 856-0635
Mobile: (716) 998-4334

MERCY HOSPITAL:	(716) 826-7000
MERCY HOSPITAL (ER):	(716) 828-2790
FIRE:	911
AMBULANCE:	911
BUFFALO POLICE:	911
STATE EMERGENCY RESPONSE HOTLINE:	(800) 457-7362
NATIONAL RESPONSE HOTLINE:	(800) 424-8802
NYSDOH:	(716) 847-4385
NYSDEC:	(716) 851-7220
NYSDEC 24-HOUR SPILL HOTLINE:	(800) 457-7252

The Site location is:

Colgate Avenue (Ameron) Site
119 Colgate Avenue, Buffalo, NY 14220
Site Phone Number: (Insert Cell Phone or Field Trailer): _____

6.0 EMERGENCY ALERTING & EVACUATION

Internal emergency communication systems are used to alert workers to danger, convey safety information, and maintain site control. Any effective system can be employed. Two-way radio headsets or field telephones are often used when work teams are far from the command post. Hand signals and air-horn blasts are also commonly used. Every system must have a backup. It shall be the responsibility of each contractor's Site Health and Safety Officer to ensure an adequate method of internal communication is understood by all personnel entering the site. Unless all personnel are otherwise informed, the following signals shall be used.

1) Emergency signals by portable air horn, siren, or whistle: two short blasts, personal injury; continuous blast, emergency requiring site excavation.

2) Visual signals: hand gripping throat, out of air/cannot breathe; hands on top of head, need assistance; thumbs up, affirmative/ everything is OK; thumbs down, no/negative; grip partner's wrist or waist, leave area immediately.

If evacuation notice is given, site workers leave the worksite with their respective buddies, if possible, by way of the nearest exit. Emergency decontamination procedures detailed in Section 12.0 of the HASP are followed to the extent practical without compromising the safety and health of site personnel. The evacuation routes and assembly area will be determined by conditions at the time of the evacuation based on wind direction, the location of the hazard source, and other factors as determined by rehearsals and inputs from emergency response organizations. Wind direction indicators are located so that workers can determine a safe up wind or cross wind evacuation route and assembly area if not informed by the emergency response coordinator at the time the evacuation alarm sounds. Since work conditions and work zones within the site may be changing on daily basis, it shall be the responsibility of the construction Site Health and Safety Officer to review evacuation routes and procedures as necessary and to inform all Benchmark-TurnKey workers of any changes.

Personnel exiting the site will gather at a designated assembly point. To determine that everyone has successfully exited the site, personnel will be accounted for at the assembly site. If any worker cannot be accounted for, notification is given to the SSHO (***Bryan Hann*** or ***Richard Dubisz***) so that appropriate action can be initiated. Contractors and

subcontractors on this site have coordinated their emergency response plans to ensure that these plans are compatible and that source(s) of potential emergencies are recognized, alarm systems are clearly understood, and evacuation routes are accessible to all personnel relying on them.

7.0 EXTREME WEATHER CONDITIONS

In the event of adverse weather conditions, the SSHO in conjunction with the Contractor's SSHO will determine if engineering operations can continue without sacrificing the health and safety of site personnel. Items to be considered prior to determining if work should continue include but are not limited to:

- Potential for heat/cold stress.
- Weather-related construction hazards (e.g., flooding or wet conditions producing undermining of structures or sheeting, high wind threats, etc).
- Limited visibility.
- Potential for electrical storms.
- Limited site access/egress (e.g., due to heavy snow)

8.0 EMERGENCY MEDICAL TREATMENT & FIRST AID

Personnel Exposure:

The following general guidelines will be employed in instances where health impacts threaten to occur acute exposure is realized:

- Skin Contact: Use copious amounts of soap and water. Wash/rinse affected area for at least 15 minutes. Decontaminate and provide medical attention. Eyewash stations will be provided on-site. If necessary, transport to medical center.
- Inhalation: Move to fresh air and, if necessary, transport to medical center.
- Ingestion: Decontaminate and transport to medical center.

Personal Injury:

Minor first-aid will be applied on-site as deemed necessary. In the event of a life threatening injury, the individual should be transported to Mercy Hospital via ambulance. The Site Health and Safety Officer will supply available chemical specific information to appropriate medical personnel as requested.

First aid kits will conform to Red Cross and other applicable good health standards, and shall consist of a weatherproof container with individually sealed packages for each type of item. First aid kits will be fully equipped before being sent out on each job and will be checked weekly by the SSHO to ensure that the expended items are replaced.

Directions to Mercy Hospital (see Figure A-1):

- Turn right onto Colgate Avenue.
- Turn left (north) onto RT 62 South Park Avenue (0.3 miles).
- Turn right (east) onto Choate Avenue (0.4 miles).
- Enter next roundabout and take 2nd exit onto Red Jacket Pkwy (0.3 miles).
- Turn Left onto Abbott Road (0.1 mile).
- Turn Left into Emergency Room entrance.

Mercy Hospital is located at 565 Abbott Road, Buffalo, NY, 14220, and is approximately 1 mile northeast of the Site.

