Analysis of Brownfield Cleanup Alternatives (ABCA)
Revision 0

155 and 159 Hamm Road
Chattanooga, Hamilton County, Tennessee
US EPA Cooperative Agreement No.: BF-95462910-0
August 9, 2013
Terracon Project No.: E2107081

Prepared for:
Chattanooga-Hamilton County Regional Planning Agency
Chattanooga, Tennessee

Prepared by:
Terracon Consultants, Inc.
Chattanooga, Tennessee

August 9, 2013

Chattanooga-Hamilton County
Regional Planning Agency
1250 Market Street, Suite 2000, DRC
Chattanooga, Tennessee 37402

Attn: Ms. Yuen Lee

Re: Analysis of Brownfield Cleanup Alternatives (ABCA)
Hamm Road Property
155 and 159 Hamm Road
Chattanooga, Tennessee
US EPA Cooperative Agreement No.: BF-95462910-0
Terracon Project No.: E2107081

Dear Ms. Lee:

Terracon is pleased to present to the Chattanooga-Hamilton County Regional Planning Agency (RPA) this Analysis of Brownfield Cleanup Alternatives, Revision 0 (ABCA) as part of cleanup design for the Hamm Road Property project located at 155 and 159 Hamm Road, Chattanooga, Hamilton County, Tennessee. The RPA is the primary Cooperative Agreement Recipient.

This ABCA was prepared as part of Cleanup Planning under the Community-Wide Petroleum Brownfields Grant awarded to the RPA. This cleanup design activity was performed as authorized by the RPA. These services are in keeping with EPA's Strategic Plan, Goal 4: Healthy Communities and Ecosystems, Objective 4.2 Communities, Sub-objective 4.2.3 Assess and Cleanup Brownfields.

On behalf of the RPA, Terracon evaluated and compared potential brownfield cleanup alternatives relative to technical feasibility and cost. Consistent with the EPA process for cleanup of hazardous substances, multiple technologies were considered. The ABCA considered combinations of a "no action" alternative and three other alternative technological approaches. These services support the future redevelopment of this site.

The analysis and opinions expressed in this report are based upon the data derived from samples collected by others at the indicated locations and from other information discussed in this report. This report does not reflect any variations in subsurface stratigraphy, geohydrology, or contaminant distribution which may occur beyond or between the indicated sampling locations or across the site. This report is prepared for the exclusive use of the RPA for specific application to the project as discussed and has been prepared in accordance with generally accepted local environmental practices within the scope of the client's directives.

No warranties, either express or implied, are intended or made. Should any changes in the nature or location of contaminants outlined be observed, the conclusions and recommendations contained in this report cannot be considered valid unless the changes are reviewed and the conclusions and objectives of this report are modified or verified in writing by Terracon.

Terracon appreciates this opportunity to continue to provide environmental engineering services for the RPA in support of local Brownfields redevelopment. Should you have any questions or require additional information, please do not hesitate to contact our office at (423) 499-6111.

Sincerely,
Terracon Consultants, Inc.

Amanda M. Herrit, M.S.
Environmental Scientist

Dallas Whitmill
Senior Engineer/
Chattanooga Environmental Manager

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August 9, 2013

1.0 INTRODUCTION AND BACKGROUND

This Analysis of Brownfield Cleanup Alternatives (ABCA) has been developed under funding provided by the United States Environmental Protection Agency (EPA) Brownfield Assessment grant to address petroleum substances as awarded to the Chattanooga-Hamilton County Regional Planning Agency in 2010.

This ABCA has been prepared in anticipation of submitting on an application for an EPA Brownfield Cleanup Grant. The EPA Brownfield Cleanup funding proposal must include, as an attachment, an ABCA which briefly summarizes information about the site and contamination issues, cleanup standards, applicable laws, cleanup alternatives considered, and the proposed cleanup. The ABCA should also include information on the effectiveness, the ability of the grantee to implement each alternative, the cost of each proposed cleanup alternative and an analysis of the reasonableness of the various cleanup alternatives considered, including the one chosen. The ABCA submitted as part of the proposal is intended as a brief preliminary document summarizing the larger and more detailed technical and financial evaluations performed in addressing each of these areas. The ABCA may be modified technically and financially or in more depth relative to each of these areas upon award of funding and in response to community interaction.

Cleanup alternatives were evaluated in accordance with EPA protocols and general guidance required prior to implementation of a cleanup design using EPA Brownfields Grant funding. More specifically, this ABCA summarizes viable cleanup alternatives based on site-specific conditions, technical feasibility and preliminary cost/benefit analyses. Specific cleanup alternatives and associated recommendations are presented in the applicable sections of this report.

1.1 Site Location, Description and History

The site is located at 155 and 159 Hamm Road, Chattanooga, Hamilton County, Tennessee 37405 and includes Tax Parcels 135 027.1 and 135 027.03. A site location (USGS topographic) map is included as Exhibit 1 and a Site Vicinity Map is included as Exhibit 2 and are found in Appendix A. The site totals approximately 12.25 acres. The 159 Hamm Road parcel is currently occupied by Affiliated Transit. The parcel is improved with a garage and office building and a large gravel parking area. The garage is used by Affiliated Transit for repairs to the truck fleet.

The 155 Hamm Road parcel is currently vacant; however the warehouse foundation remains at the site. The 155 and 159 Hamm Road parcels (Hamm Property) was historically the location of Hydro Chem Industrial Services, Inc., Fox Transport, Inc, Scenicland Motors and Bus Service, and the Kamatsu Stage facility.

1.2 Site Assessment Findings

In July 2011, Terracon conducted a Phase I Environmental Site Assessment (ESA) for the site. The 2011 *Phase I Environmental Site Assessment* report identified potential petroleum contamination from onsite and offsite sources. As described in the Phase I ESA report, a petroleum release was discovered at Fox Transport, Inc., formerly located at 159 Hamm Road, during the closure of a 17,000-gallon diesel UST. The tank was removed in 1989 and a Permanent Closure Letter was issued in 2000. At the time the UST closure, pump islands and the product lines were not removed, and testing for suspected contamination in these areas was not required. In many cases, petroleum releases are a result of leaking product lines and pump islands. Hydro Chem Industrial Services, Inc. was previously located at 159 Hamm Road. As described in the Phase I ESA report, Hydro Chem Industrial Services, Inc. was once a large quantity generator of lead. The Phase I ESA report recommended additional investigation including the collection of subsurface soil samples and groundwater samples.

Terracon conducted a geotechnical investigation in October 2011. During the investigation, a petroleum-type product was observed in boring samples collected at the 155 Hamm Road parcel in two soil boring sample locations. Foundry sand was also observed in several boring samples collected from both parcels of the Hamm Road Property. Based on the data collected during the geotechnical investigation, the proposed environmental sample locations were selected near areas of suspected contamination.

Terracon completed a Phase II ESA report in January 2013. The investigation included soil and groundwater sample collection on both site parcels. The laboratory analysis identified analyte concentrations above action levels for arsenic, EPH, SVOCs, and VOCs in soil; and lead, naphthalene, and SVOCs in groundwater. Terracon completed additional sampling for the Phase II ESA in May 2013. It was determined that a second soil sampling event was necessary to delineate surface soil contamination. On May 21, 2013, 25 shallow soil borings from 0 to 2 feet bgs were installed in a grid pattern across the site and a shallow soil sample was collected from each boring location. The laboratory analysis identified analyte concentrations above action levels for arsenic, EPH, and SVOCs in soil. The Phase II ESA report recommended that a corrective action plan should be developed detailing investigative procedures for managing and, if desired, remediating contaminated soil and groundwater located at the site. Along with the corrective action plan, deed restrictions should be placed on the site controlling the future use of the groundwater at the site. Based on the elevated concentrations of soil and groundwater contaminants at the site, a Brownfield agreement should be developed between the current property owners and the State of Tennessee.

2.0 PROJECT GOAL AND RE-USE PLAN

The purpose of these activities is to support the Chattanooga-Hamilton County RPA's broader effort to revitalize communities with a diversified mix of businesses – resulting in a sustainable local economy as well as better positioning Southeast Tennessee within the regional economy. At the center of this effort is the redevelopment of Brownfields properties into uses compatible with adjacent development without the stigma associated with potentially contaminated properties. Uncertainties related to contamination have inhibited redevelopment efforts in the region. Individual Brownfields assessments will help the RPA resolve these uncertainties, and are expected to increase the marketability of sites to prospective purchasers and developers.

On the behalf of the City of Chattanooga, the RPA is using EPA Brownfield funding at this site to assess the extent of contamination located at the site for the future end use of the site as a passive recreation facility. As a result, it is necessary to eliminate direct exposure pathways in order for redevelopment to proceed. The end goal of the federal funding is to address agency and public concerns in redevelopment of the site in a way that safeguards the citizens and visitors of Chattanooga.

Due to contamination being present on the site Terracon recommends that the City of Chattanooga enter into a Brownfield Agreement with the State of Tennessee.

3.0 APPLICABLE REGULATIONS AND CLEANUP STANDARDS

Terracon completed a Phase II ESA report in January 2013. The investigation included soil and groundwater sample collection on both site parcels. The laboratory analysis identified analyte concentrations above action levels for arsenic, EPH, SVOCs, and VOCs in soil; and lead, naphthalene, and SVOCs in groundwater. Analytical data collected during this Phase II ESA revealed the following information:

- Arsenic was detected in the analyzed soil samples collected during the installation of groundwater monitoring wells HR-MW-1, HR-MW-4, and HR-MW-6 as well as the near surface soil samples collected from HR-12, HR-24, and HR-27 at concentrations that either meet or exceed the TDEC Division of Solid Waste Screening Level of 10 mg/kg for Arsenic. TDEC has adopted this action level based on 10 mg/kg being measured as naturally occurring background concentrations within Tennessee. Due to the relatively consistent concentrations and detections across the site, the arsenic is believed to be naturally occurring;

- Extractable Petroleum Hydrocarbons (EPHs) were detected above the TDEC Division of Solid Waste action level of 100 ppm in the soil samples collected from HR-MW-1, HR-MW-4, HR-MW-5, HR-MW-6 , HR-7, HR-10, HR-12 and HR-25;

- Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, and Naphthalene were found to be above their respective action levels in soil samples collected from HR-MW-1 and the duplicate soil sample which was also collected from HR-MW-1. In addition, Benzene was found to be above its action level in the duplicate soil sample which was collected from HR-MW-1;

- Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, and Dibenz(a,h)anthracene were found to be above their applicable action levels in the soil samples collected from HR-MW-4, HR-MW-5, and HR-MW-6. These three groundwater monitoring wells were installed on the property identified as 159 Hamm Road. The boring logs indicate black sand, metal pieces, and water rounded stones were encountered within the subsurface at these boring locations.

- Benzo(a)anthracene, Benzo(b)fluoranthene, and Benzo(a)pyrene, were found to be above their applicable action levels in the near surface soil samples collected from HR-7, HR-8, HR-10, HR-11, HR-12, HR-13, HR-15, HR-22 and HR-DUP-2A; Benzo(b)fluoranthene was also found to be above applicable action level in the near surface soil sample collected from HR-14; Benzo(a)pyrene was also found to be above applicable action level in the near surface soil sample collected from HR-14, HR-24, and HR-29;

- Benzo(k)fluoranthene was also found to be above applicable action levels in the near surface soil samples collected from HR-7, HR-10, HR-11, and HR-12,

- Indeno(1,2,3-cd)pyrene was found to be above applicable action levels in the near surface soil samples collected from HR-7, HR-8, HR-10, HR-11, HR-12, HR-13, HR-14, and HR-15.

- Naphthalene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Benzo(k)fluoranthene, Benzo(g,h,I,)perylene, Indeno(1,2,3-cd)pyrene, and Chrysene were all detected above their applicable TDEC and/or EPA drinking water action level in the groundwater sample collected from monitoring well HR-MW-1;

- Lead was found to be above the applicable TDEC and/or EPA drinking water action level in the groundwater sample collected from monitoring well HR-MW-5. Based on the site currently having city water available for use, it is not anticipated that the groundwater of the site would be utilized for drinking water purposes in

the future. We recommend placing a deed restriction on the use of groundwater; and

- The concentrations of SVOCs and one VOC (Naphthalene) encountered in the groundwater sample collected from HR-MW-1 can likely be attributed to a black viscous material located within the capillary fringe directly above the water table. Soil boring logs completed during the installation of HR-MW-1 described a material encountered from 4 to 14 feet as a soft, black viscous material with a strong petroleum odor. It is anticipated this material is the source of the SVOC and VOC contaminants encountered in the samples collected from HR-MW-1. Further investigation of the extent of the black, viscous material is recommended.

All other parameters were either not detected above the laboratory PQLs or were reported to be below applicable action levels. The Analytical Summaries are included in Appendix B.

4.0 EVALUATION OF CLEANUP ALTERNATIVES

4.1 Cleanup Alternative Considered

To address hazardous substances at the site, it is necessary to consider more than one presumptive remedy or approach. Four alternatives were considered that are presumptive remedies. These alternatives are outlined below. The following subsections present each alternative in greater detail including estimated costs and potential contingency items.

- Alternative 1: Excavation, Off-site Disposal
- Alternative 2: Excavation, On-site Thermal Treatment
- Alternative 3: Engineered Capping, On-site Containment
- Alternative 4: No Action

The following table summarizes the Analysis of Brownfield Cleanup Alternatives relative to Hamm Road.

Table 1: Cleanup Alternatives

Cleanup Alternatives	Effectiveness*	Implementability	Cost**
1. Excavation Off-Site Non-Hazardous Disposal	High	Non-Specialized	$1,451,000 / $1,948,000
2. Excavation On-Site Thermal Treatment	High	Specialized	$1,540,000 / $1,837,000
3. Engineered Capping, On-Site Containment	Low	Moderately Specialized	$547,000 / $759,000
4. No Action	None	None	None

*Relative to containment mitigation for Brownfields redevelopment
**Direct cost / with markup costs through subcontracting

4.2 Alternative 1: Excavation Off-Site Non-Hazardous Disposal

This alternative includes the removal of identified soils/fills over 5.2 acres to a depth of 2 feet. It limits direct contact with contaminated soils at the site through the removal of existing soils, placing of soil backfill, and installation of permanent vegetation. It is assumed based on previous analytical testing that the removed materials would be suitable for disposal off-site at a non-hazardous Subtitle D Landfill facility. The compacted backfill would be stabilized with permanent vegetation, but this remedy does not include actual landscaping.

Effectiveness
The volatile organic and semi-volatile organic compounds (VOC/SVOCs) would be permanently removed from the surface soils. This approach would be technically effective as a definitive and direct physical elimination of the contaminants that produce public risk by direct contact. With removal and off-site disposal of contaminants, the approach requires no special post-remedy institutional or land use controls for the property as the buffer zone for direct contact to users. Institutional or land use controls would be required on excavation activities and the use of groundwater. This alternative creates a waste generation stream and associated secondary environmental liabilities for the generator.

Implementability
This alternative is technically achievable and it is a mature remedy that is common in the remediation industry. The approach requires construction equipment to be readily available in the local demolition and engineering markets. A specialized labor force exists in Tennessee to accomplish the remedy. The implementation period would be short-term.

