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Teutonia Buena Vista, LLC.

Remedial Design

Former Teutonia Hall Site
Yonkers, New York
BCP Site #C360085

December 2012

5633002

I, Kent McManus, certify that I am currently a NYS registered professional engineer and that this Remedial Design was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

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1. INTRODUCTION

1.1 Purpose and Scope

Teutonia Buena Vista, LLC plans to redevelop the Former Teutonia Hall Site (Site) (BCP Site number C360085) located in Yonkers, New York as a multi-story residential apartment complex with on-site underground automated parking. The Site has a long history of commercial and industrial use that included clothing, jewelry and toy manufacturing, dry cleaning, dental office facilities, warehouse storage and auto repair/parts distribution. Evidence of former Site use includes two aboveground fuel storage tanks and contaminated soil and soil vapor. Based on the Site history and documented environmental contamination, the Site was admitted into the New York State Department of Environmental Conservation (NYSDEC)-sponsored Brownfield Cleanup Program (BCP).

ARCADIS has prepared this Remedial Work Plan (RWP) and Design on behalf of the Teutonia Buena Vista, LLC in support of the remediation and redevelopment of the Site. This Work Plan summarizes the findings and recommendations of the Remedial Investigation Report completed for the Site (Malcolm Pirnie Inc., 2010) and describes the remedy selection process and recommended remedial alternative for the Site.

1.2 Background

The Site is located on the west side of Buena Vista Avenue south west of the intersection with Hudson Avenue. The Site consists of five adjoining parcels. The buildings have a long history of use, but have fallen into disrepair and currently stand vacant and abandoned. The building structures that occupy the Site can generally be characterized as multi-story brick and concrete buildings with street addresses identified as #41, 45, 47, 51 and 53 Buena Vista Avenue. The parcels known as and numbered 41, 45, and 47 Buena Vista Avenue were collectively admitted into the BCP program as the Former Teutonia Hall Site (BCP Site #360085) and are subject to an amended Brownfield Cleanup Agreement dated November 2006. On or about April 16, 2007, that agreement was further amended to, among other things, admit the sites known as and numbered 51 and 53 Buena Vista Avenue into the BCP (collectively all five parcels now constitute BCP Site #360085).

As shown on **Figures 1** and **2**, the Former Teutonia Hall Site is situated on approximately 0.78-acres of land located in the City of Yonkers, Westchester County, New York. The five parcels that comprise the BCP Site include the attached building

complex and land at #41, 45, 47, 51 and 53 Buena Vista Avenue as shown on **Figure 3**. The Site is located approximately 500 feet east of the south-flowing Hudson River and is currently bounded to the north by an occupied 40-unit loft residential building, to the south by residential property, to the east by Buena Vista Avenue and to the west by the active Metro North/Amtrak railroad line and Right of Way.

Site development work completed under the approved BCP Program will include removal of all fuel storage tanks, demolition of all on-site buildings while preserving and relocating the Architecturally interesting elements of the former Teutonia Hall, and finally, excavation of the on-site soil to a depth equal to the adjacent railroad grade west of the Site, up to approximately 25 feet. The redevelopment project is larger than the overall BCP Site and will extend to the south of the BCP Site including the next two residential home lots.

2. SUMMARY OF CONTAMINATION AND POTENTIAL RISK

2.1 Summary of Soil Contamination and Potential Risk

2.1.1 Surface Soil:

The following summary of contamination and potential risk is reflective of the Remedial Investigation Report, which was accepted as Final by the Department on (June 2010). At the time that the RI Report was prepared and accepted as final, the volunteer intended to remediate the Site to Track 2 (restricted residential) standards. Thus, the summary of contamination and potential risks were compared to the NYSDEC's restricted residential soil cleanup objectives (SCOs). Since the time of acceptance of the Final RI Report, the volunteer has decided to attempt cleanup of the Site to meet the Track 1, unrestricted use standards. The following summary of contamination compares data to unrestricted SCOs. Achievement of Track 1 or Track 2 cleanup will be determined by the analytical results of confirmation samples collected from the bottom of the final excavation.