9.0 EMERGENCY RESPONSE CRITIQUE & RECORD KEEPING

Following an emergency, the SSHO and Project Manager shall review the effectiveness of this ERP in addressing notification, control and evacuation requirements. Updates and modifications to this ERP shall be made accordingly. It shall be the responsibility of each contractor to establish and assure adequate records of the following:

- Occupational injuries and illnesses.
- Accident investigations.
- Reports to insurance carrier or State compensation agencies.
- Reports required by the client.
- Records and reports required by local, state, federal and/or international agencies.
- Property or equipment damage.
- Third party injury or damage claims.
- Environmental testing logs.
- Explosive and hazardous substances inventories and records.
- Records of inspections and citations.
- Safety training.

10.0 EMERGENCY RESPONSE TRAINING

All persons who enter the worksite, including visitors, shall receive a site-specific briefing about anticipated emergency situations and the emergency procedures by the SSHO. Where this site relies on off-site organizations for emergency response, the training of personnel in those off-site organizations has been evaluated and is deemed adequate for response to this site.

FIGURES

From Site:

- Turn RIGHT onto COLGATE AVENUE.
- Turn LEFT (north) onto RT 62 SOUTH PARK AVE (0.3 miles).
- Turn RIGHT (east) onto CHOATE AVENUE (0.4 miles).
- Enter next roundabout and take 2nd exit onto RED JACKET PKWY (0.3 miles).
- Turn Left onto ABBOTT ROAD (0.1 mile).
- Turn Left into Emergency Room entrance.

BENCHMARK
ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC
726 EXCHANGE STREET
SUITE 624
BUFFALO, NEW YORK 14210
(716) 856-0599

PROJECT NO.: 0100-001-200

DATE: MAY 2009

DRAFTED BY: AJZ

HOSPITAL ROUTE MAP

HEALTH AND SAFETY PLAN (HASP) - RA WORK PLAN

COLGATE AVENUE SITE
BUFFALO, NEW YORK

PREPARED FOR
AMERON INTERNATIONAL

FIGURE A-1

FILEPATH: g:\cad\benchmark\ameron international\colgate avenue\hasp\figure A-1; hospital route map RA WORK PLAN.dwg

ATTACHMENT A-2

NYSDOH GENERIC COMMUNITY AIR MONITORING PLAN

APPENDIX 1A

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

ATTACHMENT A-3

HOT WORK PERMIT FORM

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

HOT WORK PERMIT

PART 1 - INFORMATION

Issue Date:

Date Work to be Performed: Start: Finish (permit terminated):

Performed By:

Work Area:

Object to be Worked On:

PART 2 - APPROVAL

(for 1, 2 or 3: mark Yes, No or NA)*

Will working be on or in:	Finish (permit terminated):	
1. Metal partition, wall, ceiling covered by combustible material?	yes	no
2. Pipes, in contact with combustible material?	yes	no
3. Explosive area?	yes	no

* = If any of these conditions exist (marked "yes"), a permit will not be issued without being reviewed and approved by Thomas H. Forbes (Corporate Health and Safety Director). Required Signature below.

PART 3 - REQUIRED CONDITIONS**

(Check all conditions that must be met)

	PROTECTIVE ACTION		PROTECTIVE EQUIPMENT
	Specific Risk Assessment Required		Goggles/visor/welding screen
	Fire or spark barrier		Apron/fireproof clothing
	Cover hot surfaces		Welding gloves/gauntlets/other:
	Move movable fire hazards, specifically		Wellintons/Knee pads
	Erect screen on barrier		Ear protection: Ear muffs/Ear plugs
	Restrict Access		B.A.: SCBA/Long Breather
	Wet the ground		Respirator: Type:
	Ensure adequate ventilation		Cartridge:
	Provide adequate supports		Local Exhaust Ventilation
	Cover exposed drain/floor or wall cracks		Extinguisher/Fire blanket
	Fire watch (must remain on duty during duration of permit)		Personal flammable gas monitor
	Issue additional permit(s):		

Other precautions:

** Permit will not be issued until these conditions are met.

SIGNATURES

Orginating Employee:	Date:
Project Manager:	Date:
Part 2 Approval:	Date:

Prepared By: _____

APPENDIX B

PROJECT DOCUMENTATION FORMS AND FIELD OPERATING PROCEDURE

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

INSPECTOR'S DAILY REPORT

Page _____ of _____

CONTRACTOR:	JOB NO.:
CLIENT:	DATE:

LOCATION:		DAY: Su M Tu W Th F Sa	
WEATHER:	TEMP: °F	START:	END:

WORK PERFORMED:

TEST PERFORMED:	QA PERSONNEL:
	SIGNATURE:

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

INSPECTOR'S DAILY REPORT

(CONTINUED) Page ____ of ____

CONTRACTOR:	JOB NO.:
CLIENT:	DATE:

MEETINGS HELD & RESULTS:

CONTRACTOR'S WORK FORCE AND EQUIPMENT

DESCRIPTION	H	#	DESCRIPTION	H	#	DESCRIPTION	H	#
Field Engineer						Front Loader Ton		
Superintendent						Bulldozer		
Laborer-Foreman						DJ Dump Truck		
Laborer						Water Truck		
Operating Engineer			Equipment			Backhoe		
Carpenter			Generators			Excavator		
Ironworker			Welding Equipment			Pad foot roller		
Concrete Finisher			Roller					
			Paving Equipment					
			Air Compressor					