Cost
RACER costs modeled in this remedy range from $1,451,000 in direct cost to $1,948,000, which includes marked up sub-contracted costs to implement. The cost detail report is included in Appendix C.

4.3 Alternative 2: Excavation On-Site Thermal Treatment

Alternative 2 is an on-site technology that uses heat to drive VOC/SVOCs as a vapor from excavated soils to below the current cleanup thresholds in soils. This approach requires removal of identified soils/fills over 5.2 acres to a depth of 2 feet, handling and treatment on-site with a portable low-temperature thermal unit. Thermal desorption is used to remove organic contaminants from soils, sludge, and other solid media. It is not an incineration or burning process. Chemical oxidation and reactions are not encouraged, and no combustion byproducts are formed. The organic contaminants are removed as vapors. Because of low temperatures (100° to 400° C) and gas flow rates, this process is less expensive than incineration.

Effectiveness
The VOC/SVOCs would be permanently removed from the treated soils. Some SVOCs may be partially resistant to low-temperature thermal desorption, but the resistant SVOCs should be significantly reduced. This approach would be technically effective.

Implementability
This alternative is technically achievable. It is a remedy that is reasonably common in the remediation industry. The approach requires specialized equipment that may not be readily available in the local construction equipment markets. A specialized labor force exists in Tennessee to accomplish the remedy, although the contractor with the requisite equipment and experience may be local. The implementation period would be long-term and has a higher potential for interference from weather.

Cost
RACER costs modeled in this remedy range from $1,202,000 in direct cost to $1,436,000, which includes marked up sub-contracted costs to implement. The cost detail report is included in Appendix D.

4.4 Alternative 3: Capping, Containment, Operation and Maintenance

This alternative provides for capping the affected area with a dermal cover of 18-inches in thickness and an upper 6-inches of gravel or crushed stone to protect the integrity of the material foundation layer of the cap from traffic. This remedy is a contaminant management and risk reduction approach that ‘ disconnects ’ the contact pathway. Contaminants would remain in place and no on-site contaminants would be removed or reduced.

Effectiveness
VOC/SVOCs would not be permanently removed. This approach would not be a definitive or direct physical elimination of the contaminants that produce public risk. With no removal or off-site disposal of contaminants, the approach would require special post-remedy institutional or land use controls for the property. This alternative would require subsequent operations and maintenance to maintain integrity of the severed exposure pathway. This alternative would not

remove "stigma" against on-site Brownfields reconstruction for projects that must remove soil/fills for foundations or utilities. This alternative would not create a waste generation stream and associated secondary environmental liabilities for the owner at remedy, but would do so if construction spoils need disposal in the future.

Implementability
This alternative is technically achievable. It is a mature remedy that is common in the remediation industry. The approach requires construction equipment to be readily available in the local construction and engineering markets. The stone/gravel materials for cover are readily available in the local area. A labor force readily exists in Tennessee to accomplish the remedy. The implementation period would be short-term.

Cost
RACER costs modeled in this remedy range from $547,000 in direct cost to $759,000, which includes marked up sub-contracted costs to implement. The RACER model for this estimate does not account for long-term operations and maintenance. The model does not account for soil removed from the site and properly disposed of as part of future reconstruction. The cost detail report is included in Appendix E.

4.5 Alternative 4: No Action

The "no action" scenario is required by the EPA ABCA process. This alternative would not address contaminants and exposures as described in the ATSDR assessment and public health evaluation report are not realized through further flooding, weathering and degradation of PAHs to become available for human exposure.

Effectiveness
This alternative is deemed ineffective and unacceptable for continued Brownfield and community redevelopment. Community visioning has stated that unaddressed residual contaminants, although not an imminent acute threat to health, are unacceptable for the future uses at the site. It is socially unacceptable to the community because citizens and workers could be placed at risk. No-action provides neither remedy nor preventive value to site conditions or supports the improvement of public health conditions at this site.

Implementability
By its definition, taking no action precludes a discussion of implementation. The residual contaminants would be left in the state in which they currently exist. The identified contaminants would continue to pose a hazard to human health.

Cost
By its definition, taking no action precludes a discussion of cost to implement. This cleanup alternative would not include any specific efforts to remove or maintain contaminants. There would be no direct cleanup costs associated with this alterative. Direct costs associated with

the No Action alternative and associated non-use of the buildings could consist of providing site security to prevent unrestricted community use. The indirect cost of losing potential tax revenues and associated jobs of new Brownfield re-construction due to no action is currently unquantifiable within the scope of the ABCA, but should be considered as part of planning discussions by the client.

5.0 REFINED ALTERNATIVES FOR CONSIDERATION

Contaminants are typically of two types, point and non-point sources. Point source releases are associated with a specific event or release mechanism that allows a contaminant to move outward from the source, generally decreasing in strength the farther from the point of release (e.g., leaks from underground storage tanks, spills of chemicals). Non-point sources are conditions where contaminants were uniformly distributed to the environment initially, usually across larger areas (e.g., landfarm application of water treatment sludge, application of agrichemical products, bulk burial of industrial byproducts from a specific process). When designing sampling and analysis plans, it is neither physically nor financially possible to test everywhere. A balance must be struck between the two in conducting the initial Brownfield assessment.

In estimating the area and amounts of contaminated media, environmental professionals must extrapolate between the limited number of sampling points available. It assumes that the concentration of contaminants is linear and increases or decreases between any two points at a uniform rate. Based on this extrapolation, soils between sampling points are necessarily assumed to be ‘clean’ or ‘impacted’ relative to the state regulatory action limit. Project experience shows us that unless contaminants result from a non-point source the distribution of contaminants in the media is rarely uniform or linear. Historical project and industry experience demonstrate that as the density of sampled and tested data points increases on a property, the certainty of volume estimates increase. It is similarly observed that with greater sample density defining point source areas, the volume of material is lower than the preliminary estimates. Terracon has provided consideration of these relationships below.

Increasing the number of data points in an expanded assessment would refine the actual quantities of impacted soil for remedy. Expanded assessment could significantly reduce the estimated volume for remedy and thereby the cost of the Alternative. Although historical project experience observes that increasing the dataset has reduced the volume estimate, there is no guarantee that expanded assessment will do so on this site. RACER™ was used to calculate the effects of a 30% and 40% reduction in volume of soil for treatment theoretically achieved by expanding to additional 50 and 100 data point assessments respectively. The results are evaluated and included in this ABCA for use in cleanup planning discussions by the client under the cooperative agreement. The following summarizes these considerations.

Table 2: Cleanup Alternatives

Cleanup Alternatives		Cost**
1.	Excavation / Off-Site Disposal, Existing Assessments	$1,451,000 / $1,948,000
1a.	70% Excavation / Off-Site Disposal, Additional 50 Sampling Points Assessment	$1,072,000 / $1,435,000
1b.	60% Excavation / Off-Site Disposal, Additional 100 Sampling Points Assessment	$1,031,000 / $1,380,000

**Direct cost / with markup costs estimated by RACER™

5.1 Alternative 1a: Excavation (70%), Study-Based, Off-Site Disposal

Currently the Hamm Road Site is represented by 31 sampling points, or approximately 1 data point per 0.4 acres, of property from which volumes of impacted soils exceeding the cleanup criteria were estimated. This alternative provides for consideration of an expanded Phase II site assessment to sample and analyze an additional 50 data points. This alternative assumes for presentation this refinement will produce a 30% reduction in the soils volume to be treated. The reduction factor is for comparative planning purposes of the potential benefit of increasing assessment costs relative to lowering treatment costs. This refinement in quantities of material for treatment could similarly be applied to other definitive remedies than excavation.

If the expanded study and increased data point density results in a 30% reduction of treated volume of soils, this alternative provides for “surgical” excavation and removal of identified soils/fills over 3.6 acres to an average depth of 2 feet. These areas may be multiple and discontinuous, occurring as “pockets” of material randomly distributed across the property. This alternative provides a ‘clean’ site through removal and re-vegetation of a soil backfill. It is assumed based on previous analytical testing that the removed materials would be suitable for disposal off-site at a non-hazardous Subtitle D Landfill facility. Unpaved, but compacted backfill will be seeded but does not include actual landscaping.

Effectiveness

The volatile organic and semi-volatile organic compounds (VOC/SVOCs) would be permanently removed from the surface soils. This approach would be technically effective as a definitive and direct physical elimination of the contaminants that produce public risk by direct contact. With removal and off-site disposal of contaminants, the approach requires no special post-remedy institutional or land use controls for the property as the buffer zone for direct contact to users. Institutional or land use controls would be required on excavation activities and the use of groundwater. This alternative creates a waste generation stream and associated secondary environmental liabilities for the generator.

Implementability

This alternative is technically achievable. It is a mature remedy that is common in the remediation industry. The approach requires construction equipment to be readily available in

the local demolition and engineering markets. A specialized labor force exists in Tennessee to accomplish the remedy. The implementation period is short-term.

Cost
RACER costs modeled in this remedy range from $1,072,000 in direct cost to $1,435,000, which includes marked up sub-contracted costs to implement. These fees are contingent on data identifying a 30% reduction in treated volume, but are included for Brownfield planning discussions by the client. The cost detail report is included in Appendix F.

5.2 Alternative 1b: Excavation (60%), Study-Based, Off-Site Disposal

Currently the Hamm Road Site is represented by 31 sampling points from which volumes of impacted soils exceeding the cleanup criteria were estimated. This alternative provides for consideration of an expanded Phase II site assessment to sample and analyze an additional 100 data points. This alternative assumes for presentation this refinement will produce a 40% reduction in the soils volume to be treated. The reduction factor is for comparative purposes of the potential benefit of increased assessment costs relative to lowering treatment costs. This refinement in quantities of material for treatment could similarly be applied to other definitive remedies.

If the expanded study and increased data point density results in a 40% reduction of treated volume of soils, this alternative provides for “surgical” excavation and removal of identified soils/fills over 3.6 acres to an average depth of 2 feet. These areas may be multiple and discontinuous, occurring as “pockets” of material randomly distributed across the property. This alternative provides a ‘clean’ site through removal and re-vegetation of a soil backfill. It is assumed based on previous analytical testing that the removed materials would be suitable for disposal off-site at a non-hazardous Subtitle D Landfill facility. The compacted backfill would be stabilized with permanent vegetation, but this remedy does not include actual landscaping.

Effectiveness
The volatile organic and semi-volatile organic compounds (VOC/SVOCs) would be permanently removed from the surface soils. This approach would be technically effective as a definitive and direct physical elimination of the contaminants that produce public risk by direct contact. With removal and off-site disposal of contaminants, the approach requires no special post-remedy institutional or land use controls for the property as the buffer zone for direct contact to users. Institutional or land use controls would be required on excavation activities and the use of groundwater. This alternative creates a waste generation stream and associated secondary environmental liabilities for the generator.

Implementability
This alternative is technically achievable. It is a mature remedy that is common in the remediation industry. The approach requires construction equipment to be readily available in

the local demolition and engineering markets. A specialized labor force exists in Tennessee to accomplish the remedy. The implementation period is short-term.

Cost
RACER costs modeled in this remedy range from $1,031,000 in direct cost to $1,380,000, which includes marked up sub-contracted costs to implement. These fees are contingent on data identifying a 40% reduction in treated volume, but are included for Brownfield planning discussions by the client. The cost detail report is included in Appendix G.

6.0 RECOMMENDED CLEANUP ALTERNATIVE

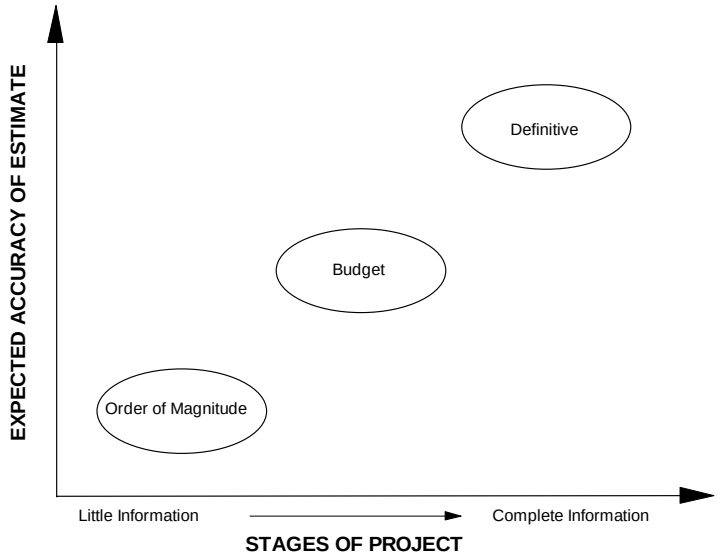
The recommended cleanup alternative is Alternative 1: Excavation, Off-site Disposal. This alternative would address exposure risks by a definitive reduction of contaminants in soils using a proven approach consistent with recognized industry standards. It is readily implementable by non-specialized environmental subcontractors drawing from a readily available local labor force. It mitigates through active treatment and reduces the stigma and concerns from redevelopers.

Terracon considered the value of expanding the assessment and sampling/testing density to more accurately determine treatment volumes. If volume reductions of materials requiring remedy in Alternatives 1a and 1b were achieved, the relative marked up cost reduction in Alternative 1 would be and, if cleanup is not time-critical to redevelopment, should be considered by the client. See attached in Appendix H detailed information for applying RACER™ to analysis of ABCA.

7.0 METHODS OF ESTIMATING COST

The three types of cost estimating for remediation are order of magnitude estimate, budget estimate, and definitive estimate. The type of estimate developed generally depends on the amount of information available to the evaluator.

An order of magnitude estimate typically has the largest margin of error because it is performed in the initial stages of a project when relatively little information is known. Conversely, a definitive estimate typically has a smaller margin of error because it is performed at a later stage of a project when presumably most of the needed information is known. The following figure plots the three types of estimates against the expected accuracy of the estimate, based on the amount of information available.



Inset 1. Remedial Estimation for ABCA

For an order of magnitude estimate, historical costs for similar types of projects are often used to calculate a "ballpark" figure for the project. An order of magnitude estimate is completed at the initial stages of a cleanup, when minimal information is available. The cost of a project at this stage is frequently estimated by multiplying the number of "units" of a particular type of contamination (e.g., the number of cubic feet of contaminated sludge) by a pre-established cost for cleanup per unit (e.g., dollars per cubic foot) using a particular technology. USEPA guidance indicates an order of magnitude estimate might be expected to be between 70% and 150% of the future cost of remedy for the project. These ranges are not definitive and final costs can vary greatly depending on the complexity of the project and regulatory requirements which may be required as the project moves forward during redevelopment. These types of estimates are used when considering the potential magnitude of restoration as it might relate to a potential project's value or feasibility of acquisition.