Analytical results of surface soil/fill samples previously collected from locations outside the buildings at depths between 0 and 2 feet below ground surface (bgs) identified the presence of VOCs (PCE), SVOCs (PAHs), and metals at concentrations that exceed the NYSDEC's unrestricted Soil Cleanup Objectives (SCOs) (6 NYCRR Part 375-6.8(a), 2006). Analytical data for surface soil samples are shown on summary **Tables 1 and 2**.

SVOCs detected above the unrestricted SCOs include; naphthalene, acenaphthene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene. Elevated metals concentrations detected in excess of the unrestricted SCO standards include, arsenic, barium, chromium, cadmium, copper, lead, mercury, nickel, silver and zinc.

The human health risk evaluation indicated that under the current/future use scenario, where the Site is left vacant and undeveloped, it is possible that trespassers could be exposed to chemicals of potential concern (COPC) in surface soil by dermal contact and incidental ingestion as well as inhalation of particulate COPC adsorbed to fugitive dust released from surface soil/fill.

Under the future-use scenario where the Site is redeveloped into a residential apartment building, the risk characterization indicated that the potential for

construction/utility worker exposure to COPC in surface soil/fill is likely via dermal contact with and incidental ingestion of COPC; inhalation of volatile and particulate COPC in surface soil/fill during future redevelopment and maintenance of the Site. Such exposure would be limited to the duration of construction/utility work and would be mitigated through development and implementation of a health and safety plan.

The planned removal of the contaminated soil/fill source material from the entire Site would remove those contaminants identified in the surface soil discussed above.

2.1.2 Subsurface Soil

As shown on summary **Tables 1** and **3,** xylene, PCE, PAHs and/or metals were detected at concentrations above the unrestricted SCOs in some of the 54 subsurface soil samples collected on-site. Methylene chloride and acetone, common laboratory contaminants, were also detected at low concentrations but are not believed to be Site contaminants. SVOC/PAHs detected above the NYSDEC SCOs include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene. Benzo(a)pyrene and chrysene were also detected at concentrations above the upper range of PAH concentrations typically found in urban background soils (NYSDEC, 2000).

Analytical soil data from some of the 35 sample locations identified concentrations of chromium, lead, manganese and mercury in excess of the unrestricted SCOs. Both chromium and mercury were also present at concentrations above the upper range found in eastern US background soils. **Table 3** shows the deepest of these samples containing constituents (lead and mercury) above SCOs was collected from the 14 to 16 feet bgs depth interval at only one location identified as SB-21. Additionally, none of the soil samples collected below 16 feet bgs contained Site-related constituents at concentrations greater than the NYS unrestricted SCO's. Based on the data available, it appears that the vertical depth of on-site subsurface soil contamination in excess of unrestricted SCOs is less than or equal to 16 feet bgs.

Under the future scenario where the Site is redeveloped into a residential apartment building, the risk characterization indicated that the potential for construction/utility worker exposure to COPC in subsurface soil/fill during future redevelopment and maintenance of the Site is likely via dermal contact, incidental ingestion and inhalation of volatile and particulate COPCs. Such exposure would be limited to the duration of construction/utility work and would be mitigated through development and implementation of a health and safety plan

Since Site redevelopment design plans now include removal of all on-site soil/fill to a minimum depth of 20 feet, the contaminants identified in the subsurface soil/fill to that depth will be removed and disposed of offsite. Confirmatory samples collected from the final construction grade and sidewalls will be compared to unrestricted and restricted residential SCOs to verify the conditions of the soil/fill and remedial track achievement. Regardless of the level of cleanup achieved (Track 1 or Track 2), potential exposure to COPCs in the subsurface soil/fill will be limited to the construction period as the entire Site will be covered by the subsurface parking facility and the new apartment building.

2.2 Summary of Soil Vapor Contamination and Potential Risk

Soil vapor samples collected from beneath on-site buildings detected PCE and TCE at concentrations greater than the NYSDOH indoor air guidance criteria. As shown on summary **Tables 4 and 5,** the greatest concentrations of PCE and TCE compounds were detected in soil vapor samples collected from beneath Building #53. PCE was detected at 190,000 ug/m^3 in soil vapor sample SG-3 and TCE was detected at 9,100 ug/m^3 in soil vapor sample SG-10.