REMARKS:

REFERENCES TO OTHER FORMS:

SAMPLES COLLECTED:

Sample Number:
Approx. Location of Stockpile:
No. of Stockpile
Date of Collection:
Weather:
Field Observations:

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

DAILY LOG	DATE			
	REPORT NO.			
	PAGE		OF	

PROBLEM IDENTIFICATION REPORT

Date:

Project:

Job No:

Location:

CQA Monitor(s):

Client:

Contractor:

Contractor's Supervisor:

WEATHER CONDITIONS:

Ambient Air Temp. - A.M.:

Ambient Air Temp. - P.M.:

Wind Direction:

Wind Speed:

Precipitation:

Problem Description:

Problem Location (reference test location, sketch on back of form as appropriate)

Problem Causes:

Suggested Corrective Measures or Variances:

Linked to Corrective Measures Report No. *or Variance Log No.*

Approvals (initial):

CQA Engineer:

Project Manager:

Signed:

CQA Representative

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

DAILY LOG	DATE			
	REPORT NO.			
	PAGE		OF	

CORRECTIVE MEASURES REPORT

Date:

Project:

Job No:

Location:

CQA Monitor(s):

Client:

Contractor:

Contractor's Supervisor:

WEATHER CONDITIONS:

Ambient Air Temp. - A.M.:

Ambient Air Temp. - P.M.:

Wind Direction:

Wind Speed:

Precipitation:

Corrective Measures Undertaken (reference Problem Identification Report No.)

Retesing Location:

Suggested Method of Minimizing Re-Occurrence:

Approvals (initial):

CQA Engineer:

Project Manager:

Signed:

CQA Representative

FOP 079.0

STOCKPILE SAMPLING PROCEDURES FOR CHEMICAL ANALYSIS

PURPOSE

This guideline presents a method for collecting representative soil samples from stockpiled borrow source material for chemical analysis.

GENERAL

In general, off-site soil that is brought to a Site for use as supplemental fill is subject to Quality Assurance sampling and analysis. If QA is required, all off-site soil proposed for use as Site backfill shall be documented by the subcontractor in writing to have originated from locations having no evidence of disposal or release of hazardous, toxic or radioactive substances, wastes or petroleum products. If the subcontractor designates a source as "virgin" soil, it shall be further documented in writing to be native soil material having not supported any known past industrial or commercial development or agricultural use. Borrow soils can be used as backfill once concentrations are confirmed to meet project designated criteria for the Constituents of Primary Concern (COPCs) and NYSDEC TAGM HWR-94-4046 recommended soil cleanup objectives (SCOs) or NYSDEC 6NYCRR Part 375 SCOs.

Sample collection equipment will include stainless steel mixing bowls, stainless steel mixing spoons, and a stainless steel hand auger with extension rods or a stainless steel spade or equivalent. It may be necessary to use a backhoe or drilling rig to facilitate sample collection.

FOP 079.0

STOCKPILE SAMPLING PROCEDURES FOR CHEMICAL ANALYSIS

SAMPLING PLAN

1. Virgin Sources – Virgin borrow sources will be confirmed acceptable for use as site backfill through collection of a single composite soil sample representative of the borrow pit or stockpile.

2. Non-Virgin Sources – Prior to sampling, determine the amount of soil that will be sampled. The soil will be tested via collection of one composite sample per 250 cubic yards of material from each source area. If more than 1,000 cubic yards of soils are excavated from a given off-site source area and all samples of the first 1,000 cubic yards meet project designated criteria, the sample collection frequency may be reduced to one composite for each additional 1,000 cubic yards of soils from the same source area, up to 5,000 cubic yards. For borrow sources greater than 5,000 cubic yards, sampling frequency may be reduced to one sample per 5,000 cubic yards, providing all earlier samples meet project designated criteria. Sampling procedure for non-virgin sources is described in the next section.

SAMPLE COLLECTION AND HANDLING

The following procedure will be used to collect representative soil samples from a non-virgin soil stockpile.

1. Using a stainless steel spade (or hand auger), a backhoe, or drilling rig, penetrate the pile to a depth of approximately 2 to 3 feet and collect four (4) representative grab samples of approximate equal volume from the top, middle, and bottom.

2. Transfer each grab into a small stainless steel mixing bowl.

3. **VOC Analysis:** Using a clean stainless steel spoon, transfer equal amounts from each small mixing bowl into a laboratory-supplied, 4 oz. VOC sample jar. This should be performed by randomly transferring several small aliquots from each bowl, taking care to minimize disturbance of the soil.

4. **Other COPCs:** Transfer equal aliquots from each small bowl into a large mixing bowl and homogenize the sample. Fill the remaining laboratory-supplied jars with the homogenized soil for all other project required COPCs (i.e., SVOCs, PCBs, Pesticides, Herbicides, inorganics, etc.).

5. Label each set of jars with the following information:
   - Project and site name
   - Sample Code
   - Project Number
   - Date/Time
   - Sample type (soil composite or grab)
   - Sampler's initials
   - Sample Preservation
   - Required analysis

   The sample code will consist of a unique, alphanumeric identification code keyed to the sampling location. Identify the sampling location on a field sketch.