The budget estimate is prepared during the intermediate stages of the remedial design process. A higher level of accuracy is expected than that achieved with the order of magnitude estimate because more project-specific information is known. A budget estimate assesses the cost of each project component to compute an estimated total project cost. Several activities and cost items are grouped into a "system" that relates to the phase of cleanup. These systems are generally listed in the order in which they are employed in the cleanup. Budget estimates are sometimes referred to as assemblies or systems estimates. USEPA guidance indicates a budget estimate might be expected to be between 85% and 130% of the actual cost of the project. These ranges too are not definitive and final costs may vary significantly depending on the complexity of the project and regulatory requirements which may be required as the project moves forward or land use changes during redevelopment. These types of estimates may be

used to support requests for funding, preliminary budgeting, or planning as part of overall redevelopment.

A detailed cleanup plan design is required to produce a definitive estimate. This type of estimate is typically conducted once site characterization and/or a substantial portion of the remedial and redevelopment reconstruction design are completed. A definitive estimate is normally prepared by multiplying the quantity of each item needed by its unit price, and summing the line item totals. A competitive bid process is typically used to determine definitive estimates for reconstruction. Developing a definitive estimate is time consuming, but it is generally more accurate than other estimates because more is known about the site. Definitive estimates are sometimes referred to as unit price, quantity take-off, or bottom-up estimates. USEPA guidance indicates a definitive estimate might be expected to be between 95% and 115% of the actual cost of the project. Typically developed through engineering estimates from the remedial design plans and specifications, final costs may still vary.

The scope and budget structures of the pre-grant ABCA limit the remedial cost estimation effort. Regardless of format or level of detail, discussions of cost and remedy must be considered similar to order of magnitude cost estimates for making comparative evaluations, subject to changes required by regulatory agencies.

Labor costs were scaled and selected to geographical limits of RACER as Tennessee/Chattanooga, which employs an industry default multiplier of 0.850. Although labor costs may be lower due to recent recessional effects of the national economy, the modeler could not adjust the internal RACER multiplier without some basis for adjustment. Escalation of cost was not considered since the timeframe for cleanup is not multiple years. The modeler did not artificially escalate cost over the 2011 base inputs in view of recessional impacts on the current economy since 2011.

8.0 GENERAL COMMENTS

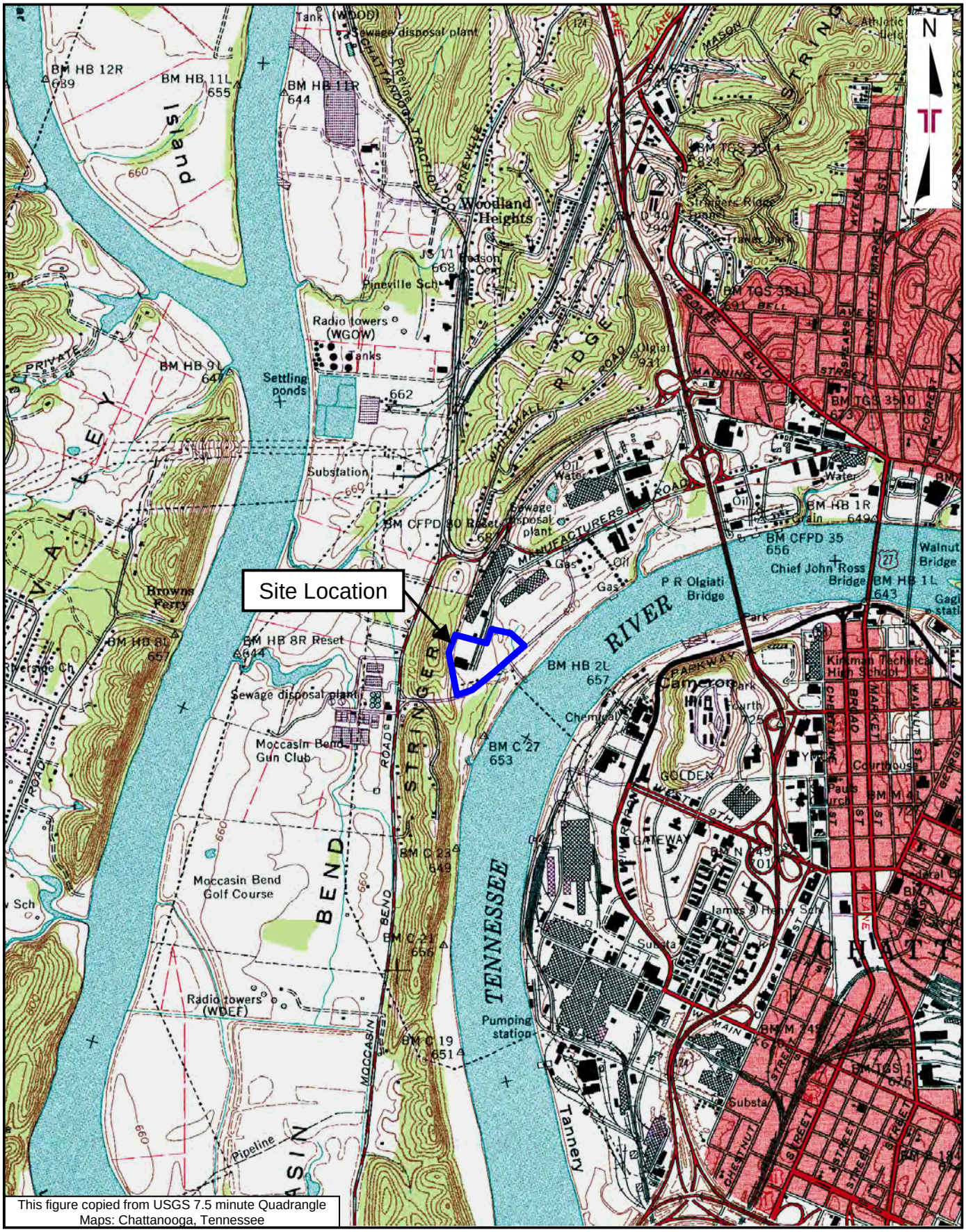
The analysis and opinions expressed in this report are based upon the data obtained from the indicated soil borings advanced at the indicated locations and from other information discussed in this report. This report does not reflect any variations in subsurface stratigraphy, geohydrology, or contaminant distribution which may occur beyond or between the indicated sampling locations or across the site.

This report is prepared for the exclusive use of the City of Chattanooga for specific application to the project as discussed and has been prepared in accordance with generally accepted local assessment practices within the scope of the client's directives. No warranties, either express or implied, are intended or made. Should any changes in the nature or location of contaminants outlined be observed, the conclusions and recommendations contained in this report cannot be

considered valid unless the changes are reviewed and the conclusions and objectives of this report are modified or verified in writing by Terracon.

APPENDIX A

Exhibit 1 – Topographic Map
Exhibit 2 - Site Vicinity Map



This figure copied from USGS 7.5 minute Quadrangle Maps: Chattanooga, Tennessee

Project Manager: PED	Project No. E2107081	Terracon Consulting Engineers & Scientists	Site Location Map
Drawn By: JIM	Scale: 1" = 2,000'	51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406	ABCA
Checked By: PED	File Name: N:\Projects\2010	PH. (423) 499-6111 FAX. (423) 499-8099	155 & 159 Hamm Road
Approved By: DEW	Date: 6/21/13		Chattanooga, Tennessee

Exhibit 1

Note:

Site Map image provided by Hamilton County GIS.

0 100 200
1" = 200'

Project Mngr:	PED
Drawn By:	JIM
Checked By:	PED
Approved By:	DEW

Project No.	E2107081
Scale:	AS SHOWN
File No.	N:\Projects\2010
Date:	6/21/13

Terracon
Consulting Engineers and Scientists
51 Lost Mound Dr. Suite 135 Chattanooga, TN 37406
PH. (423) 499-6111 FAX. (423) 499-8099

Site Vicinity Map

ABCA

155 & 159 Hamm Road

Chattanooga, Tennessee

Exhibit

2

APPENDIX B

Analytical Summaries

Terracon

Table 1

Soil Analytical Data Summary - GRO, EPH, RCRA 8 Metals & PCBs
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	Duplicate	HR-MW-1	HR-MW-2	HR-MW-2	HR-MW-3	HR-MW-3	HR-MW-4	HR-MW-4	HR-MW-5	HR-MW-5	HR-MW-6	HR-MW-6	Rinseate
Sample Depth			10'-12'	NA	12'-14'	4'-6'	16'-18'	10'-12'	12'-14'	4'-6'	10'-12'	4'-6'	10'-12'	0'-2'	10'-12'	NA
Sample Date			8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/9/2012	8/9/2012	8/9/2012	8/9/2012	8/8/2012	8/8/2012	8/9/2012
TPH-GRO	**Industrial Soil Action Levels**	**Residential Soil Action Levels**														
TPH-GRO	100*	100*	73.0	41	43.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	12.0	<0.50	<0.10
EPH	**Industrial Soil Action Levels**	**Residential Soil Action Levels**														
EPH	100*	100*	1800	17000	6400	<4.0	4.0	<4.0	6.7	240	9.6	<80	190	53.0	120.0	<0.10
Metals	**Industrial Soil Action Levels**	**Residential Soil Action Levels**														
Arsenic	10*	10*	11.0	9.6	11.0	2.3	7.4	6.1	4.1	10	8.5	7.8	6.20	5.5	11.0	<0.020
Barium	190,000**	15,000**	63.0	67.0	73.0	24.0	64.0	52.0	57.0	140.0	130.0	110.0	180.0	8.00	220.00	<0.0050
Cadmium	800**	70**	0.29	<0.25	0.3	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.0050
Chromium	1,500,000**	120,000**	6.4	7.6	8.4	11.0	14.0	9.00	6.6	19.0	16	19.0	11.0	61.00	30.00	<0.010
Lead	800**	400**	14.0	13	14.0	8.6	15.0	15.0	11.0	31.0	39.0	38.0	44.0	8.60	15.00	<0.0050
Selenium	5,100**	390**	<1.0	<1.0	<1.0	<1.0	8.30	<5.0	5.30	<1.0	<1.0	1.4	<1.0	<1.0	5.10	<0.020
Silver	5,100**	390**	<0.50	<1.0	<1.0	<0.50	<1.0	<2.5	<1.0	<2.5	<2.5	<2.5	<2.5	<0.50	<1.0	<0.010
Mercury	34**	5.6**	0.087	0.094	0.093	0.021	0.068	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.067	<0.020	<0.00020
PCBs	**Industrial Soil Action Levels**	**Residential Soil Action Levels**														
PCB-1016	21	3.90	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.005
PCB-1221	0.54	0.14	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.005
PCB-1232	0.54	0.14	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.005
PCB-1242	0.74	0.22	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.005
PCB-1248	0.74	0.22	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.005
PCB-1254	0.74	0.22	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.005
PCB-1260	0.74	0.22	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.005

NOTE: ***Background concentration as established by TDEC**

****Regional Screening Levels as established by EPA and published April 2012**

*****EPA Region 9 Primary Remediation Goal**

-Compounds with Laboratory PQLs above action level

-Detected Concentrations

- Industrial Soil Action Levels action level

- Residential Soil Action Levels action level

NA - Not Analyzed

NE - Not Established

Terracon

Table 2

Soil Analytical Data Summary - SVOCs
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	Duplicate	HR-MW-1	HR-MW-2	HR-MW-2	HR-MW-3	HR-MW-3	HR-MW-4	HR-MW-4	HR-MW-5	HR-MW-5	HR-MW-6	HR-MW-6	Rinseate
Sample Depth			10'-12'	NA	12'-14'	4'-6'	16'-18'	10'-12'	12'-14'	4'-6'	10'-12'	4'-6'	10'-12'	0'-2'	10'-12'	NA
Sample Date			8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/9/2012	8/9/2012	8/9/2012	8/9/2012	8/8/2012	8/8/2012	8/9/2012
SVOCs	Industrial Soil Action Levels	Residential Soil Action Levels														
Acenaphthene	33,000**	3,400**	38	39.0	41	<0.033	<0.033	<0.033	<0.033	1.2	0.092	<0.33	9.3	0.35	<0.33	<0.001
Acenaphthylene	NE	NE	8	6.3	9.1	<0.033	<0.033	<0.033	<0.033	1	0.081	<0.33	8.3	0.1	0.58	<0.001
Anthracene	170,000**	17,000**	63	63	78	<0.033	0.04	0.04	<0.033	3.7	0.28	0.79	26	0.67	1.2	<0.001
Benzidine	0.0075**	0.0005**	<170	<170	<170	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
Benzo(a)-anthracene	2.1**	0.15**	85	92	110	0.065	0.062	0.13	<0.033	5.9	0.76	1.8	42	0.94	2.60	<0.001
Benzo(b)-fluoranthene	2.1**	0.15**	93	92	110	0.11	0.067	0.17	<0.033	6.8	0.83	2.5	39	1	3	<0.001
Benzo(k)-fluoranthene	21**	1.5**	28	28	37	0.04	<0.033	0.054	<0.033	2	0.3	0.8	15	0.42	0.9	<0.001
Benzo (g,h,i) perylene	NE	NE	19	20	25	0.077	<0.033	0.089	<0.033	1.5	0.36	0.6	4.5	0.18	0.71	<0.001
Benzo(a)pyrene	0.21**	0.015*	63	64	80	0.08	0.049	0.12	<0.033	4.6	0.67	1.7	27	0.75	2	<0.001
Bis(2-chloroethoxy)methane	1,800**	180**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
Bis(2-chloroethyl)ether	1**	0.21**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
Bis(2-chloroisopropyl)ether	NE	NE	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
4-Bromophenyl phenyl ether	NE	NE	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
2-Chloronaphthalene	NE	NE	<0.66	<0.66	<0.66	<0.033	<0.033	<0.033	<0.033	<0.33	<0.033	<0.33	<0.66	<0.033	<0.33	<0.001
4-Chlorophenyl phenyl ether	NE	NE	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
Chrysene	210**	15*	91	88	117	0.074	0.061	0.13	<0.033	5.4	0.73	1.8	32	0.84	2.2	<0.001
Dibenz (a,h) anthracene	0.21**	0.015*	<16	<16	<16	<0.033	<0.033	<0.033	<0.033	0.69	0.15	<0.33	3.2	0.11	0.38	<0.001
3,3-Dicchlorobenzidine	3.8**	1.1**	<170	<170	<170	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
2,4-Dinitrotoluene	5.5**	1.6**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
2,6-Dinitrotoluene	620**	61**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
Fluoranthene	22,000**	2,300*	210.0	210.0	260	0.095	0.13	0.34	0.04	14	1.5	4	100	2.6	5	<0.001
Fluorene	22,000**	2,300**	64.0	74.0	88	<0.033	0.041	<0.033	<0.033	3.5	0.21	0.5	32	0.64	1.1	<0.001
Hexachlorobenzene	1.1**	0.3**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.001
Hexachloro-1,3-butadiene	NE	NE	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
Hexachlorocyclopentadiene	3,700**	370**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
Hexachloroethane	120**	35**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.010
Indeno (1,2,3-cd)pyrene	2.1**	0.15**	20	22	25	0.063	<0.033	0.082	<0.033	1.5	0.35	0.57	5.3	0.2	0.74	<0.001
Isophorone	1,800**	510**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
Naphthalene	403*	135*	150	170	180	0.034	0.036	<0.033	<0.033	1.2	0.17	<0.33	62	0.66	0.61	<0.001
Nitrobenzene	24**	4.8**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
N-Nitrosodimethylamine	2,300**	340**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
N-Nitrosodiphenylamine	350**	99**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
N-Nitrosodi-n-propylamine	0.25**	0.069**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01