Under the current/future land use scenario defined in the RI report in which the Site remains vacant and undeveloped, the human health evaluation identified potential exposure pathways to both trespassers and off-site residents. Based on the results of soil gas samples collected during the August 2007 RI, VOCs in soil gas have the potential to migrate to indoor air of the vacant on-site and off-site buildings. The exposure of off-site residents to VOCs in soil gas that migrates to the indoor air of off-site residential buildings is possible.

Under the future land-use scenario in which the Site is redeveloped into a residential apartment facility, if no soil or vapor mitigation were to take place, the potential for Site workers and on-site residents' exposure to VOCs in soil gas that migrates to indoor air of a future on-site building is possible. In addition, the potential for exposure of off-site residents to VOCs in soil gas that migrate to the indoor air of off-site residential buildings is possible.

A possible point source of the soil vapor contamination, (i.e., impacted soil) was not identified during subsurface drilling and sampling investigations. Redevelopment of the Site includes the removal of all soil/fill to a depth up to 25 feet bgs. The excavation and disposal of the soil/fill to this depth would likely remove the source of soil vapor contamination, and would minimize the potential for human exposure.

2.3 Summary of Groundwater Contamination and Potential Risk

Groundwater samples collected from on-site monitoring wells contained metals at concentrations above the NYS Class “GA” groundwater quality standards. However, based on the documented ephemeral nature of Site groundwater and subsequent discussions with NYSDEC representative(s), the Human Health Evaluation supported a determination that groundwater was not an environmental medium of concern.

Human exposure to groundwater and the constituents in the groundwater is unlikely because on-site groundwater is not used, rather, potable water is provided to the Site and vicinity by the City of Yonkers. Also, at those locations where groundwater was present in the overburden, the depth to groundwater ranged from 30 to 44 feet below bgs. Thus, it is not expected that construction/utility workers would have direct contact exposure to groundwater at these depths during future construction or excavation activities.

3. REMEDIAL ACTION OBJECTIVES

The most significant conclusion drawn from the Remedial Investigation is that on-site soil/fill and soil vapor are the media of concern warranting remedial action. The following medium-specific Remedial Action Objectives (RAOs) were identified to be protective of public health and are based on contaminant-specific standards, criteria, and guidance (SCGs):

Soil: Soil Cleanup Objectives (SCOs) for the Protection of Public Health-unrestricted. (New York Code of Rules and Regulations-NYCRR Subpart 375-6.8(a)

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

The overall objective of the Site remedial actions is to mitigate the potential risks posed by the on-site soil and soil vapor, to achieve a Site condition that allows for the proposed reuse as a multistory apartment complex. The specific RAOs for the media of concern are:

Soil RAOs include:

- Protect current/future trespassers from potential direct contact with and incidental ingestion and inhalation of COPCs (VOCs, PAHs and metals) in surface soils (0-2' depth) in areas exterior of current Site buildings in the absence of Site redevelopment.

- Protect future construction/utility workers from direct potential contact with and incidental ingestion and inhalation of COPCs (VOCs, PAHs and metals) in surface (0-2') and subsurface (2-16 feet) soils.

Soil Vapor RAOs include:

- Mitigate potential impacts to health of current/future Site users/residents and off-site residents resulting from potential inhalation of soil vapor intrusion into current and future Site and near-Site buildings. Mitigation measures to include removal of VOC-impacted on-Site soil and associated on-Site soil vapor. Potentially affected receptors include; current/future on-site trespassers and workers, and off-site

residents as well as future affected receptors including on-site workers and residents and off-site residents.

The remedial goals for this Site are to eliminate or reduce to the extent practicable, potential exposure of persons at or near the Site to VOCs, SVOCs, and metals in soil/fill and VOCs in soil vapor.

4. REMEDIAL ALTERNATIVES

Remedies for the site fall into one of two general categories, those that result in unrestricted use and those that result in restricted residential use of the Site.

Remedies that could result in unrestricted use of the Site include:

- Complete removal and off-site disposal of impacted on-site soil/fill down to native uncontaminated soils and replacement with clean fill or new re-development structures
- In-situ or ex-situ treatment of the impacted soil/fill.

To the extent a Track 1 unrestricted remedy cannot be achieved, remedies for the site that could result in the restricted residential use of the Site include:

- Partial removal and off-site disposal of impacted on-site soils.
- Institutional Controls
- Cover System with Institutional Controls

The following remedial alternatives assume that all underground and aboveground storage tanks present on the Site will be removed along with the related impacted soil/fill, if present, prior to implementation of the Site-wide remedy.