6. Record all information associated with sample collection in the Project Field Book.

7. Label, store, and ship the samples in accordance with the Benchmark Field Operating Procedure for Sample Labeling, Storage and Shipment Procedures.

8. Clean the sampling and mixing equipment with Alconox and deionized water and repeat steps 1 through 7 for the remaining samples.

REFERENCES

Benchmark FOPs:
046 Sample Labeling, Storage and Shipment Procedures

APPENDIX C

HRC® INSTALLATION INSTRUCTIONS

REGENESIS

Hydrogen Release Compound (HRC â)

INSTALLATION INSTRUCTIONS
Direct-Push Injection

GENERAL GUIDELINES

The best method to deliver HRC into the subsurface is to inject the material through direct push rods using hydraulic equipment. This approach increases the spreading and mixing of HRC into the aquifer. This set of instructions is specific to direct push equipment.

Regenesis has found that very few pumps can adequately deliver HRC to the subsurface. Although other pumps may be capable of injecting HRC, we have developed the following instructions specifically for use with an R.E. RUPE Company Model ORC/HRC 9-1500 mixing and pumping machine. There is also strong evidence that the Geoprobe GS-2000 pump can effectively deliver HRC to the subsurface. In general, Regenesis strongly recommends using a pump with a minimum pressure rating of 1,500 pounds per square inch (psi) and a minimum delivery rate of 3 gallons per minute.

The installation of HRC should span the entire vertical contaminated saturated thickness. If the vertical extent of HRC application is confined to a limited interval, then the HRC material should be placed across a vertical zone extending a minimum of 2 feet above and below the screened Interval of monitoring wells to be used to evaluate the performance of the bioremediation project.

MATERIAL OVERVIEW, HANDLING, AND SAFETY

HRC is shipped in 4.25-gallon buckets and each bucket has a gross weight of approximately 32 pounds (net weight of HRC is 30 pounds). At room temperature, HRC is a sticky gel with a viscosity of approximately 20,000 centipoise (roughly equivalent to cold honey). The HRC material has a nominal density of 1.3 grams/cubic centimeter or approximately 10.8 pounds per gallon. The viscosity of HRC is temperature sensitive. Significant changes in viscosity are observed with large changes in product temperature. It should be noted that the temperature/viscosity relationship is not linear. For ease of installation, HRC should be stored in a warm, dry place that is protected from direct sunlight. It is common for stored HRC to settle somewhat in a container. Pre-heating HRC makes it easier to work with the material. Although HRC is manufactured as a food-grade material that is safe to ingest, field personnel should take precautions while handling and applying HRC. Field personnel should use appropriate safety equipment, including eye protection. The low pH when dissolved in water and the viscosity of the product make eye protection mandatory. Gloves should be used as appropriate based on the exposure duration and field conditions. A Material Safety Data Sheet is provided with each shipment. Personnel who operate field equipment during the installation process should have appropriate training, supervision, and experience.

SPECIFIC INSTALLATION PROCEDURES

1) Prior to the installation of HRC, any surface or overhead impediments should be identified as well as the location of all underground structures. Underground structures include but are not limited to: utility lines, tanks, distribution piping, sewers, drains, and landscape irrigation systems.

2) The planned installation locations should be adjusted to account for all impediments and obstacles.

3) Regenesis recommends pre-heating HRC in a hot water bath. Place unopened buckets of HRC into an empty water tank. A Rubbermaid fiberglass Farm Trough Stock Tank (Model 4242-00-GRAY) is typically used for this application and can hold up to 16 buckets of HRC. Hot water (approximately 130-170°F or 54-77°C) should be added to the tank after the buckets of HRC have been placed inside. When the HRC reaches a minimum temperature of 95°F or 35°C (approximately 20-30 minutes) it is ready to be poured into the pump hopper.

4) Pre-mark the installation locations, noting any points that may have different vertical application requirements or total depth.

5) Set up the direct push unit over each specific point and follow the manufacturer standard operating procedures (SOP) for the direct push equipment. Care should be taken to assure that probe holes remain in the vertical.

6) For most applications, Regenesis suggests using 1.25-inch O.D./0.625-inch I.D Geoprobe brand drive rods. However, some applications may require the use of 2.125-inch O.D./1.5-inch I.D. drive rods.

7) The HRC delivery sub-assemblies that Regenesis currently uses are designed for 1.25-inch Geoprobe rods. Other brands of drive rods can also be used but require the fabrication of a sub-assembly (see Regenesis Website).

8) Advance drive rods through the surface pavement, as necessary, following SOP.

9) Push the drive rod assembly with an expendable tip to the desired maximum depth. Regenesis suggests pre-counting the number of drive rods needed to reach depth prior to starting injection activities.

10) After the drive rods have been pushed to the desired depth, the rod assembly should be withdrawn three to six inches. Then the expendable tip can be dropped from the drive rods, following SOP.

    a) If an injection tool was used instead of an expendable tip, the application of material can take place without any preliminary withdrawal of the rods.

11) In some cases, introduction of a large column of air may be problematic. This is particularly the case in deep injections (>50 ft) with large diameter rods (>1.5-inch O.D.). To prevent the injection of air into the aquifer during HRC application, fill the drive rods with water.