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Table 2

Soil Analytical Data Summary - SVOCs
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	Duplicate	HR-MW-1	HR-MW-2	HR-MW-2	HR-MW-3	HR-MW-3	HR-MW-4	HR-MW-4	HR-MW-5	HR-MW-5	HR-MW-6	HR-MW-6	Rinseate
Sample Depth			10'-12'	NA	12'-14'	4'-6'	16'-18'	10'-12'	12'-14'	4'-6'	10'-12'	4'-6'	10'-12'	0'-2'	10'-12'	NA
Sample Date			8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/9/2012	8/9/2012	8/9/2012	8/9/2012	8/8/2012	8/8/2012	8/9/2012
SVOCs	Industrial Soil Action Levels	Residential Soil Action Levels														
Phenanthrene	NE	NE	240	250	290	0.062	0.15	0.17	0.037	14	1.1	3	140	3	4.7	<0.001
Benzylbutyl phthalate	NE	NE	<170	<170	<170	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.003
Bis(2-ethylhexyl)phthalate	120**	35**	<170	<170	<170	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.003
Di-n-butylphthalate	NE	NE	<170	<170	<170	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.003
Diethyl phthalate	490,000**	49,000**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.003
Dimethyl phthalate	NE	NE	<170	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.003
Di-n-octyl phthalate	NE	NE	<170	<170	<170	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.003
Pyrene	17,000**	1,700*	130	140	170	0.087	<0.033	0.24	<0.033	9.9	1.2	2.9	69	1.4	3.80	<0.001
1,2,4-Trichlorobenzene	99**	22**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
4-chloro-3-methylphenol	NE	NE	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
2-Chlorophenol	5,100**	390**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
2,4-Dichlorophenol	1,800**	180**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
2,4-Dimethylphenol	12,000**	1,200**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
4,6-Dinitro-2-methylphenol	NE	NE	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
2,4-Dinitrophenol	1,200**	120**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
2-Nitrophenol	NE	NE	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
4-Nitrophenol	NE	NE	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
Pentachlorophenol	2.7**	0.89**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
Phenol	180,000**	18,000**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01
2,4,6-Trichlorophenol	160**	44**	<6.7	<6.7	<6.7	<0.33	<0.33	<0.33	<0.33	<3.3	<0.33	<3.3	<6.7	<0.33	<3.3	<0.01

NOTE: *Background concentration as established by TDEC

****Regional Screening Levels as established by EPA and published April 2012**

-Compounds with Laboratory PQLs above action level

-Detected Concentrations

- Industrial Soil Action Levels action level

- Residential Soil Action Levels action level

NA - Not Analyzed

NE - Not Established

Terracon

Table 3

Soil Analytical Data Summary - VOCs
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	Duplicate	HR-MW-1	HR-MW-2	HR-MW-2	HR-MW-3	HR-MW-3	HR-MW-4	HR-MW-4	HR-MW-5	HR-MW-5	HR-MW-6	HR-MW-6	Rinseate
Sample Depth			10'-12'	NA	12'-14'	4'-6'	16'-18'	10'-12'	12'-14'	4'-6'	10'-12'	4'-6'	10'-12'	0'-2'	10'-12'	NA
Sample Date			8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/9/2012	8/9/2012	8/9/2012	8/9/2012	8/8/2012	8/8/2012	8/9/2012
VOCs	Industrial Soil Action Levels	Residential Soil Action Levels														
Acetone	630,000**	61,000**	<25	<0.25	<25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<2.5	<0.25	<0.25	<0.05
Acrolein	0.65**	0.15**	NM	NM	NM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05
Acrylonitrile	1.2**	0.24**	<5.0	<0.05	<5.0	<0.050	<0.050	<0.05	<0.05	<0.05	<0.050	<0.05	<0.5	<0.05	<0.05	<0.01
Benzene	3.80*	0.0729*	<0.5	0.19	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Bromobenzene	1,800**	300**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Bromodichloromethane	1.4**	0.27**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Bromoform	220**	62**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Bromomethane	32**	7.3**	<2.5	<0.025	<2.5	<0.025	<0.25	<0.025	<0.025	<0.025	<0.025	<0.025	<0.25	<0.025	<0.025	<0.005
n-Butylbenzene	51,000**	3,900**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
sec-Butylbenzene	NE	NE	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	0.021	<0.005	<0.001
tert-Butylbenzene	NE	NE	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Carbon Tetrachloride	3.0**	0.61**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Chlorobenzene	1,400**	290**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Chlorodibromomethane	NE	NE	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Chloroethane	NE	NE	<2.5	<0.025	<2.5	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.25	<0.025	<0.025	<0.005
2-chloroethyl vinyl ether	NE	NE	<25	<0.25	<25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<2.5	<0.25	<0.25	<0.05
Chloroform	1.5**	0.29**	<2.5	<0.025	<2.5	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.25	<0.025	<0.025	<0.005
Chloromethane	500**	120**	<1.2	<0.012	<1.2	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.12	<0.012	<0.012	<0.0025
2-Chlorotoluene	NE	NE	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.001
4-Chlorotoluene	NE	NE	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,2-Dibromo-3-chloropropane	0.069***	0.0054**	<2.5	<0.025	<2.5	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.25	<0.025	<0.025	<0.005
1,2-Dibromoethane (EDB)	0.17**	0.034**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Dibromomethane	110**	25**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,2-Dichlorobenzene	9,800**	1,900**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,3-Dichlorobenzene	9,800**	NE	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,4-Dichlorobenzene	120**	2.4**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Dichlorodifluoromethane	400**	94**	<2.5	<0.025	<2.5	<0.025	<0.025	<0.025	<0.25	<0.025	<0.025	<0.025	<0.25	<0.025	<0.025	<0.005
1,1-Dichloroethane	17**	3.3**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,2-Dichloroethane	2.2**	0.43**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,1-Dichloroethene	1,100**	240**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
cis-1,2-Dichloroethene	2000**	160**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
trans-1,2-Dichloroethene	690**	150**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,2-Dichloropropane	4.7**	0.94**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,1-Dichloropropene	NE	NE	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,3-Dichloropropane	20000**	1600**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
cis-1,3-Dichloropropene	NE	NE	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
trans-1,3-Dichloropropene	NE	NE	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
2,2-Dichloropropane	NE	NE	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Di-isopropyl ether	10000**	2400**	<0.50	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Ethylbenzene	1310*	143*	<0.5	0.059	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001

Terracon

Table 3

Soil Analytical Data Summary - VOCs
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	Duplicate	HR-MW-1	HR-MW-2	HR-MW-2	HR-MW-3	HR-MW-3	HR-MW-4	HR-MW-4	HR-MW-5	HR-MW-5	HR-MW-6	HR-MW-6	Rinseate
Sample Depth			10'-12'	NA	12'-14'	4'-6'	16'-18'	10'-12'	12'-14'	4'-6'	10'-12'	4'-6'	10'-12'	0'-2'	10'-12'	NA
Sample Date			8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/9/2012	8/9/2012	8/9/2012	8/9/2012	8/8/2012	8/8/2012	8/9/2012
VOCs	Industrial Soil Action Levels	Residential Soil Action Levels														
Hexachloro-1,3-butadiene	NE	NE	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Isopropylbenzene	NE	NE	<0.5	0.014	<0.50	<0.0050	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	0.0091	<0.005	<0.001
p-Isopropyltoluene	NE	NE	<0.5	0.0072	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	0.014	<0.005	<0.001
2-Butanone (MEK)	200,000	28,000	<5.0	<0.050	<0.50	<0.05	<0.05	<0.050	<0.05	<0.05	<0.05	<0.05	<0.50	<0.05	<0.05	<0.010
Methylene Chloride	960**	56**	<2.5	0.028	<2.5	<0.025	<0.025	<0.25	<0.025	<0.025	<0.025	<0.025	<0.25	<0.025	<0.025	<0.005
4-Methyl-2-pentanone	NE	NE	<5.0	<0.05	<5.0	<0.050	<0.050	<0.05	<0.050	<0.05	<0.05	<0.05	<0.50	<0.050	<0.050	<0.01
Methyl tert-Butyl Ether	364*	39.6*	<0.5	<0.005	<0.5	<0.0050	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Naphthalene	403*	135*	<25	930	400	<0.025	<0.025	<0.025	<0.025	0.46	0.036	<0.025	2.6	0.67	0.095	<0.005
n-Propylbenzene	NE	NE	<0.5	0.006	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	0.0096	<0.005	<0.001
Styrene	36,000**	6,300**	<0.5	0.033	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,1,1,2-Tetrachloroethane	9.3**	1.9**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,1,2,2-Tetrachloroethane	2.8**	0.56**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
1,1,2-Trichlorotrifluoroethane	NE	NE	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Tetrachloroethene	110**	0.22**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Toluene	62.2*	6.78*	<2.5	0.32	<2.5	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.25	<0.025	<0.025	<0.005
1,2,3-Trichlorobenzene	490	49	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.001
1,2,4-Trichlorobenzene	99**	22**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.001
1,1,1-Trichloroethane	38,000**	8,700**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.001
1,1,2-Trichloroethane	5.3**	1.1**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.001
Trichloroethene	6.4**	0.91**	<0.5	<0.005	<0.50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.001
Trichlorofluoromethane	3,400**	790**	<2.5	<0.025	<2.5	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.25	<0.025	<0.025	<0.005
1,2,3-Trichloropropane	0.095**	0.005**	<1.2	<0.012	<1.2	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.12	<0.012	<0.012	<0.0025
1,2,4-Trimethylbenzene	260**	62**	1.3	0.32	0.54	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	0.09	<0.005	<0.001
1,2,3-Trimethylbenzene	NE	NE	<0.5	0.1	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	0.053	<0.005	<0.001
1,3,5-Trimethylbenzene	10,000**	780**	0.65	0.15	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	0.02	<0.005	<0.001
Vinyl Chloride	1.7**	0.06**	<0.5	<0.005	<0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.001
Xylenes, total	88*	9.6*	1.9	0.61	<1.5	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.15	<0.015	<0.015	<0.003

NOTE: *Initial Screening Levels as established by TDEC-DUST

****Regional Screening Levels as established by EPA and published November 2010**

*****EPA Region 9 Primary Remediation Goal**

-Compounds with Laboratory PQLs above action level

-Detected Concentrations

- Industrial Soil Action Levels action level

- Residential Soil Action Levels action level

NA - Not Analyzed

NE - Not Established

Terracon

Table 4
Soil Analytical Data Summary - Pesticides and Herbicides
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	Duplicate	HR-MW-1	HR-MW-2	HR-MW-2	HR-MW-3	HR-MW-3	HR-MW-4	HR-MW-4	HR-MW-5	HR-MW-5	HR-MW-6	HR-MW-6	Rinseate
Sample Depth			10'-12'	NA	12'-14'	4'-6'	16'-18'	10'-12'	12'-14'	4'-6'	10'-12'	4'-6'	10'-12'	0'-2'	10'-12'	NA
Sample Date			8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/9/2012	8/9/2012	8/9/2012	8/9/2012	8/8/2012	8/8/2012	8/9/2012
Pesticides	**Industrial Soil Action Levels**	**Residential Soil Action Levels**														
Aldrin	0.10**	0.029**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Alpha BHC	0.27**	0.077**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Beta BHC	0.96**	0.27**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Delta BHC	NE	NE	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Gama BHC	2.1**	0.52**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Chlordane	6.5**	1.6**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.0005
4,4-DDD	7.2**	2.0**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
4,4-DDE	5.1**	1.4**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
4,4-DDT	7.0**	1.7**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Dieldrin	0.11**	0.03**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Endosulfan I	3,700**	370**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Endosulfan II	3,700**	370**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Endosulfan Sulfate	3,700**	370**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Endrin	180**	18**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Endrin aldehyde	180**	18**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Endrin keytone	180**	18**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Heptachlor	0.38**	0.11**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Heptachlor epoxide	0.19**	0.053**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Hexachlorobenzene	1.1**	0.3**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Methoxychlor	3,100**	310**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00005
Toxaphene	1.6**	0.44**	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.0005

Terracon

Table 4
Soil Analytical Data Summary - Pesticides and Herbicides
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	Duplicate	HR-MW-1	HR-MW-2	HR-MW-2	HR-MW-3	HR-MW-3	HR-MW-4	HR-MW-4	HR-MW-5	HR-MW-5	HR-MW-6	HR-MW-6	Rinseate
Sample Depth			10'-12'	NA	12'-14'	4'-6'	16'-18'	10'-12'	12'-14'	4'-6'	10'-12'	4'-6'	10'-12'	0'-2'	10'-12'	NA
Sample Date			8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/8/2012	8/9/2012	8/9/2012	8/9/2012	8/9/2012	8/8/2012	8/8/2012	8/9/2012
Herbicides	**Industrial Soil Action Levels**	**Residential Soil Action Levels**														
2,4-D	7,700**	690**	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.002
Dalapon	18,000**	1,800**	<0.8	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.2
2,4-DB	18,000**	490**	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.002
Dicamba	18,000**	1,800**	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.002
Dichloroprop	NE	NE	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.002
Dinoseb	620**	61**	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.002
MCPA	310**	31**	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<0.1
MCPP	620**	61**	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<0.1
2,4,5-T	6,200**	610**	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.002
2,4,5-TP (silvex)	4,900**	490**	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.002

NOTE: *Initial Screening Levels as established by TDEC-DUST
****Regional Screening Levels as established by EPA and published November 2010**
*****EPA Region 9 Primary Remediation Goal**
-Compounds with Laboratory PQLs above action level
-Detected Concentrations
- Industrial Soil Action Levels action level
- Residential Soil Action Levels action level
NA - Not Analyzed
NE - Not Established

Terracon

Table 5

Potentiometric Data Summary
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Well	Date	Top of Casing Elevation (TOC) (feet MSL)	Top of Screen Elevation (feet MSL)	Total Depth of Well (feet)	Bottom of Screen Elevation (feet MSL)	Depth to Free Product (feet)	Depth to Water (feet)	Product Thickness (feet)	Potentiometric Elevation (feet MSL)	Adjusted Potentiometric Elevation (feet MSL)	Potentiometric Surface Within Screen Interval (Yes/No)
HR-MW-1	8/14/12	666.09	654.84	21.3	644.84	NA	16.25	NA	649.84	649.84	Yes
HR-MW-2	8/14/12	668.51	654.59	23.9	644.59	NA	18.3	NA	650.21	650.21	Yes
HR-MW-3	8/14/12	666.29	654.85	21.4	644.85	NA	16.28	NA	650.01	650.01	Yes
HR-MW-4	8/14/12	659.21	652.54	21.7	637.54	NA	11.87	NA	647.34	647.34	No
HR-MW-5	8/14/12	659.97	653.59	21.4	638.59	NA	10.88	NA	649.09	649.09	No
HR-MW-6	8/14/12	658.98	649.15	19.8	639.15	NA	14.37	NA	644.61	644.61	Yes