Removal and off-site disposal of the VOC, SVOC, and metals-impacted soils is the focus of the remedial alternatives considered for the Site for the following reasons:

- The effectiveness of excavation/removal methods at eliminating the potential hazards posed by the contamination.
- The planned redevelopment of the Site includes two floors of subgrade parking such that the current grade of the Site will be reduced by up to 25 feet.
- Removal of soil/fill up to 25 feet is expected to include removal of the source of soil vapor VOCs of concern as well as the installation of vapor barriers and passive vapor mitigation systems included for precautionary measures in conjunction with redevelopment construction.

Evaluation of multiple Cleanup Track scenarios (I.e., Track 1, Track 2, etc.) was not performed because the planned Site remediation is the most conservative approach possible (Track 1). The redevelopment of the Site includes the excavation and removal of up to 25 feet of on-site soils throughout the entire BCP Site footprint as well as to the south of the BCP Site to accommodate subgrade parking and foundation structures. The excavation and subsequent redevelopment will effectively remove the impacted surface and subsurface soils, resulting in a Track 1 Cleanup. The following two remedial alternatives were evaluated for this Site:

1. No Action – The No Action alternative assumes that no remedial action is taken and the Site is redeveloped but without removal of any of the impacted soils or the USTs and associated soil/fill.

2. Track 1 Cleanup – Under a Track 1 cleanup, all on-site soils with constituents above unrestricted SCOs, including that which is beneath the existing buildings, will be removed to a depth of approximately 25 feet.

Each of these two remedial alternatives is described in more detail below.

4.1 Description of Remedial Alternatives

4.1.1 Alternative # 1- No Action

This alternative assumes that no remedial action is taken and the Site is developed without removal of any of the USTs and impacted surface and subsurface soil/fill. Since VOCs, SVOCs, and metals are present in surface and subsurface soils at concentrations that exceed the NYS Unrestricted and Restricted Residential SCOs, this alternative would not be protective of human health and would not be compliant with 6NYCRR Subpart 375-6. For this reason, this alternative was not considered further.

4.1.2 Alternative #2 - Track 1 Cleanup

Under a Track 1 cleanup, all USTs and related impacted soil, if present, would be removed. Also, on-site contaminated soil/fill, down to native soils above the Track 1 cleanup levels, including that which is beneath the existing buildings, would be removed, characterized and disposed off-site at a NYSDEC-permitted and pre-approved waste disposal facility prior to re-development construction. Cleanup under Track 1 requires achieving unrestricted SCOs. Implementing the Track 1 alternative at

this Site would involve removal of all on-site soil/fill material to native soils until the Track 1 cleanup levels are achieved for VOCs, SVOCS, pesticides, PCBs, and metals. Removed soil/fill will be replaced with documented clean soil and/or new building structures as appropriate for the Site redevelopment. This remedial option would include the removal of approximately 31,000 cubic yards of soil/fill from the Site at an estimated cost of approximately $5.3 million, see **Table 6**. Excavation and confirmation sampling would be performed in accordance with DER-10 (DEC November 2009). This option would meet and exceed the remedial action objective and would include placement of vapor barriers at excavation bottom and sides as well as a passive (perforated pipe network) system to create a means of ventilation between the perimeter of the new Site structure and the bottom, and north and east excavation sidewalls if determined necessary in the future.

4.1.2.1 Storage Tank Removal and Disposal

There are three known fuel storage tanks present on Site as follows:

- A 3,000 gallon above ground storage tank in the #45 building
- A 1,000 gallon above ground storage tank in the #51 building
- A 1,000 gallon underground storage tank in the #53 building.

As part of the overall Site remedy, each tank will be removed along with liquid contents and related impacted soil if present. The procedures for tank removal will include the following steps:

- Evacuation and disposal of tank contents (if present)
- Cutting and removal of ASTs
- Sampling of soils beneath ASTs
- Building demolition
- Sampling of Soil at the UST
- Removal and disposal of UST and any impacted soil (if confirmed present)

Each of these steps is discussed in detail below.