12) Pour the pre-heated HRC into the pump hopper (up to 40 gallons). Remove the separated HRC from the bucket bottom by tipping the bucket into the hopper and scraping out the smooth residual material. Use the pumps mixing and recirculation features to create a uniform consistency. This typically requires recirculation of approximately one hopper volume. NOTE: Do not attempt to mix HRC with water or other liquids to thin or decrease the viscosity of the material. This may adversely affect HRC longevity.

13) A volume check should be performed prior to injecting HRC. Determining the volume displaced per pump stroke can be accomplished in two easy steps.

    a) Determine the number of pump strokes needed to deliver 3 gallons of HRC (use a graduated bucket for this)

    b) Divide 3 gallons by the results from the first step to determine the number of gallons of HRC delivered by each pump stroke.

    c) Level indicators present in the hopper are in 3 gallon increments.

    d) The volume of HRC displaced should be confirmed using the HRC level indicators located inside the pump hopper.

14) Connect the 1.25-inch O.D., 1-inch I.D. delivery hose to the pump outlet and the provided HRC delivery sub-assembly. Circulate HRC though the hose and the delivery sub-assembly to displace air in the hose.

15) Connect the HRC sub-assembly to the drive rod. After confirming that all of the connections are secure, pump the HRC through the delivery system to displace the water/fluid in the rods. **NOTE:** Prior to pumping HRC into the aquifer, close the pump recirculation valve; failure to do so will allow material to short-circuit into the hopper and change the volume of HRC delivered per pump stroke.

16) The pump engine RPM and hydraulic settings should remain constant throughout the day. However, if the hydraulic system starts to “squeal”, the pump speed should be decreased until the noise is mitigated.

17) Use the pump’s stroke counter and the provided volume/weight conversions to apply the appropriate HRC volume per injection location (and per vertical foot of contaminated saturated zone). Table 1 shows typical HRC delivery information followed by an example calculation.

Table 1: Pump Volume Calculation

Example: For each injection location, install 60 pounds of HRC across 10 vertical feet of aquifer (an application rate of 6 pounds per vertical foot).

Solution:

- 60 pounds/10.8 pounds per gallon ≈ 5.6 gallons for the injection location
- 5.6 gallons/0.2 gallons per stroke ≈ 28 pump strokes for the injection location
- 28 pump strokes/10 vertical feet = 2.8 strokes per vertical foot
- 2.8 strokes per vertical foot = 8.4 strokes per 3 foot drive rod
- 2.8 strokes per vertical foot = 11.2 strokes per 4 foot drive rod

18) Slowly withdraw the drive rods using Geoprobe Rod Grip or Pull Plate Assembly (Part AT1222-For 1.25-inch drive rods). While slowly withdrawing single lengths of drive rod (3 or 4 feet), pump the pre-determined volume of HRC into the aquifer across the desired treatment interval (Step 13). Use the stroke counter and pump on/off switch to control volume of injection. See Helpful Hints at the end of this section.

19) Remove one section of the drive rod. The drive rod may contain some residual HRC. Place the HRC-filled rod in a clean, empty bucket and allow the HRC to drain. Eventually, the HRC should be returned to the HRC pump hopper for reuse.

20) Observe any indications of aquifer refusal. This is typically indicated by a high-pitched squeal in the pump's hydraulic system or (in the case of shallow applications) HRC "surfacing" around the injection rods or previously installed injection points. If aquifer acceptance appears to be low, allow enough time for the aquifer to equilibrate prior to removing the drive rod.

21) Repeat steps 15 through 20 until treatment of the entire contaminated vertical zone has been achieved.

22) Install an appropriate seal, such as bentonite, above the HRC material through the entire vadose zone. Depending on soil conditions and local regulations, use a bentonite seal via chips or pellets after the probe rods have been removed. This assures that the HRC remains properly placed and prevents contaminant migration from the surface. If HRC continues to "surface" up the direct push borehole, an appropriately sized (oversized) disposable drive tip or wood plug/stake can be used to plug the hole until the aquifer equilibrates and the HRC stops surfacing.

23) Remove and clean the drive rods as necessary.

24) Finish the borehole at the surface as appropriate (concrete or asphalt cap, if necessary).

25) Periodically compare the pre- and post-injection volumes of HRC in the pump hopper using the pre-marked volume levels. Volume level indicators are not on all pump hoppers. In this

case, volume level markings can be temporarily added using known amounts of water and a carpenter's grease pencil (Kiel crayon). We suggest marking the water levels in 3-gallon increments.

26) Move to the next probe point, repeating steps 8 through 25.

HELPFUL HINTS

1) *Application in Cold Weather Settings*

The viscosity of HRC is directly related to the ambient temperature. As discussed in the Material Overview, Handling, and Safety section, cold weather tends to increase HRC viscosity and decrease ease of pumping. To maintain HRC at a temperature/viscosity at which it is easy to apply:

Raise and maintain the temperature of the HRC to at least 95°F (35°C) prior to pouring it into the pump hopper.

Insulate the delivery hose and keep the pump and hot water bath inside an enclosed structure such as a cargo van or trailer.

Periodically check the HRC temperature in the hopper.

Occasionally re-circulate HRC through the pump and hose to maintain temperature and viscosity.

The volume of HRC recirculated should not exceed the volume of HRC in the hopper.

Do not constantly recirculate HRC through the pump and hoses, as this may adversely affect the longevity of HRC.