Terracon

Table 6

Groundwater Analytical Data Summary - GRO, EPH, RCRA 8 Metals & PCBs
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	HR-MW-2	HR-MW-3	HR-MW-4	Duplicate	HR-MW-5	HR-MW-6	Field Blank
Sample Date			8/14/2012	8/14/2012	8/14/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012
TPH-GRO	**Non Drinking Groundwater Action Levels**	**Drinking Water Groundwater Action Levels**								
TPH-GRO	100*	100*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EPH	**Non Drinking Groundwater Action Levels**	**Drinking Water Groundwater Action Levels**								
EPH	NE	NE	3.2	<0.1	<0.1	<0.1	<0.1	<0.1	0.87	<0.1
Metals	**Non Drinking Groundwater Action Levels**	**Drinking Water Groundwater Action Levels**								
Arsenic	NE	0.010**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Barium	NE	2.0**	0.053	0.03	0.077	0.098	0.076	0.11	0.045	<0.005
Cadmium	NE	0.005*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium	NE	0.1*	<0.01	<0.01	<0.01	<0.01	<0.01	0.024	<0.01	<0.01
Lead	NE	0.015*	0.0053	<0.005	<0.005	0.0051	<0.005	0.056	<0.005	<0.005
Selenium	NE	0.050**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Silver	NE	0.1*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury	NE	2**	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
PCBs	**Non Drinking Groundwater Action Levels**	**Drinking Water Groundwater Action Levels**								
PCB-1016	NE	0.00096***	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
PCB-1221	NE	0.0000043***	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
PCB-1232	NE	0.0000043***	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
PCB-1242	NE	0.000034***	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
PCB-1248	NE	0.000034***	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
PCB-1254	NE	0.000034***	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
PCB-1260	NE	0.000034**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

NOTE: *Background concentration as established by TDEC

****Regional Screening Levels as established by EPA and published April 2012**

*****EPA Region 9 Regional Screening Levels, Tap Water Standard, as established by EPA and published April 2012**

-Compounds with Laboratory PQLs above action level

-Detected Concentrations

-Non Drinking Groundwater Action Levels

-Drinking Water Groundwater Action Levels

NA - Not Analyzed

NE - Not Established

Terracon

Table 7
Groundwater Analytical Data Summary - VOCs
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	HR-MW-2	HR-MW-3	HR-MW-4	Duplicate	HR-MW-5	HR-MW-6	Field Blank
Sample Date			8/14/2012	8/14/2012	8/14/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012
VOCs	Non Drinking Groundwater Action Levels	Drinking Water Groundwater Action Levels								
Acetone	NE	12.0***	<0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acrolein	NE	0.000041***	<0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acrylonitrile	0	0.000045***	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzene	0.072*	0.005*	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromobenzene	NE	0.054**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromodichloromethane	NE	0.080**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromoform	NE	0.080**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromomethane	NE	0.007***	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
n-Butylbenzene	NE	0.780***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
sec-Butylbenzene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
tert-Butylbenzene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Carbon Tetrachloride	NE	0.005***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chlorobenzene	NE	0.1***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chlorodibromomethane	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloroethane	NE	NE	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2-Chloroethyl vinyl ether	NE	NE	<0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloroform	NE	0.080**	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chloromethane	NE	0.190**	<0.025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.025
2-Chlorotoluene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001
4-Chlorotoluene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001
1,2-Dibromo-3-chloropropane	NE	0.0002**	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2-Dibromoethane (EDB)	NE	0.00005***	<0.01	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001	<0.001
Dibromomethane	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichlorobenzene	NE	0.6**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3-Dichlorobenzene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,4-Dichlorobenzene	NE	0.075**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dichlorodifluoromethane	NE	0.190***	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1-Dichloroethane	NE	0.0024***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichloroethane	NE	0.005**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloroethene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
cis-1,2-Dichloroethene	NE	0.070**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
trans-1,2-Dichloroethene	NE	0.1**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichloropropane	NE	0.005**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloropropene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3-Dichloropropane	NE	0.29***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
cis-1,3-Dichloropropene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
trans-1,3-Dichloropropene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,2-Dichloropropane	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Di-Isopropyl ether	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	10.3*	0.7*	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexachloro-1,3-butadiene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
isopropylbenzene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
p-Isopropyltoluene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Butanone	NE	4.9***	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Methylene Chloride	NE	0.005**	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-Methyl-2-pentanone	NE	NE	<0.1	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
Methyl tert-Butyl Ether	175*	0.02*	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Naphthalene	9.81*	0.02*	0.59	<0.005	<0.005	<0.005	<0.005	0.0066	0.013	<0.005
n-Propylbenzene	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Styrene	NE	0.1**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,1,2-Tetrachloroethane	NE	0.0005**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,2,2-Tetrachloroethane	NE	0.000066***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,2-Trichlorotrifluoroethane	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tetrachloroethene	NE	0.005**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	4.31*	1*	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Terracon

Table 7
Groundwater Analytical Data Summary - VOCs
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	HR-MW-2	HR-MW-3	HR-MW-4	Duplicate	HR-MW-5	HR-MW-6	Field Blank
Sample Date			8/14/2012	8/14/2012	8/14/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012
VOCs	Non Drinking Groundwater Action Levels	Drinking Water Groundwater Action Levels								
1,2,3-Trichlorobenzene	NE	0.0052***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,4-Trichlorobenzene	NE	0.07***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,1-Trichloroethane	NE	0.2**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,2-Trichloroethane	NE	NE	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trichloroethene	NE	0.005**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trichlorofluoromethane	NE	1.1**	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2,3Trichloropropane	NE	0.00000065***	<0.025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
1,2,4-Trimethylbenzene	NE	.015***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,3-Trimethylbenzene	NE	0.010***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3,5-Trimethylbenzene	NE	0.087***	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vinyl chloride	NE	0.002**	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Xylenes, total	3.57*	10.0*	<0.03	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

NOTE: *Initial Screening Levels as established by TDEC-DUST

****Regional Screening Levels as established by EPA and published April 2012**

*****EPA - Regional Screening Levels -Tap Water Standard-as established by EPA and published April 2012**

-Compounds with Laboratory PQLs above action level

-Detected Concentrations

-Non Drinking Groundwater Action Levels

-Drinking Water Groundwater Action Levels

NA - Not Analyzed

NE - Not Established

Terracon

Table 8

Groundwater Analytical Data Summary - SVOCs
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	HR-MW-2	HR-MW-3	HR-MW-4	Duplicate	HR-MW-5	HR-MW-6	Field Blank
Sample Date			8/14/2012	8/14/2012	8/14/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012
SVOCs	Non Drinking Groundwater Action Levels	Drinking Water Groundwater Action Levels								
Acenaphthene	NE	0.939*	0.019	<0.001	<0.001	<0.001	<0.001	<0.001	0.0027	<0.001
Acenaphthylene	NE	0.939*	0.0011	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Anthracene	NE	0.0434	0.014	<0.001	<0.001	<0.001	<0.001	<0.001	0.0011	<0.001
Benzidine	NE	0.000000092***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)-anthracene	NE	0.00117*	0.0097	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010
Benzo(b)-fluoranthene	NE	0.00117*	0.0083	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010
Benzo(k)-fluoranthene	NE	0.0008*	0.0025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010
Benzo (g,h,i) perylene	NE	0.0007*	0.0026	<0.001	<0.01	<0.001	<0.001	<0.001	<0.001	<0.0010
Benzo(a)pyrene	NE	0.0002*	0.0055	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0010
Bis(2-chloroethoxy)methane	NE	0.047***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bis(2-chloroethyl)ether	NE	0.00012***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bis(2-chloroisopropyl)ether	NE	NE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4-Bromophenyl phenyl ether	NE	NE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Chloronaphthalene	NE	NE	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Chlorophenyl phenyl ether	NE	NE	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	NE	0.0016*	0.0087	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibenz (a,h) anthracene	NE	0.000117*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3,3-Dicchlorobenzidine	NE	0.011***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,4-Dinitrotoluene	NE	0.0002***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,6-Dinitrotoluene	NE	0.015***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	NE	0.206*	0.048	<0.001	<0.001	<0.001	<0.001	<0.001	0.0021	<0.001
Fluorene	NE	0.626*	0.051	<0.001	<0.001	<0.001	<0.001	<0.001	0.0046	<0.001
Hexachlorobenzene	NE	0.001**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexachloro-1,3-butadiene	NE	NE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001
Hexachlorocyclopentadiene	NE	0.05**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hexachloroethane	NE	0.00079***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno (1,2,3-cd)pyrene	NE	0.000029**	0.0023	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Isophorone	NE	0.00117*	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	9.81*	0.02*	0.0018	<0.001	<0.001	<0.001	<0.001	<0.001	0.0093	<0.001
Nitrobenzene	NE	0.00012***	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
N-Nitrosodimethylamine	NE	0.00000042***	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
N-Nitrosodiphenylamine	NE	0.010***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
N-Nitrosodi-n-propylamine	NE	0.0000093***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	NE	0.469	0.074	<0.001	<0.001	<0.001	<0.001	<0.001	0.0042	<0.001
Benzylbutyl phthalate	NE	NE	<0.003	<0.003	<0.003	<0.001	<0.003	<0.003	<0.003	<0.003
Bis(2-ethylhexyl)phthalate	NE	0.006**	<0.003	<0.003	<0.002	<0.001	<0.003	<0.003	<0.003	<0.003
Di-n-butylphthalate	NE	NE	<0.003	<0.003	0.0048	<0.001	0.0044	<0.003	<0.003	<0.003
Diethyl phthalate	NE	11***	<0.003	<0.003	<0.003	<0.001	<0.003	<0.003	<0.003	<0.003
Dimethyl phthalate	NE	NE	<0.03	<0.003	<0.003	<0.001	<0.003	<0.003	<0.003	<0.003
Di-n-octyl phthalate	NE	NE	<0.003	<0.003	<0.003	<0.001	<0.003	<0.003	<0.003	<0.003
Pyrene	NE	0.135*	0.032	<0.001	<0.001	<0.001	<0.001	<0.001	0.0016	<0.001
1,2,4-Trichlorobenzene	NE	0.070**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4-chloro-3-methylphenol	NE	NE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Chlorophenol	NE	0.071***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,4-Dichlorophenol	NE	0.035***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,4-Dimethylphenol	NE	0.270***	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4,6-Dinitro-2-methylphenol	NE	NE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,4-Dinitrophenol	NE	0.030***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Nitrophenol	NE	NE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4-Nitrophenol	NE	NE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pentachlorophenol	NE	0.001**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenol	NE	4.5**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Terracon

Table 8

Groundwater Analytical Data Summary - SVOCs
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	HR-MW-2	HR-MW-3	HR-MW-4	Duplicate	HR-MW-5	HR-MW-6	Field Blank
Sample Date			8/14/2012	8/14/2012	8/14/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012
SVOCs	Non Drinking Groundwater Action Levels	Drinking Water Groundwater Action Levels								
2,4,6-Trichlorophenol	NE	0.0035***	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

NOTE: *Initial Screening Levels as established by TDEC-DUST
**Regional Screening Levels as established by EPA and published April 2012
***EPA - Regional Screening Levels -Tap Water Standard-as established by EPA and published April 2012
-Compounds with Laboratory PQLs above action level
-Detected Concentrations
-Non Drinking Groundwater Action Levels
-Drinking Water Groundwater Action Levels
NA - Not Analyzed
NE - Not Established

Terracon

Table 9

Groundwater Analytical Data Summary - Pesticides and Herbicides
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-MW-1	HR-MW-2	HR-MW-3	HR-MW-4	Duplicate	HR-MW-5	HR-MW-6	Field Blank
Sample Date			8/14/2012	8/14/2012	8/14/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012	8/15/2012
Pesticides	**Industrial Soil Action Levels**	**Residential Soil Action Levels**								
Aldrin	NE	0.21***	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Alpha BHC	NE	0.0000062***	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Beta BHC	NE	0.000022***	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Delta BHC	NE	NE	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Gama BHC	NE	0.0002**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Chlordane	NE	0.002**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
4,4-DDD	NE	0.00028***	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
4,4-DDE	NE	0.0002***	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
4,4-DDT	NE	0.0002***	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Dieldrin	NE	0.0000015***	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Endosulfan I	NE	0.078***	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Endosulfan II	NE	0.078***	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Endosulfan Sulfate	NE	0.078***	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Endrin	NE	0.002**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Endrin aldehyde	NE	0.002**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Endrin keytone	NE	0.002**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Heptachlor	NE	0.0004**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Heptachlor epoxide	NE	0.0002**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Hexachlorobenzene	NE	0.001**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Methoxychlor	NE	0.04**	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Toxaphene	NE	0.003**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Herbicides	**Industrial Soil Action Levels**	**Residential Soil Action Levels**								
2,4-D	NE	0.07**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dalapon	NE	0.2**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2,4-DB	NE	0.091***	0.014	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dicamba	NE	0.44***	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dichloroprop	NE	NE	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dinoseb	NE	0.007**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MCPA	NE	0.0057***	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MCPP	NE	0.012***	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4,5-T	NE	0.12***	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,4,5-TP (silvex)	NE	0.05**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