Evacuation and Disposal of Tank Contents (if present) – Each of the three tanks will be investigated for the presence of liquid product. If present, liquid product will be pumped out by a licensed remedial contractor and the product properly transported and disposed off Site in accordance with applicable regulations at a permitted and DEC pre-approved waste disposal facility. In addition to liquid product, the interior of

each tank will be investigated for the presence of organic vapors. If concentrated organic vapors are determined present, these too will be properly removed.

Cutting and Removal - Once the liquid contents and organic gases have been removed, the two above ground tanks will be cut open and pressure washed prior to removal and disposal as scrap. These ASTS will then be cut into pieces as necessary to remove them from their respective buildings through the available man-doors. In the case of the one UST at building # 53, it will remain in place until after the building has been demolished and removed.

Sampling of Soils Beneath ASTs– Once the two ASTs have been emptied, cleaned, cut, and removed, the soil that was beneath these tanks will be sampled to determine if it has been impacted by the former contents of the tank. Five bottom samples will be collected from each former tank footprint, one per primary compass direction and one from the approximate center. All 10 samples will be analyzed for the STARS list of VOCs and SVOCs. If the analytical results of these samples indicate impacted soil requiring remediation, the soils will be excavated, removed, and properly disposed at a permitted waste disposal facility after the buildings have been demolished and removed from the Site but prior to the overall Site-wide soil removal action.

Building Demolition – After all three tanks have been emptied and cleaned, and the two ASTs cut into pieces, removed, and their underlying soils sampled, all on-Site buildings can them be demolished and removed from the site. During building demolition and removal, care will be taken to avoid disturbance of the soils at the two former AST locations and to the remaining UST beneath building #53. Additional discussion of building demolition and removal is provided in Section 4.1.2.2 below.

Sampling of Soil at the UST – Once the Site buildings have been demolished, and removed from the Site, the UST at the #53 building will be removed and the underlying and adjacent soils sampled to determine if it has been impacted by the former contents of the tank. Samples will be collected in accordance with DER-10 Section 5.4(b). A total of five soil samples will be collected, one from the bottom of each of the four sidewalls and one from the approximate center of the tank footprint. These samples will be analyzed for the STARS list of VOCs and SVOCs.

Removal and disposal of UST and any impacted soil (if confirmed present) – Once the buildings have been removed and the analytical results of all tank pull soil samples received and evaluated, a determination will be made as to whether or not soils adjacent to any or all of the three tanks has been impacted by the former tank contents

and if these soils require removal and off-site disposal prior to the overall Site soil characterization and removal. If so, the qualified environmental remediation contractor will excavate and remove the soils based on visual and organic vapor field measurements using a photo ionization detector (PID) until the apparently impacted soils have been completely removed and properly disposed off-Site at a permitted waste disposal facility.

4.1.2.2 Building Demolition and Removal

All on-Site buildings will be demolished and removed from the Site in accordance with applicable local, state, and Federal regulations. Foundation materials that are in contact with soil/fill material will be cleaned of soil/fill using high pressure water prior to removal and disposal.

4.1.2.3 Site Soil/Fill Sampling and Removal

Upon removal and disposal of all on-Site fuel storage tanks and building structures, the on-Site soil/fill that is planned for removal will be pre-characterized so that it can be direct loaded and removed from the Site as it is being excavated. The approximate in-place volume of soil/fill to be removed is estimated at approximately 31,000 cubic yards (0.78 acres x 25 feet deep). Using Table 5.4(e)10 of DER-10, as a guide, discrete soil samples will be collected for VOC analysis and 3-point composite samples will be collected for analysis of SVOCs and metals. These samples will be collected from direct-push soil borings placed in a grid pattern of 18 approximately equally spaced locations (See Figure 5). VOC samples will be collected from each of the 18 borings at depths of 5, 10, 15, and 20 feet below grade for a total of 72 field samples. SVOC and metals samples will be collected from the same 18 borings but as 3-point lateral composite samples at the same depths as the VOC samples (5, 10, 15, and 20 feet) for a total of 24 composite samples including QA/QC samples noted below. .

QA/QC samples will be collected for each analysis at a frequency of 1 per 20 field samples. QA/QC samples to be collected will include field duplicates and matrix spike (MS) and matrix spike duplicate (MSD).