2) *HRC Pump Information*

Regenesis has evaluated a number of pumps that are capable of delivering 20,000 centipoise HRC to the subsurface at a sufficient pressure and volumetric rate. Although a number of pumps may be capable of delivering the HRC to the subsurface at adequate pressures and volume, each pump has a set of practical issues that make it difficult to manage in a field setting. As a result of this evaluation, Regenesis has determined that the R.E. RUPE Company Model ORC/HRC 9-1500 meets the pressure and volume requirements needed to successfully inject HRC in the field. In general, Regenesis strongly recommends using a pump with a minimum pressure rating of 1,500 pounds per square inch (psi) and a minimum delivery rate of 3 gallons per minute. When applying measured volumes of HRC via probe boreholes, it is useful to know the volume of a single pump stroke (Table 1 above) and the associated delivery system lines. The following additional information is provided for reference:

Table 2: HRC Physical Characteristics

Density	1.3 g/cc or 10.8 lbs/gal
Viscosity	Approx. 20,000 centipoise

Table 3: Equipment Volume and HRC Weight per length

Equipment	Volume	HRC weight
1-inch OD; 0.625-inch ID hose (10 feet long)	0.2 gallon	1.8 lbs.
1.25-inch OD; 0.625-inch ID drive rod (3 feet length):	0.05 gallon	0.5 lbs.
1.25-inch OD; 0.625-inch ID drive rod (4 feet length):	0.06 gallon	0.7 lbs.

3) *Pump Cleaning*

For best results, use a hot water pressure washer (150 - 170 °F or 66 - 77 °C) to clean equipment and rods periodically throughout the day. Internal pump mechanisms and hoses can be easily cleaned by circulating hot water and a biodegradable cleaner such as Simple Green through the pump and delivery hose. Further cleaning and decontamination (if necessary due to subsurface conditions) should be performed according to the equipment supplier's standard procedures and local regulatory requirements.

NOTE: The remote control/pump counter should be kept dry at all times. If it gets wet, it will short-circuit and will need to be replaced.

Before using the Rupe Pump, check the following:

- Fuel level prior to engaging in pumping activities (it would be best to start with a full tank)
- Remote control/pump stroke counter LCD display (if no display is present, the electronic counter will need to be replaced (Grainger Stock No. 2A540))

Monitor pump strokes by observing the proximity switches (these are located on the top of the piston).

4) *HRC Bedrock Applications*

When contaminants are present in competent bedrock aquifers, the use of direct push technology as a delivery method is not possible. *Regenesis is in the process of developing methods for applying HRC via boreholes drilled using conventional rotary techniques.* To develop the best installation strategy for a particular bedrock site, it is critical that our customers call the technical support department at Regenesis early in the design process.

HRC can be applied into a bedrock aquifer in cased and uncased boreholes. HRC can be delivered by simply filling the borehole without pressure or by using a single or straddle packer system to inject HRC under pressure. Selection of the appropriate delivery

method is predicated on site-specific conditions. The following issues should be considered in developing an HRC delivery strategy:

- Is the aquifer's transmissivity controlled by fractures?
- Backfilling may be the better delivery method in massive, unfractured bedrock. This is particularly true in an aquifer setting with high permeability and little fracturing (such as that found in massive sandstone).
- Down-hole packer systems may be more advantageous in fractured bedrock aquifers.
    - In this case the fracture type, trends, and interconnections should be evaluated and identified.
- Are the injection wells and monitoring wells connected by the same fractures?
- Determine if it is likely that the HRC injection zone is connected to the proposed monitoring points.
- If pressure injection via straddle packers is desired, consideration should be given to the well construction. Specific issues to be considered are:
    - Diameter of the uncased borehole (*will casing diameter allow a packer system to be used*?).
    - Diameter of the casing (*same as above*).
    - Strength of the casing (*can it withstand the delivery pressures?*).
    - Length of screened interval (*screened intervals greater than 10 feet will require a straddle packer system*).

APPENDIX D

ORC *ADVANCED*™ INSTALLATION INSTRUCTIONS

REGENESIS

Oxygen Release Compound (ORC®)
&
Advanced Formula Oxygen Release Compound (ORC Advanced™)

INSTALLATION INSTRUCTIONS

SAFETY

Pure ORC and ORC Advanced are shipped as fine white and pale yellow powders, respectively. ORC is considered to be a mild oxidizer while ORC Advanced is considered an oxidizer therefore both products should be handled with care while in the field. Field personnel should take precautions while installing either the ORC or ORC Advanced product. Typically, the operator should work upwind of the products as well as use the appropriate personal protection equipment (PPE) which includes eye, respiratory protection, and gloves as deemed appropriate by exposure duration and field conditions. In addition, personnel operating the field equipment utilized during installation activities should have appropriate training, supervision and experience.

GENERAL GUIDELINES

ORC/ORC Advanced can be installed in the contaminated saturated zone in the ground utilizing hand-augured holes, direct-push, hollow stem augers or air/mud-rotary drilling techniques. For optimum results, the ORC/ORC Advanced slurry should be installed across the entire vertical contaminated saturated thickness, including the capillary fringe and "smear zone."