NOTE: *Initial Screening Levels as established by TDEC-DUST

****Regional Screening Levels as established by EPA and published April 2012**

*****EPA - Regional Screening Levels -Tap Water Standard-as established by EPA and published April 2012**

-Compounds with Laboratory PQLs above action level

-Detected Concentrations

-Non Drinking Groundwater Action Levels

-Drinking Water Groundwater Action Levels

NA - Not Analyzed

NE - Not Established

Terracon

Table 10
Shallow Soil Analytical Data Summary - EPH and PAH
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-7	HR-8	HR-9	HR-10	HR-11	HR-12	HR-13	HR-14	HR-15	HR-16	HR-17	HR-18	HR-19	HR20	HR-21	HR-22	HR-23	HR-24	HR-25	HR-26	HR-27	HR-28	HR-29	HR-30	HR-31	HR-DUP-1A	HR-DUP-2A	HR-RIN-1A
Sample Depth			0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	-	-	-
Sample Date			5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013
EPH	**Industrial Soil Action Levels**	**Residential Soil Action Levels**																												
EPH	100*	100*	290	62	<4.0	1200	<4.0	200	32	30	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	14	12	<4.0	74	160	57	88	<20	35	<4.0	<4.0	<20	5	<0.10
SVOCs	**Industrial Soil Action Levels**	**Residential Soil Action Levels**																												
Acenaphthene	33,000**	3,400**	0.90	<0.33	<0.033	<1.6	<0.33	<0.33	0.037	<0.033	<0.33	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	<0.33	<0.033	<0.033	<1.6	<0.66	<0.33	<0.33	<0.033	<0.033	<0.033	<0.033	<0.033	<0.0010
Acenaphthylene	NE	NE	0.87	0.42	<0.033	<1.6	1.2	0.72	0.062	<0.033	<0.33	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	<0.33	<0.033	<0.033	<1.6	<0.66	<0.33	<0.33	<0.033	<0.033	<0.033	<0.033	0.063	<0.0010
Anthracene	170,000**	17,000**	3.5	0.69	<0.033	1.7	1.4	0.80	0.13	<0.033	0.80	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	<0.33	<0.033	<0.033	<1.6	<0.66	<0.33	<0.33	0.054	<0.033	<0.033	<0.033	0.12	<0.0010
Benzidine	0.0075**	0.0005**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Benzo(a)anthracene	2.1**	0.15**	13	2.8	<0.033	6.7	6.2	4.6	0.45	0.14	2.6	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	0.64	<0.033	0.071	<1.6	<0.66	<0.33	<0.33	0.11	<0.033	<0.033	<0.033	0.43	<0.0010
Benzo(b)fluoranthene	2.1**	0.15**	15	3.9	<0.033	7.9	7.4	6.1	0.55	0.24	3.3	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	0.72	<0.033	0.086	<1.6	<0.66	<0.33	<0.33	0.13	<0.033	<0.033	<0.033	0.52	<0.0010
Benzo(k)fluoranthene	21**	1.5**	5.6	1.3	<0.033	3.4	2.3	2.3	0.21	0.086	1.1	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	0.38	<0.033	0.048	<1.6	<0.66	<0.33	<0.33	0.044	<0.033	<0.033	<0.033	0.16	<0.0010
Benzo(g,h,i)perylene	NE	NE	2.9	0.99	<0.033	2.5	1.7	1.4	0.18	0.070	0.69	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	<0.33	<0.033	0.040	<1.6	<0.66	<0.33	<0.33	0.037	<0.033	<0.033	<0.033	0.11	<0.0010
Benzo(a)pyrene	0.21**	0.015**	12	2.7	<0.033	6.4	5.2	4.4	0.40	0.16	2.3	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	0.58	<0.033	0.071	<1.6	<0.66	<0.33	<0.33	0.096	<0.033	<0.033	<0.033	0.34	<0.0010
Bis(2-chlorethoxy)methane	1,800**	180**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Bis(2-chloroethyl)ether	1**	0.21**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Bis(2-chloroisopropyl)ether	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
4-Bromophenyl-phenylether	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
2-Chloronaphthalene	NE	NE	<0.66	<0.33	<0.033	<1.6	<0.33	<0.33	<0.033	<0.033	<0.33	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	<0.33	<0.033	<0.033	<1.6	<0.66	<0.33	<0.33	<0.033	<0.033	<0.033	<0.033	<0.033	<0.0010
4-Chlorophenyl-phenylether	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Chrysene	210**	15**	13	2.8	<0.033	6.5	5.6	4.3	0.43	0.17	2.5	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	0.54	<0.033	0.074	<1.6	<0.66	<0.33	<0.33	0.11	<0.033	<0.033	<0.033	0.36	<0.0010
Dibenz(a,h)anthracene	0.21**	0.015**	<0.66	<0.33	<0.033	<1.6	<0.33	<0.33	<0.033	<0.033	<0.33	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	<0.33	<0.033	<0.033	<1.6	<0.66	<0.33	<0.33	<0.033	<0.033	<0.033	<0.033	0.042	<0.0010
3,3-Dichlorobenzidine	3.8**	1.1**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
2,4-Dinitrotoluene	5.5**	1.6**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
2,6-Dinitrotoluene	620**	6.1**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Fluoranthene	22,000**	2,300**	24	5.9	<0.033	13	11	6.5	0.82	0.26	4.5	0.035	<0.033	0.18	<0.33	<0.033	<0.033	0.97	<0.033	0.11	<1.6	<0.66	<0.33	<0.33	0.25	<0.033	0.038	<0.033	0.96	<0.0010
Fluorene	22,000**	2,300**	2.8	<0.33	<0.033	<1.6	0.46	<0.33	0.075	<0.033	<0.33	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	<0.33	<0.033	<0.033	<1.6	<0.66	<0.33	<0.33	<0.033	<0.033	<0.033	<0.033	0.057	<0.0010
Hexachlorobenzene	1.1**	0.3**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Hexachloro-1,3-butadiene	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Hexachlorocyclopentadiene	3,700**	370**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Hexachloroethane	120**	35**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Indeno(1,2,3-cd)pyrene	2.1**	0.15**	3.7	1.0	<0.033	2.7	2.0	1.5	0.18	0.075	0.73	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	<0.33	<0.033	0.037	<1.6	<0.66	<0.33	<0.33	0.035	<0.033	<0.033	<0.033	0.12	<0.0010
Isophorone	1,800**	510**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Naphthalene	403*	135*	1.0	<0.33	<0.033	<1.6	<0.33	<0.33	<0.033	<0.033	<0.33	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	<0.33	<0.033	<0.033	<1.6	<0.66	<0.33	<0.33	<0.033	<0.033	<0.033	<0.033	<0.033	<0.0010
Nitrobenzene	24**	4.8**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
n-Nitrosodimethylamine	2,300**	340**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
n-Nitrosodiphenylamine	350**	99**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
n-Nitrosodi-n-propylamine	0.25**	0.069**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Phenanthrene	NE	NE	16	2.6	<0.033	7.8	4.0	2.4	0.54	0.099	2.7	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	0.48	<0.033	0.051	<1.6	<0.66	<0.33	<0.33	0.25	<0.033	<0.033	<0.033	0.68	<0.0010
Benzylbutyl phthalate	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.0030
Bis(2-ethylhexyl)phthalate	120**	35**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.0030
Di-n-butyl phthalate	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.0030
Diethyl phthalate	490,000**	49,000**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.0030
Dimethyl phthalate	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.0030
Di-n-octyl phthalate	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.0030
Pyrene	17,000**	1,700**	17	3.9	<0.033	9.4	8.3	5.5	0.64	0.20	3.6	<0.033	<0.033	<0.16	<0.33	<0.033	<0.033	0.77	<0.033	0.10	<1.6	<0.66	<0.33	<0.33	0.20	<0.033	<0.033	<0.033	0.69	<0.0010
1,2,4-Trichlorobenzene	99**	22**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
4-Chloro-3-methylphenol	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
2-Chlorophenol	5,100**	390**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
2,4-Dichlorophenol	1,800**	180**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
2,4-Dimethylphenol	12,000**	1,200**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
4,6-Dinitro-2-methylphenol	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
2,4-Dinitrophenol	1,200**	120**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
2-Nitrophenol	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
4-Nitrophenol	NE	NE	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Pentachlorophenol	2.7**	0.89**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
Phenol	180,000**	18,000**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010
2,4,6-Trichlorophenol	160**	44**	<6.7	<3.3	<0.33	<17	<3.3	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<1.7	<3.3	<0.33	<0.33	<3.3	<0.33	<0.33	<17	<6.7	<3.3	<3.3	<0.33	<0.33	<0.33	<0.33	<0.33	<0.010

NOTE: *Background concentration as established by TDEC
****Regional Screening Levels as established by EPA and published April 2012**
*****EPA Region 9 Primary Remediation Goal**
-Compounds with Laboratory PQLs above action level
-Detected Concentrations
- Industrial Soil Action Levels action level
- Residential Soil Action Levels action level
NA - Not Analyzed
NE - Not Established

Table 11

Soil Analytical Data Summary - RCRA 8 Metals
155 & 159 Hamm Road - Limited Site Assessment
155 & 159 Hamm Road Chattanooga, Tennessee

Site ID			HR	HR	HR	HR	HR	HR	HR	HR	HR
Sample ID			HR-12	HR-13	HR-24	HR-25	HR-26	HR-27	HR-28	HR-30	HR-30 DUP
Sample Depth			0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'	0'-2'
Sample Date			5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013	5/21/2013
Metals	Industrial Soil Action Levels	Residential Soil Action Levels									
Arsenic	10*	10*	12.0	9.5	10.0	5.3	6.7	12.0	3.6	2.8	2.7
Barium	190,000**	15,000**	160.00	93.00	55.00	120.00	420.00	76.00	5300.00	51.00	50.00
Cadmium	800**	70**	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.88	<0.25	<0.25
Chromium	1,500,000**	120,000**	12.00	11.00	23.00	140.00	23.00	18.00	8.90	35.00	40.00
Lead	800**	400**	41.00	65.00	8.50	26.00	16.00	5.20	8.20	10.00	9.60
Selenium	5,100**	390**	2.10	1.40	<1.0	<1.0	1.80	1.10	<1.0	1.30	1.20
Silver	5,100**	390**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Mercury	34**	5.6**	<0.020	0.024	<0.020	<0.020	<0.020	0.032	<0.020	<0.020	<0.020

NOTE: *Background concentration as established by TDEC

****Regional Screening Levels as established by EPA and published April 2012**

*****EPA Region 9 Primary Remediation Goal**

-Compounds with Laboratory PQLs above action level

-Detected Concentrations

- Industrial Soil Action Levels action level

- Residential Soil Action Levels action level

NA - Not Analyzed

NE - Not Established

APPENDIX C

RACERTM Scenario Alternative Technology Cost Detail Report
Alternative 1: Excavation Off-Site Non-Hazardous Disposal

Project Cost Detail Report
(with Markups)

System:

RACER Version: RACER™ Version 11.0.98.0
Database Location: C:\Users\RacerUser\Documents\RACER\Racer.mdb

Folder:

Folder Name: Hamm Road ABCA (Rev 2) Alternative 1

Project:

ID: E2107081-RPA Revised
Name: Alternative 1: 155-159 Hamm Road ABCA
Category: None

Location

State / Country: TENNESSEE
City: CHATTANOOGA

Location Modifier	Default	User	Reason for changes
	0.850	0.850	

Options

Database: System Costs
Cost Database Date: 2012
Report Option: Calendar

Description

The Chattanooga-Hamilton County Regional Planning Agency (RPA) requires this Analysis of Brownfield Cleanup Alternatives, Revision 0 (ABCA) as part of cleanup feasibility and design for the Hamm Road Property project located at 155 and 159 Hamm Road, Chattanooga, Hamilton County, Tennessee. The RPA is the primary Cooperative

Project Cost Detail Report
(with Markups)

Agreement Recipient of Cooperative Agreement BF-95462910-0.
Contaminants were identified in Phase II environmental site assessment of this property. This revision reflects expanded Phase II data and analysis provided June 2013.

Property:

ID: 135 027.1 / 135 027.03
Name: 155-159 Hamm Road Parcels
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Volatile Organic Compounds (VOCs)
Secondary: Semi-Volatile Organic Compounds (SVOCs)

Phase Names

Pre-Study ☐
Study ☐
Design ☐
Removal/Interim Action ☐
Remedial Action ☑
Operations & Maintenance ☐
Long Term Monitoring ☐
Site Closeout ☐

Documentation

Description: D. Koch, Terracon Senior Consultant using limited data for preliminary Analysis of Brownfield Cleanup Alternatives (ABCA) screening in support of EPA Brownfield cleanup planning to evaluate the cost feasibility of cleanup alternatives for this property.
Terracon completed a Phase II Environmental Site Assessment report in January 2013.

Project Cost Detail Report
(with Markups)

The investigation included soil and groundwater sample collection on both site parcels. The laboratory analysis identified analyte concentrations above action levels for arsenic, EPH, SVOCs, and VOCs in soil; and lead, naphthalene, and SVOCs in groundwater. An expanded Phase II assessment was performed and this ABCA considers the data as evaluated by the Chattanooga office professionals.

The Phase II ESA report recommended that a corrective action plan should be developed detailing investigative procedures for managing and, if desired, remediating contaminated soil and groundwater located at the site. Along with the corrective action plan, deed restrictions should be placed on the site controlling the future use of the groundwater at the site. Based on the elevated concentrations of soil and groundwater contaminants at the site, a Brownfield agreement should be developed between the current property owners and the State of Tennessee. Document is preliminary and is not a budget estimate of cost, this ABCA is intended for cleanup planning purposes only and should not limit consideration of other redevelopment or financial factors.

Support Team: D. Whitmill. A. Herrit and Terracon- Chattanooga office project staff.

References: Phase II ESA report of Hamm Road Property 155 and 159 Hamm Road, Chattanooga, Tennessee 37405. US EPA Cooperative Agreement No. BF-95462910-0, Terracon Project No. E2107081, January 2013 for Chattanooga-Hamilton County Regional Planning Agency, 1250 Market Street, Suite 2000, DRC, Chattanooga, Tennessee 37402. Inclusive of expanded Phase II data evaluation via e-mail from A. Herrit/Terracon 06-12-2013.

Estimator Information

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Estimate Prepared Date: 06/24/2013

Estimator Signature: _____ **Date:** _____

Project Cost Detail Report
(with Markups)

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed: 06/24/2013

Reviewer Signature: _____ **Date:** _____

Project Cost Detail Report
(with Markups)

Alternative (Markup Template)	Direct Cost	Sub Overhead	Sub Profit	Prime Overhead	Prime Profit	Contingency	Owner Cost	Markup Total	Total
Alternative 1. Excavation, Off-site Disposal	$1,450,890							$497,156	$1,948,046
(System Defaults)		$0	$0	$199,415	$119,815	$0	$177,926		
Total Property Cost	$1,450,890	$0	$0	$199,415	$119,815	$0	$177,926	$497,156	$1,948,046

Total Property Cost $1,948,046

	Direct Cost	Markups	Total
Total Project Cost	$1,450,890	$1,948,046	$1,948,046

APPENDIX D

RACERTM Scenario Alternative Technology Cost Detail Report
Alternative 2: Excavation On-Site Thermal Treatment

Project Cost Detail Report
(with Markups)

System:

RACER Version: RACER™ Version 11.0.98.0
Database Location: C:\Users\RacerUser\Documents\RACER\Racer.mdb

Folder:

Folder Name: Hamm Road ABCA (Revised) Alternate 2

Project:

ID: E2107081-RPA Revised
Name: Alternative 2: 155-159 Hamm Road ABCA
Category: None

Location
State / Country: TENNESSEE
City: CHATTANOOGA

Location Modifier	Default	User	Reason for changes
	0.850	0.850	

Options
Database: System Costs
Cost Database Date: 2012
Report Option: Calendar

Description

The Chattanooga-Hamilton County Regional Planning Agency (RPA) requires this Analysis of Brownfield Cleanup Alternatives, Revision 0 (ABCA) as part of cleanup feasibility and design for the Hamm Road Property project located at 155 and 159 Hamm Road, Chattanooga, Hamilton County, Tennessee. The RPA is the primary Cooperative

Project Cost Detail Report
(with Markups)

Agreement Recipient of Cooperative Agreement BF-95462910-0.
Contaminants were identified in Phase II environmental site assessment of this property. This revision reflects expanded Phase II data and analysis provided June 2013.

Property:

ID: 135 027.1 / 135 027.03
Name: 155-159 Hamm Road Parcels
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Volatile Organic Compounds (VOCs)
Secondary: Semi-Volatile Organic Compounds (SVOCs)

Phase Names

- Pre-Study ☐
- Study ☐
- Design ☐
- Removal/Interim Action ☐
- Remedial Action ☑
- Operations & Maintenance ☐
- Long Term Monitoring ☐
- Site Closeout ☐

Documentation

Description: D. Koch, Terracon Senior Consultant using limited data for preliminary Analysis of Brownfield Cleanup Alternatives (ABCA) screening in support of EPA Brownfield cleanup planning to evaluate the cost feasibility of cleanup alternatives for this property.
Terracon completed a Phase II Environmental Site Assessment report in January 2013. The investigation included soil and groundwater sample

collection on both site parcels. The laboratory analysis identified analyte concentrations above action levels for arsenic, EPH, SVOCs, and VOCs in soil; and lead, naphthalene, and SVOCs in groundwater. An expanded Phase II assessment was performed and this ABCA considers the data as evaluated by the Chattanooga office professionals.