Additional analyses may be required by the selected disposal facility to which the soils will be taken. Once the soil to be removed has been sufficiently characterized, sheet pile will be placed as necessary to stabilize the excavation area. Once sheet piles have been placed, the excavation of soil will proceed until all requisite soil has been removed and properly disposed off-Site. Appendix A contains an Excavation Work

Plan (EWP), which provides greater detail of the soil screening, sampling, and handling procedures to be followed.

4.1.2.4 Post Excavation Confirmation Sampling

Upon completion of the soil removal to construction depth (approximately 20 to 25 feet), samples will be collected from the excavation bottom to confirm that the remaining soils meet unrestricted SCOs. In accordance with DER-10 Section 5.4(b), thirty six (soil samples will be collected from the excavation bottom in a grid pattern with each sample representing approximately 900 square feet. These samples will be collected from the uppermost 6-inches of soil, See Figure 5. Each of the excavation bottom samples plus requisite 2 duplicates, 2 Matix Spikes, and 2 Matrix Spike Duplicates will be analyzed for TCL VOCs, SVOCs, Pesticides, PCBs and TAL metals. If analytical results of these excavation bottom samples contain constituents at concentrations above unrestricted (Track 1) SCOs, Teutonia, LLC will discuss with the Department options of either further excavation and sampling for continued pursuit of a Track 1 cleanup or ceasing further excavation and sampling for achievement of a Track 2 or other level of BCP cleanup, see Section 4.1.2.5 for further discussion of the ramifications of a Track 2 cleanup.

Soil samples will also be collected from locations along the northern and eastern excavation sidewalls. Samples will not be collected from the south wall of the excavation because the overall project and excavation extend off of the BCP site to the South. Also, no samples are anticipated along the western side of the Site because the ground surface slopes steeply downward toward the west such that the planned excavation depth is essentially zero along the western BCP Site boundary. Since the excavation will require steel sheet piling along the perimeters and the sheet piling would complicate sample collection post-excavation. The sidewall samples will be collected during the pre-characterization phase using the direct-push drill rig. Sidewall samples will be collected from four approximately equal-spaced borings along the northern Site boundary, two of which will be located at the extreme corners of the boundary (NW and NE corners). Five approximately equal-spaced borings will also be placed along the eastern Site boundary, the southernmost of these placed as close as possible to the southeastern corner of the Site. Figure 5 illustrates the approximate locations of the proposed sidewall borings. A minimum of two soil samples will be collected from each sidewall boring. From each boring, a grab soil sample will be collected from the approximate depth as the planned Site-wide remedial excavation (up to 25 feet bgs). A second grab sample will be collected from the approximate mid depth (10 to 12 feet bgs) of the boring or from one or more depths at which evidence of

suspected contamination is observed during soil core collection. Such evidence of contamination may include the presence of liquid product, staining/discoloration, odor, or elevated organic vapor readings. The 18 or more sidewall grab samples will be analyzed for TCL VOCs, SVOCs, PCBs, pesticides and TAL metals.

Note that the north and east excavation sidewalls will be located at the BCP Site boundary, thus the analytical results of the sidewall samples will be for the sole purpose of providing the Department with data for evaluation of potential risks related to off-Site contamination, if present.

Subsequent to the completion of the excavation activities, eight temporary soil vapor sampling probes will also be installed, sampled and analyzed in accordance with the Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (New York State Department of Health [NYSDOH], 2006). The final locations of the sampling probes will be determined and agreed to by the NYSDEC upon completion of the soil excavation activities and evaluation of existing environmental data, site utilities, and other possible underground obstructions. The location of the sampling probes will be surveyed and recorded upon installation.

Soil vapor samples will be collected from each soil vapor probe location in accordance with the Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH, 2006). The samples will be submitted to an Environmental Laboratory Accreditation Program approved laboratory and analyzed for VOCs according to USEPA Method TO-15.

4.1.2.5 Track 2 Cleanup Contingency

Based on the analytical results collected to date and the planned volume and depth of soil to be removed, a Track 1 (unrestricted Site use) BCP cleanup is anticipated for this Site. However, a Track 2 (restricted Site use) cleanup may be necessary if the analytical results of post-excavation confirmatory samples collected from the Site-wide excavation bottom significantly exceed the Track 1 SCOs. If this happens, Teutonia Buena Vista, LLC may pursue a Track 2 cleanup for restricted residential use, which conditionally allows for low levels of soil contamination to remain on Site. If a Track 2 cleanup is pursued, a Site Management Plan will be prepared by the volunteer and submitted to the Department for approval.