Two general approaches are available for installation of these products. The first is to inject the ORC/ORC Advanced slurry through direct-push drive rods across the contaminated saturated zone and the second is to backfill the application points with the ORC/ORC Advanced slurry. Using the injection method should increase oxygen dispersion in the zone of interest over the life of the project because the ORC/ORC Advanced slurry affects a larger zone right from the start. If the backfill method is used more time may be required for the completion of the remediation process because oxygen distribution will be most likely be less.

It is important that the installation method and specific ORC/ORC Advanced slurry point location be established prior to field installation. It is also important that the ORC/ORC Advanced slurry volume and solids content for each drive point be pre-determined. The Regenesis Technical Services Group is available to discuss these issues. The Helpful Hints at the end of these instructions offers relevant information. Further information regarding ORC/ORC Advanced is available on the Regenesis website at www.regenesis.com.

SPECIFIC INSTALLATION PROCEDURES

1. Identify the location of all underground structures, including utilities, tanks, and distribution piping, sewers, drains, and landscape irrigation systems.

2. Identify surface and aerial impediments.

3. Adjust planned installation locations for all impediments and obstacles.

4. Pre-mark the installation grid/barrier point locations, noting any that have special depth requirements.

5. Set up the unit over each specific point, following manufacturer recommended standard operating procedures (SOP).

The section below contains instructions for augured-hole (hollow stem or air/mud rotary) applications. For direct-push applications, go to the following section.

Instructions for Augured Whole Applications

6. Hand augering and solid stem auger applications will generally require the soil matrix to stay open during auger removal. If this is the method being used, the ORC/ORC Advanced slurry should be installed immediately upon tool removal from the borehole.

7. Mix the appropriate quantity of ORC/ORC Advanced slurry for the current application point. Do not mix more slurry than will be used within a 30-minute period because the slurry could solidify and become useless.

8. Where soil conditions are unstable in the saturated zone, we recommend using a thicker ORC/ORC Advanced slurry. A solids content of 65-67% (consistency of toothpaste) is appropriate in these situations, since it comes relatively close to mimicking the density of soil.

9. **Tremie pipe option #1**: The slurry may be pumped through standard geotechnical slurry pumps and a tremie hose/pipe. We strongly recommend following the equipment manufacturer's standard operating instructions. Regenesis recommends that the tremie application be performed from the bottom of the hole up to the top of the capillary fringe. This is especially important if there is groundwater in the bottom of the installation hole, since it serves to maintain the densest portion of the ORC/ORC Advanced slurry mix.

10. **Tremie pipe option #2**: In relatively shallow situations, a tremie pipe may be used. Depending on the open hole diameter, a PVC tremie pipe with a one- to two-inch diameter may be used. The hole should be filled from the bottom of the hole to the top of the capillary fringe. It is normally a good idea, and may sometimes be a necessity, to use a "plunger" inside the tremie pipe to push the slurry through as the pipe is withdrawn. A funnel to pour slurry into the tremie pipe is advised.

11. **Hollow-stem auger option #1**: If the borehole being drilled would collapse during tool removal, augering applications require a hollow stem. By drilling with a plug in place, an open temporary source hole is created. The slurry may be installed with a tremie pipe or a tremie pump, following the pump manufacturer's operating instructions. Depending on the saturated zone soil conditions, it may be necessary to carefully coordinate the rate of auger withdrawal with the rate of slurry addition to preserve the hole void space for acceptance of the slurry.

12. **Hollow stem auger option #2 (auger as "tremie pipe")**: When soil conditions in the saturated zone are unstable and borehole collapse is likely, the hollow stem auger may be used as a tremie pipe. Prior to dropping the auger plug at the bottom of the hole, the ORC/ORC Advanced slurry is poured directly into the hollow stem, in a volume equal to the expected requirement for the hole. A plunger inside the auger is used to push the slurry down in the hole to keep it there as the auger is removed.

Skip the next section and proceed to Step 13.

For Direct-Push Applications

6. Push the drive rods (A 1.5-inch pre-probe can be used but is not recommended) with the detachable tip to the maximum desired depth. Standard drive rods (typically 1.25-inch O.D.) should be used. Pre-counted drive rods should be positioned prior to the installation driving procedure to assure the desired depth is reached.

7. Disconnect the drive rods from the implantable tip, following standard equipment procedures.

8. Mix the appropriate quantity of ORC/ORC Advanced slurry for the current injection point. Do not mix more slurry than will be used within a 30-minute period.

9. Set up and operate an appropriate slurry pump according to manufacturer's directions. Connect the pump to the probe puller/injector connector via a standard delivery hose. The hose is then attached to the drive rod with its quick disconnect fitting. Upon confirmation of all connections, add the ORC/ORC Advanced slurry to the pump hopper/tank.

10a. **Injection Application (if this is a backfill application, go to step 10b)**: While slowly withdrawing the drive rods, pump the pre-determined amount of ORC/ORC Advanced slurry into the aquifer. Typically, ORC/ORC Advanced injection rates are based on pounds of material installed per foot of vertical treatment. Observe pump pressure levels for indications of slurry dispersion and/or slurry refusal into aquifer (increasing pressure indicates reduced acceptance of material by the aquifer). As an optional pre-treatment step, pump one to two gallons of tap water into the aquifer to enhance dispersion pathways from the probe hole.