The Phase II ESA report recommended that a corrective action plan should be developed detailing investigative procedures for managing and, if desired, remediating contaminated soil and groundwater located at the site. Along with the corrective action plan, deed restrictions should be placed on the site controlling the future use of the groundwater at the site. Based on the elevated concentrations of soil and groundwater contaminants at the site, a Brownfield agreement should be developed between the current property owners and the State of Tennessee. Document is preliminary and is not a budget estimate of cost, this ABCA is intended for cleanup planning purposes only and should not limit consideration of other redevelopment or financial factors.

Support Team: D. Whitmill. A. Herrit and Terracon- Chattanooga office project staff.

References: Phase II ESA report of Hamm Road Property 155 and 159 Hamm Road, Chattanooga, Tennessee 37405. US EPA Cooperative Agreement No. BF-95462910-0, Terracon Project No. E2107081, January 2013 for Chattanooga-Hamilton County Regional Planning Agency, 1250 Market Street, Suite 2000, DRC, Chattanooga, Tennessee 37402. Inclusive of expanded Phase II data evaluation via e-mail from A. Herrit/Terracon 06-12-2013.

Estimator Information

Estimator Name: Dave Koch
Estimator Title: Senior Consultant / Senior Principal
Agency/Org./Office: Corporate
Business Address: 18001 W106th Street
Olathe, KS 66061
Telephone Number: 913-599-6886
Email Address: dekoch@terracon.com
Estimate Prepared Date: 06/24/2013

Estimator Signature: _____ Date: _____

Review Information

Project Cost Detail Report
(with Markups)

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed: 06/24/2013

Reviewer Signature: _____ Date: _____

Project Cost Detail Report
(with Markups)

Alternative (Markup Template)	Direct Cost	Sub Overhead	Sub Profit	Prime Overhead	Prime Profit	Contingency	Owner Cost	Markup Total	Total
Excavation, On-Site Thermal, NonHaz, No GW	$1,540,062							$296,811	$1,836,873
(System Defaults)		$0	$0	$31,556	$106,742	$0	$158,512		
Total Property Cost	$1,540,062	$0	$0	$31,556	$106,742	$0	$158,512	$296,811	$1,836,873

Total Property Cost $1,836,873

	Direct Cost	Markups	Total
Total Project Cost	$1,540,062	$1,836,873	$1,836,873

APPENDIX E

RACERTM Scenario Alternative Technology Cost Detail Report
Alternative 3: Capping, Containment, Operation and Maintenance

Project Cost Detail Report
(with Markups)

System:

RACER Version: RACER™ Version 11.0.98.0
Database Location: C:\Users\RacerUser\Documents\RACER\Racer.mdb

Folder:

Folder Name: Hamm Road ABCA Alternative 3 (Revision 3)

Project:

ID: E2107081-RPA Revised
Name: Alternative 3: 155-159 Hamm Road ABCA
Category: None

Location

State / Country: TENNESSEE
City: CHATTANOOGA

Location Modifier	Default	User	Reason for changes
	0.850	0.850	

Options

Database: System Costs
Cost Database Date: 2012
Report Option: Calendar

Description

The Chattanooga-Hamilton County Regional Planning Agency (RPA) requires this Analysis of Brownfield Cleanup Alternatives, Revision 0 (ABCA) as part of cleanup feasibility and design for the Hamm Road Property project located at 155 and 159 Hamm Road, Chattanooga, Hamilton County, Tennessee. The RPA is the primary Cooperative

Project Cost Detail Report
(with Markups)

Agreement Recipient of Cooperative Agreement BF-95462910-0.
Contaminants were identified in Phase II environmental site assessment of this property. This revision reflects expanded Phase II data and analysis provided June 2013.

Property:

ID: 135 027.1 / 135 027.03
Name: 155-159 Hamm Road Parcels
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Volatile Organic Compounds (VOCs)
Secondary: Semi-Volatile Organic Compounds (SVOCs)

Phase Names

- Pre-Study ☐
- Study ☐
- Design ☐
- Removal/Interim Action ☐
- Remedial Action ☑
- Operations & Maintenance ☐
- Long Term Monitoring ☐
- Site Closeout ☐

Documentation

Description: D. Koch, Terracon Senior Consultant using limited data for preliminary Analysis of Brownfield Cleanup Alternatives (ABCA) screening in support of EPA Brownfield cleanup planning to evaluate the cost feasibility of cleanup alternatives for this property.
Terracon completed a Phase II Environmental Site Assessment report in January 2013. The investigation included soil and groundwater sample

collection on both site parcels. The laboratory analysis identified analyte concentrations above action levels for arsenic, EPH, SVOCs, and VOCs in soil; and lead, naphthalene, and SVOCs in groundwater. An expanded Phase II assessment was performed and this ABCA considers the data as evaluated by the Chattanooga office professionals.

The Phase II ESA report recommended that a corrective action plan should be developed detailing investigative procedures for managing and, if desired, remediating contaminated soil and groundwater located at the site. Along with the corrective action plan, deed restrictions should be placed on the site controlling the future use of the groundwater at the site. Based on the elevated concentrations of soil and groundwater contaminants at the site, a Brownfield agreement should be developed between the current property owners and the State of Tennessee. Document is preliminary and is not a budget estimate of cost, this ABCA is intended for cleanup planning purposes only and should not limit consideration of other redevelopment or financial factors.

Support Team: D. Whitmill. A. Herrit and Terracon- Chattanooga office project staff.

References: Phase II ESA report of Hamm Road Property 155 and 159 Hamm Road, Chattanooga, Tennessee 37405. US EPA Cooperative Agreement No. BF-95462910-0, Terracon Project No. E2107081, January 2013 for Chattanooga-Hamilton County Regional Planning Agency, 1250 Market Street, Suite 2000, DRC, Chattanooga, Tennessee 37402. Inclusive of expanded Phase II data evaluation via e-mail from A. Herrit/Terracon 06-12-2013.

Estimator Information

Estimator Name: Dave Koch
Estimator Title: Senior Consultant
Agency/Org./Office: Terracon Corporate
Business Address: 18001 West 106th Street
Olathe, KS 66061
Telephone Number: 913-599-6886
Email Address: dekoch@terracon.com
Estimate Prepared Date: 06/23/2013

Estimator Signature: _____ Date: _____

Project Cost Detail Report
(with Markups)

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed: 06/24/2013

Reviewer Signature: _____ Date: _____

Project Cost Detail Report
(with Markups)

Alternative (Markup Template)	Direct Cost	Sub Overhead	Sub Profit	Prime Overhead	Prime Profit	Contingency	Owner Cost	Markup Total	Total
Alternative 3. Capping, TDEQ Design (System Defaults)	$870,902	$0	$0	$170,794	$68,477	$0	$101,689	$340,960	$1,211,862
Total Property Cost	$870,902	$0	$0	$170,794	$68,477	$0	$101,689	$340,960	$1,211,862

Total Property Cost	$1,211,862

	Direct Cost	Markups	Total
Total Project Cost	$870,902	$1,211,862	$1,211,862

APPENDIX F

RACERTM Scenario Alternative Technology Cost Detail Report
Alternative 1a: Excavation (70%), Study-Based, Off-Site Disposal

Project Cost Detail Report
(with Markups)

System:

RACER Version: RACER™ Version 11.0.98.0
Database Location: C:\Users\RacerUser\Documents\RACER\Racer.mdb

Folder:

Folder Name: Hamm Road ABCA (Rev 2) Alternative 1a

Project:

ID: E2107081-RPA Revised
Name: Alternative 1a: 155-159 Hamm Road ABCA
Category: None

Location

State / Country: TENNESSEE
City: CHATTANOOGA

Location Modifier	Default	User	Reason for changes
	0.850	0.850	

Options

Database: System Costs
Cost Database Date: 2012
Report Option: Calendar

Description

The Chattanooga-Hamilton County Regional Planning Agency (RPA) requires this Analysis of Brownfield Cleanup Alternatives, Revision 0 (ABCA) as part of cleanup feasibility and design for the Hamm Road Property project located at 155 and 159 Hamm Road, Chattanooga, Hamilton County, Tennessee. The RPA is the primary Cooperative

Project Cost Detail Report
(with Markups)

Agreement Recipient of Cooperative Agreement BF-95462910-0.
Contaminants were identified in Phase II environmental site assessment of this property. This revision reflects expanded Phase II data and analysis provided June 2013.

Property:

ID: 135 027.1 / 135 027.03
Name: 155-159 Hamm Road Parcels
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Volatile Organic Compounds (VOCs)
Secondary: Semi-Volatile Organic Compounds (SVOCs)

Phase Names

- Pre-Study ☐
- Study ☑
- Design ☐
- Removal/Interim Action ☐
- Remedial Action ☑
- Operations & Maintenance ☐
- Long Term Monitoring ☐
- Site Closeout ☐

Documentation

Description: D. Koch, Terracon Senior Consultant using limited data for preliminary Analysis of Brownfield Cleanup Alternatives (ABCA) screening in support of EPA Brownfield cleanup planning to evaluate the cost feasibility of cleanup alternatives for this property.
Terracon completed a Phase II Environmental Site Assessment report in January 2013.

Project Cost Detail Report
(with Markups)

The investigation included soil and groundwater sample collection on both site parcels. The laboratory analysis identified analyte concentrations above action levels for arsenic, EPH, SVOCs, and VOCs in soil; and lead, naphthalene, and SVOCs in groundwater. An expanded Phase II assessment was performed and this ABCA considers the data as evaluated by the Chattanooga office professionals.

The Phase II ESA report recommended that a corrective action plan should be developed detailing investigative procedures for managing and, if desired, remediating contaminated soil and groundwater located at the site. Along with the corrective action plan, deed restrictions should be placed on the site controlling the future use of the groundwater at the site. Based on the elevated concentrations of soil and groundwater contaminants at the site, a Brownfield agreement should be developed between the current property owners and the State of Tennessee. Document is preliminary and is not a budget estimate of cost, this ABCA is intended for cleanup planning purposes only and should not limit consideration of other redevelopment or financial factors.

Support Team: D. Whitmill. A. Herrit and Terracon- Chattanooga office project staff.

References: Phase II ESA report of Hamm Road Property 155 and 159 Hamm Road, Chattanooga, Tennessee 37405. US EPA Cooperative Agreement No. BF-95462910-0, Terracon Project No. E2107081, January 2013 for Chattanooga-Hamilton County Regional Planning Agency, 1250 Market Street, Suite 2000, DRC, Chattanooga, Tennessee 37402. Inclusive of expanded Phase II data evaluation via e-mail from A. Herrit/Terracon 06-12-2013.

Estimator Information

Estimator Name: Dave Koch
Estimator Title: Senior Consultant / Senior Principal
Agency/Org./Office: Terracon - Corporate
Business Address: 18001W 106th Street
Olather, KS 66061
Telephone Number: 913-599-6886
Email Address: dekoch@terracon.com

Estimate Prepared Date: 06/24/2013

Estimator Signature: _____ Date: _____

Project Cost Detail Report
(with Markups)

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed: 06/24/2013

Reviewer Signature: _____ Date: _____

Project Cost Detail Report
(with Markups)

Alternative (Markup Template)	Direct Cost	Sub Overhead	Sub Profit	Prime Overhead	Prime Profit	Contingency	Owner Cost	Markup Total	Total
Alternative 1a. 50 Sample Study	$52,189							$49,871	$102,060
(System Defaults)		$0	$0	$32,946	$6,811	$0	$10,114		
Alternative 1a. 70% Surgical Excavation, Disposal	$1,020,016							$312,676	$1,332,692
(System Defaults)		$0	$0	$125,226	$75,433	$0	$112,017		
Total Property Cost	$1,072,205	$0	$0	$158,172	$82,243	$0	$122,132	$362,547	$1,434,752

Total Property Cost	$1,434,752

	Direct Cost	Markups	Total
Total Project Cost	$1,072,205	$1,434,752	$1,434,752

APPENDIX G

RACERTM Scenario Alternative Technology Cost Detail Report
Alternative 1b: Excavation (60%), Study-Based, Off-Site Disposal

Project Cost Detail Report
(with Markups)

System:

RACER Version: RACER™ Version 11.0.98.0
Database Location: C:\Users\RacerUser\Documents\RACER\Racer.mdb

Folder:

Folder Name: Hamm Road ABCA (Revision 2) Alternative 1b

Project:

ID: E2107081-RPA Revised
Name: Alternative 1b: 155-159 Hamm Road ABCA
Category: None

Location

State / Country: TENNESSEE
City: CHATTANOOGA

Location Modifier	Default	User	Reason for changes
	0.850	0.850	

Options

Database: System Costs
Cost Database Date: 2012
Report Option: Calendar

Description

The Chattanooga-Hamilton County Regional Planning Agency (RPA) requires this Analysis of Brownfield Cleanup Alternatives, Revision 0 (ABCA) as part of cleanup feasibility and design for the Hamm Road Property project located at 155 and 159 Hamm Road, Chattanooga, Hamilton County, Tennessee. The RPA is the primary Cooperative

Project Cost Detail Report
(with Markups)

Agreement Recipient of Cooperative Agreement BF-95462910-0.
Contaminants were identified in Phase II environmental site assessment of this property. This revision reflects expanded Phase II data and analysis provided June 2013.

Property:

ID: 135 027.1 / 135 027.03
Name: 155-159 Hamm Road Parcels
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Volatile Organic Compounds (VOCs)
Secondary: Semi-Volatile Organic Compounds (SVOCs)

Phase Names

- Pre-Study ☐
- Study ☑
- Design ☐
- Removal/Interim Action ☐
- Remedial Action ☑
- Operations & Maintenance ☐
- Long Term Monitoring ☐
- Site Closeout ☐

Documentation

Description: D. Koch, Terracon Senior Consultant using limited data for preliminary Analysis of Brownfield Cleanup Alternatives (ABCA) screening in support of EPA Brownfield cleanup planning to evaluate the cost feasibility of cleanup alternatives for this property.
Terracon completed a Phase II Environmental Site Assessment report in January 2013.

Project Cost Detail Report
(with Markups)

The investigation included soil and groundwater sample collection on both site parcels. The laboratory analysis identified analyte concentrations above action levels for arsenic, EPH, SVOCs, and VOCs in soil; and lead, naphthalene, and SVOCs in groundwater. An expanded Phase II assessment was performed and this ABCA considers the data as evaluated by the Chattanooga office professionals.

The Phase II ESA report recommended that a corrective action plan should be developed detailing investigative procedures for managing and, if desired, remediating contaminated soil and groundwater located at the site. Along with the corrective action plan, deed restrictions should be placed on the site controlling the future use of the groundwater at the site. Based on the elevated concentrations of soil and groundwater contaminants at the site, a Brownfield agreement should be developed between the current property owners and the State of Tennessee. Document is preliminary and is not a budget estimate of cost, this ABCA is intended for cleanup planning purposes only and should not limit consideration of other redevelopment or financial factors.