The Site Management Plan would include the following three parts:

- An Environmental Easement (EE) - which would detail the restrictions placed on the property and the environmental obligations of the Site owner. These would include restrictions to Site use, installation of a passive soil vapor depressurization system, and management of on-Site soils if disturbed in the future;

- A Soils Management Plan - which would provide specific soil handling, sampling, and safety measures required of the Site owner in the possible event that on-Site soils are disturbed in the future;

- Engineering Controls/Institutional Controls (EC/IC) Certification Form - which the Site owner would be required to complete and sign on a periodic basis to certify that the Site use and Site restrictions remain in place and in accordance with the provisions of the Environmental Easement.

4.1.2.6 Soil Vapor Barrier and Ventilation System

A soil vapor study will be performed after the Track 1 soil cleanup is completed. To the extent vapors remain present from adjacent properties, a soil vapor barrier and ventilation system will be designed as a precautionary measure such that the potential for migration of soil vapors beneath and adjacent to the new structure will be mitigated through placement of a vapor barrier and ventilation system designed to divert vapors to the atmosphere and away from occupied spaces.. The vapor barrier material will be placed at the interface between the soil/fill material and foundation floors/walls beneath and adjacent to the structure and the new structure itself. The soil vapor ventilation system will be designed as a passive system, yet one that could be converted to an active system by the addition of air vacuum pumps.

If upon completion of the Track 1 cleanup, a soil vapor barrier and ventilation system is deemed appropriate, and once the design of the overall redevelopment project has been finalized, more specific details of the soil vapor barrier and ventilation system will be prepared with accompanying drawings and submitted to the Department for review and approval.

This alternative is analyzed further in Section 4.2.

4.2 Alternative Analysis

4.2.1 Introduction

The following Sections present a detailed analysis of Alternative 2 with respect to the evaluation criteria outlined in 6 NYCRR Part 375-1.10 and the RAOs for the Site.

4.2.2 Overall Protection of Public Health and the Environment

This threshold assessment addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled. This evaluation allows for consideration of whether the alternative poses any unacceptable short-term or cross-media impacts.

As determined by the site-specific Qualitative Risk Assessment, Alternative #2 provides adequate protection of public health and the environment and, therefore, will achieve the RAOs for the Site.

Additionally, an Excavation Work Plan will provide guidelines and protocols for protecting on-site workers, the public, and the environment during Site redevelopment actions that would disturb the soil/fill material. The Excavation Work Plan also requires the off-site disposal of soil/fill material determined to contain contaminant concentrations above unrestricted SCOs when encountered.

4.2.3 Compliance with Standards, Criteria, and Guidance (SCGs)

A Site's remedial program must be designed so as to conform to standards and criteria that are generally applicable, consistently applied, and officially promulgated, that are either directly applicable, or that are not directly applicable but are relevant and appropriate, unless good cause exists why conformity should be dispensed with [6 NYCRR 375-1.0(c)(1)(i)].

Remedial Alternative #2 would fully comply with SCGs for the Site by removal and off-site disposal of the USTs and contaminated soil/fill.

4.2.4 Long-Term Effectiveness and Permanence

This criterion evaluates the long-term protection of human health and the environment at the completion of the remedial action. Effectiveness is assessed with respect to the

magnitude of residual risks; adequacy of controls, if any, in managing treatment residuals or untreated wastes that remain at the Site; reliability of controls against possible failure; and potential to provide continued protection.

Remedial Alternative #2 would effectively reduce the long-term risk to public health and the environment by removing the impacted soil/fill that poses the potential risk. Soil/fill remaining on Site after remediation will be clean soil and completely covered with Site development features including buildings, underground parking structures, driveways, and walkways. In addition, the removal of the impacted soils eliminates the source for contaminants to migrate to adjacent properties via groundwater flow or vapor migration.

Alternative #2 will provide long-term effectiveness and permanence in achieving the RAOs for the Site.