10b. **Backfill Application**: Pump the pre-determined quantity of ORC/ORC Advanced slurry into the borehole being treated. Observe pump pressure levels for indications of slurry dispersion

and/or slurry refusal into aquifer (increasing pressure indicates reduced acceptance of material by the aquifer).

11. Remove one four-foot section of the drive rod. If the drive rod contains slurry, return it to the ORC/ORC Advanced bucket/pump hopper for reuse.

12. Repeat steps 10 and 11 until treatment of the entire targeted thickness has been achieved. It is generally recommended that the procedure extend to the top of the capillary fringe/smear zone.

13. Place an appropriate seal, such as bentonite, above the ORC/ORC Advanced slurry through the entire vadose zone. This helps ensure that the slurry stays in place and prevents contaminants from migrating go the surface. Depending on soil conditions and local regulations, a bentonite seal can be pumped through the grout pump or added via chips or pellets after the drive rods have been removed.

14. Remove and decontaminate the drive rods and pre-probe (optional).

15. Finish the probe hole at surface as appropriate (concrete or asphalt cap, if necessary).

16. Move to the next injection point, repeating steps 5 through 15.

HELPFUL HINTS

1) Physical characteristics

The ORC/ORC Advanced slurry is made using the dry ORC/ORC Advanced powder makes a smooth slurry, the consistency of which depends on the amount of water used.

A 65-67% solids content ORC/ORC Advanced slurry (consistency of toothpaste) is thick but can still be pumped easily. This solids content slurry is normally used for back filling a borehole or probe hole. It is especially useful in situations where maximum density is desired, such as when ground water is present in the hole or when there are heaving sands.

As a rule, it is best to mix the first batch of slurry at the maximum solids content one would expect to use. The slurry can then be thinned by adding water in small increments. By monitoring this process, the appropriate quantities of water for subsequent batches can be determined.

The slurry should be mixed at about the time it is expected to be used. It is best not to hold it for longer than 30 minutes. Thinner slurries can experience separation if they stand too long. All solids content ORC/ORC Advanced slurries have a tendency to form a weak cement when left standing for extended periods or time. If a slurry begins to thicken too much, it should be mixed again and additional water should be added.

The ORC/ORC Advanced slurry should not be left sitting inside a grout pump or hose for extended periods because it will begin to set-up and harden. This problem can generally be avoided by re-circulating the slurry through the pump and hose back into the pump's hopper or mixing tank.

2) ***Pump Equipment Cleaning and Maintenance***

Pumping equipment and drive rods can be lightly cleaned by circulating clear water through them. If necessary, further cleaning and decontamination should be performed according to the equipment supplier's standard procedures and local regulatory requirements.

3) ***General Operating Procedures for Backfill Applications***

When performing a backfill installation, it is important to fill the appropriate portion of the hole with a thick (65-67% solids content) slurry that will solidify in place. Moderate amounts of pressure should be used to avoid fracturing the soil matrix or pumping slurry into the soil.

The operator should use care and monitor pumping pressures and quantities to ensure that the hole is being filled without pushing excess material into the soil matrix. Ideally, the rate of slurry pumping will be coordinated with the rate of drive rod withdrawal. It is usually important to install the slurry material to the top of the capillary fringe.

In addition, it is important that the entire contaminated saturated zone is treated (including the capillary fringe), as this is often the location of highest contaminant concentrations. Failure to properly treat this area can undermine an otherwise successful remediation effort.

1011 Calle Sombra • San Clemente, CA 92673 • tel: 949.366.8000 • fax: 949.366.8090

tech@regenesis.com • www.regenesis.com

Recommended Groundwater Monitoring Program for ORC *Advanced*™ Projects

In order to validate the effectiveness of natural attenuation processes (ORC *Advanced*-enhanced treatment), we recommend conducting groundwater monitoring at selected wells. Also, a baseline round of sampling should be performed to identify the aquifer conditions prior to the installation of this material. After ORC *Advanced* has been installed into the subsurface, groundwater samples can be collected on a bi-monthly or quarterly basis. Once the initial biodegradation and geochemical trends have been identified, the monitoring frequency can be changed to a semi-annual or annual program. The groundwater monitoring program should employ low flow groundwater sampling techniques and include the measurement of the following field/chemical parameters:

- All COCs
- Field redox parameters: oxidation-reduction potential (ORP), pH, dissolved oxygen (DO), dissolved manganese, and dissolved (ferrous) iron
- Biochemical Oxygen Demand ($BOD_{5\text{-}day}$) and Chemical Oxygen Demand (COD) at selected groundwater monitoring wells within treatment area

Groundwater Monitoring Locations

The following table outlines the suggested locations and significance of monitoring wells used to monitor the progress of an ORC *Advanced* -based project.

Location	Significance
Background (Outside the groundwater plume)	Allows for the changes in natural attenuation conditions induced by addition of ORC *Advanced* to be compared to background levels
Upgradient of treatment zone	Provides a measure of contaminant and competing electron acceptor flux entering treatment zone
Inside treatment zone	Provides information on how ORC *Advanced* is affecting the aquifer conditions and contaminant concentrations
Downgradient of treatment zone	Provides information on the effect ORC *Advanced* is having on the biodegradation rates of contaminants and on aquifer conditions and confirms the mitigation migration