Support Team: D. Whitmill. A. Herrit and Terracon- Chattanooga office project staff.

References: Phase II ESA report of Hamm Road Property 155 and 159 Hamm Road, Chattanooga, Tennessee 37405. US EPA Cooperative Agreement No. BF-95462910-0, Terracon Project No. E2107081, January 2013 for Chattanooga-Hamilton County Regional Planning Agency, 1250 Market Street, Suite 2000, DRC, Chattanooga, Tennessee 37402. Inclusive of expanded Phase II data evaluation via e-mail from A. Herrit/Terracon 06-12-2013.

Estimator Information

Estimator Name: Dave Koch
Estimator Title: Senior Consultant / Senior Principal
Agency/Org./Office: Terracon - Corporate
Business Address: 18001W 106th Street
Olather, KS 66061
Telephone Number: 913-599-6886
Email Address: dekoch@terracon.com

Estimate Prepared Date: 06/24/2013

Estimator Signature: _____ Date: _____

Project Cost Detail Report
(with Markups)

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed: 06/24/2013

Reviewer Signature: _____ Date: _____

Project Cost Detail Report
(with Markups)

Alternative (Markup Template)	Direct Cost	Sub Overhead	Sub Profit	Prime Overhead	Prime Profit	Contingency	Owner Cost	Markup Total	Total
Alternative 5. 100 Sample Study	$52,189							$49,871	$102,060
(System Defaults)		$0	$0	$32,946	$6,811	$0	$10,114		
Alternative 1b. 60% Surgical Excavation, Disposal	$978,722							$299,267	$1,277,989
(System Defaults)		$0	$0	$119,696	$72,262	$0	$107,309		
Total Property Cost	$1,030,911	$0	$0	$152,642	$79,073	$0	$117,424	$349,139	$1,380,049

Total Property Cost	$1,380,049

	Direct Cost	Markups	Total
Total Project Cost	$1,030,911	$1,380,049	$1,380,049

APPENDIX H

Detailed Information in Applying RACERTM to Analysis of ABCA

Appendix E

Detailed Considerations in Applying RACER™

to Analysis of Brownfield Cleanup Alternatives (ABCA)

Terracon used the Remedial Action Cost Engineering Requirements (RACER™) System, a commercially available cost engineering model to develop scenarios of cleanup cost. RACER™ is a personal computer-based system distributed by AECOM and originally developed in 1992 by the U.S. Air Force. The system uses a patented methodology for generating location-specific program cost estimates. The system allows the user to select the desired models from a list of available technologies, define the required parameters in the selected technology, and tailor the estimate by verifying and editing secondary parameters. RACER™ calculates quantities for each technology; localizes unit costs for materials, equipment, and labor; adjusts unit prices for safety and productivity losses; and applies markups to account for indirect costs. RACER™ uses current multi-agency pricing data, and is researched and updated annually to ensure accuracy.

RACER is a parametric, integrated cost estimating software system that was developed specifically for estimating costs associated with environmental investigation and cleanup projects. The system can provide the detail of a definitive engineers' estimate or early order-of-magnitude stages of cost estimating such as typical of ABCAs. Using RACER to prepare cost estimates provides the detail and accuracy of manual estimates, but it is faster, less error prone, and more efficient in comparing engineering alternatives. RACER has been used to estimate over $10 billion of environmental projects and is currently used by hundreds of users. Users include the Department of Defense, Department of Energy, Department of the Interior, USEPA, engineering consultants, contractors, state regulatory agencies, and the private sector.

1.0 CONSIDERATIONS OF REMEDY

Excess public risk requires four elements, all of which must be present, to produce harmful chemical risk.

- A chemical of sufficient toxicity to do harm
- A sufficient amount of the chemical to be toxic and do harm
- A receptor on which to do harm
- A pathway by which sufficient toxic material can actually reach the receptor

To be an effective remedy, the technology and/or management solution must interrupt or remove one of the four criteria.

2.0 ACCEPTABLE RISK

Corrective actions rarely "clean up" all chemicals. It is generally the intent to remove, treat, or immobilize the concentrations of chemicals producing unacceptable risk. The degree of

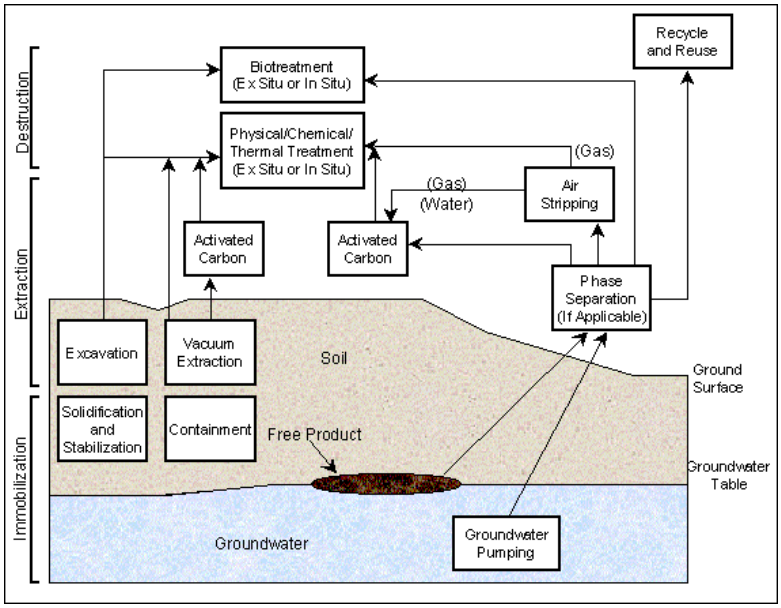
acceptable risk is determined by the public through legislative and regulated processes. Although all chemical measurements exceeding state and federal thresholds of acceptable risk are not necessarily required to be cleaned up, the ABCA must use these thresholds as an estimation starting point to develop quantities used in models.

3.0 GENERAL TREATMENT TECHNOLOGIES

When contaminants require physical or chemical action to mitigate conditions of unacceptable chemical risk, numerous methods are available. The types of contaminants, the affected media, and physical conditions of the property determine a variable range of technical effectiveness and implementation costs. Many technologies have only been tried in the laboratory or in small field pilot tests. Their actual effectiveness in large-scale application is unknown.

Industry experience shows that the following three general physical strategies are used separately or in conjunction to remedy most sites.

- Destruction or alteration of the chemical of concern
- Extraction or separation of contaminants from environmental media
- Immobilization of chemicals so they are not available for exposure



Inset 1. Typical Treatment Scenarios

Treatment technologies capable of contaminant destruction by altering their chemical structure are thermal, biological, and chemical treatment methods. These destruction technologies can be applied in-situ (in place) or ex-situ (by removing the media).

Some soil treatment technologies commonly used for extraction and separation of contaminants from environmental media include soil treatment by thermal desorption, soil washing, solvent

extraction, and soil vapor extraction. Groundwater treatment often occurs by phase separation, carbon adsorption, air stripping, ion exchange, or some combination of these technologies. Selection and integration of technologies should use the most effective contaminant transport mechanisms to arrive at the most effective treatment scheme. For example, if more air than water can be moved through soil and a volatile contaminant in soil is relatively insoluble in water, SVE would be a more efficient separation technology than soil flushing or washing.

On-site immobilization technologies include stabilization, solidification, and containment technologies (such as capping or construction of slurry walls). No immobilization technology is permanently effective, so some type of maintenance is desired. Stabilization technologies are often proposed to remedy sites contaminated by metals or other inorganic compounds.

4.0 LIMITS OF MODELING

The scope of ABCA evaluation under the limited strictures and funding of EPA Brownfield grants cannot evaluate all possible technological remedies nor can it do so to the level of a definitive cost estimate. The preliminary nature of contaminants at the feasibility stage and the unknown final future land uses of redevelopment preclude doing so.

The ABCA evaluation made use of screening of presumptive remedies. A presumptive remedy is a technology that the USEPA believes, based upon its experience, generally will be the most appropriate remedy for a specified type of site. The USEPA is establishing presumptive remedies to accelerate site-specific analysis of remedies by focusing the feasibility study efforts. The USEPA expects that a presumptive remedy, when available, will be used for all CERCLA sites except under unusual circumstances.

The USEPA has determined that, when using presumptive remedies, the site characterization data collection effort can be limited, and the detailed analysis can be limited to the presumptive remedies. This streamlines that portion of the feasibility study. This approach is appropriate to the scale and size of the Phase II ESA data set.

There are circumstances where a presumptive remedy may not be used. These can include unusual site soil characteristics, mixtures of contaminants not treated by the remedy, or demonstration of significant advantages of alternate (or innovative) technologies over the presumptive remedies. They can include conditions of extraordinary community and state concerns. The final use of other than presumptive remedy technologies, or the absence of a presumptive remedy entirely, does not render the selected treatment technology less effective. The presumptive remedy is simply an expedited approval process, not the only technically feasible alternative. This is consistent with the level of secondary project evaluation required in considering redevelopment feasibility.

The remedial cost estimation was limited to selection and preliminary costing of presumptive remedies that appear most probable for application.

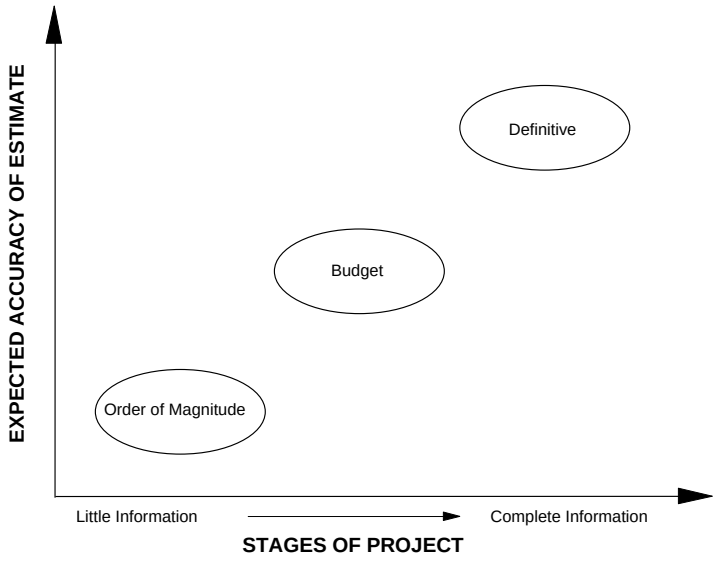
RACER™ makes use of a feature known as the *Remedial Action Wizard*. The Wizard allows users to select appropriate treatment train options based on the Primary Media/Waste Type, Secondary Media/Waste Type, Primary Contaminant and Secondary Contaminants specific to sites. The Wizard shows up to five options for the treatment parameters specified on the Remedial Action Phase input screens. The RA Wizard is based on the Federal Remediation Technologies Roundtable (FRTR) Treatment Technologies Screening Matrix[1]. The technologies in the FRTR Screening Matrix include rating codes as Above Average, Average, Below Average, and Site Specific based on the applicability of the technology to the media/waste and contaminants. Technologies that are more effective and more widely used are shown as the first options in the RA Wizard. Terracon selected from these potential technologies for comparisons.

5.0 METHODS OF ESTIMATING COST

The three types of cost estimating for remediation are order of magnitude estimate, budget estimate, and definitive estimate. The type of estimate developed generally depends on the amount of information available to the evaluator.

Inset 2. Remedial Estimation for Planning

An order of magnitude estimate typically has the largest margin of error because it is performed in the initial stages of a project when relatively little information is known. Conversely, a definitive estimate typically has a smaller margin of error because it is performed at a later stage of a project when presumably most of the needed information is known. The following figure plots the three types of estimates against the expected accuracy of the estimate, based on the amount of information available.



[1] *http://www.frtr.gov/matrix2/section3/table3_2.pdf*

For an order of magnitude estimate, historical costs for similar types of projects are often used to calculate a "ballpark" figure for the project. An order of magnitude estimate is completed at the initial stages of a cleanup, when minimal information is available. The cost of a project at this stage is frequently estimated by multiplying the number of "units" of a particular type of contamination (e.g., the number of cubic feet of contaminated sludge) by a pre-established cost for cleanup per unit (e.g., dollars per cubic foot) using a particular technology. USEPA guidance indicates an order of magnitude estimate might be expected to be between 70% and 150% of the future cost of remedy for the project. These ranges are not definitive and final costs can vary greatly depending on the complexity of project and regulatory requirements which may be required as the project moves forward during redevelopment. These types of estimates are used when considering the potential magnitude of restoration as it might relate to a potential project's value or feasibility of acquisition.

The budget estimate is prepared during the intermediate stages of the remedial design process. A higher level of accuracy is expected than that achieved with the order of magnitude estimate because more project-specific information is known. A budget estimate assesses the cost of each project component to compute an estimated total project cost. Several activities and cost items are grouped into a "system" that relates to the phase of cleanup. These systems are generally listed in the order in which they are employed in the cleanup. Budget estimates are sometimes referred to as assemblies or systems estimates. USEPA guidance indicates a budget estimate might be expected to be between 85% and 130% of the actual cost of the project. These ranges too are not definitive and final costs may vary significantly depending on the complexity of project and regulatory requirements which may be required as the project moves forward or land use changes during redevelopment. These types of estimates may be used to support requests for funding, preliminary budgeting, or planning as part of overall redevelopment.

A detailed cleanup plan design is required to produce a definitive estimate. This type of estimate is typically conducted once site characterization and/or a substantial portion of the remedial and redevelopment reconstruction design are completed. A definitive estimate is normally prepared by multiplying the quantity of each item needed by its unit price, and summing the line item totals. A competitive bid process is typically used to determine definitive estimates for reconstruction. Developing a definitive estimate is time consuming, but it is generally more accurate than other estimates because more is known about the site. Definitive estimates are sometimes referred to as unit price, quantity take-off, or bottom-up estimates. USEPA guidance indicates a definitive estimate might be expected to be between 95% and 115% of the actual cost of the project. Typically developed through engineering estimates from the remedial design plans and specifications, final costs may still vary. The scope and budget structures of the grants limit the remedial cost estimation effort. Regardless of format or level of detail, discussions of cost and remedy must be considered similar to order of magnitude estimates for making comparative evaluations, subject to changes required by regulatory agencies.

Labor costs were scaled and selected to geographical limits of RACER™ as Chattanooga, Tennessee, which employs an industry default multiplier of 0.864. Although labor costs may be lower due to recent recessional effects of the national economy, the modeler could not adjust the internal RACER™ multiplier without some basis for adjustment. Escalation of cost was not considered since the timeframe for cleanup is not yet known to encompass multiple years.

6.0 RACER™ TECHNOLOGY INPUTS AND MODEL FUNCTION

Individual technologies and parameters selected for RACER™ scenarios above are included as Phase Cost Summary and Phase Technology Detail Reports (With Markups) in other appendices of this report. Detailed supporting information relative line item assemblies used in RACER™ calculations are maintained in project files as part of project documentation.