4.2.5 Reduction of Toxicity, Mobility, or Volume

This evaluation criterion addresses the preference for selecting a remedial action alternative that permanently and significantly reduces the volume, toxicity, and/or mobility of the detected contaminants. This preference is satisfied when the remedial action is used to reduce the principal threats at a site through destruction of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media. The following is the hierarchy of remedial technologies ranked from most preferable to least preferable:

1. Removal/Destruction
2. Separation/Treatment
3. Solidification/Chemical Fixation
4. Control and Isolation

As supported by the Qualitative Risk Assessment; remedial Alternative #2, a removal remedial technology, is protective of public health and the environment. Additional treatment-focused remedial alternatives (e.g., destruction, separation/treatment, solidification/ chemical fixation, and control and isolation) therefore are considered unnecessary.

Remedial Alternative #2 would remove the contaminants of concern (i.e. elevated VOCs, SVOCs, and metals) thus reducing the volume of hazardous constituents at the

Site. This alternative would also control remaining residual concentrations of contaminants of concern by complete to nearly complete coverage of the Site by buildings, roadways, and subgrade parking structures

4.2.6 Short-Term Effectiveness

The effectiveness of alternatives in protecting human health and the environment during construction and implementation of the remedial action is evaluated under this criterion. Short-term effectiveness is assessed by protection of the community, protection of workers, environmental impacts, and time until protection is achieved.

Initially, the restriction of access to the Site in its present condition will reduce the risks posed by the Site to the general public prior to Site remediation and redevelopment. Under Alternative #2, the removal of impacted soil/fill, USTs and related soil/fill all equally reduce the risk to public health and the environment in the short-term and long-term by removing the materials that pose the greatest potential risk.

An Excavation Work Plan will further help to protect on-site workers, the public, and the environment during Site redevelopment activities. During redevelopment activities, workers engaged in subsurface construction or maintenance activities will be required to implement a site-specific, activity-specific Health and Safety Plan. In the short-term, the impact to human health and the environment during implementation of the alternative considered will be negligible, will achieve the Remedial Action Objectives, and is anticipated to be completed in approximately three to six months.

4.2.7 Implementability

A feasible remedy is one that is suitable to site conditions and planned redevelopments, is capable of being successfully carried out with available technology, and considers, at a minimum, implementability. Remedial Alternative #2 is suitable to current and future Site conditions and Site uses. Materials and equipment for removal of the VOC, SVOC, and metal-impacted soil/fill are readily available. The excavated areas will be replaced by new Site structures or limited volumes of documented clean soil per DER-10 Appendix 5. The Site will be covered completely with new buildings and pavement.

4.2.8 Community Acceptance

Redevelopment of the properties at #41, 45, 47, 51 and 53 Buena Vista Avenue is an important step for the surrounding neighborhood and the City of Yonkers as a whole. These redevelopment efforts will create positive economic benefits for the City of Yonkers. The project is in the process of going through a SEQRA and zoning process, and therefore, the public will have the opportunity to comment on the project. The considered remedial alternative will remove the primary environmental contamination and therefore risks from the Site. An alternative which sufficiently removes the contamination of concern from the property and returns the Site to productive and neighborhood- friendly use meets community acceptance.

4.2.9 Cost

Remedial Alternative #2 is estimated to cost approximately $5.3 Million, see **Table 6**.

4.3 Recommended Remedial Alternative

The remedial alternatives analysis was completed giving consideration to the Part 375-6.8 (a) SCOs for unrestricted use.

Based on the known levels of contamination at the Site, as determined from data collected from multiple Site investigations and a qualitative assessment of potential risks to the public health posed by Site contamination, it was determined that the primary concern at this Site is direct contact, inhalation, and ingestion of SVOCs and metals in surface and subsurface soils, and inhalation of VOCs from soil gas migrating into indoor air. The removal of soil/fill to a minimum of 16 feet below existing Site grade should sufficiently mitigate this potential risk to current trespassers and current/future Site workers at this former industrial Site. Therefore Remedial Alternative #2 (Track 1 cleanup to unrestricted use) is recommended for the Site. This remedial option is recommended for the Site because it would meet the remedial action objective, is protective of public health, is achievable, affordable, and would meet the Site redevelopment plans and schedule.

Figure 4 along with accompanying **Table 7** provides a summary of analytical results of subsurface soil that would remain in place under this remedial option. As shown in these tables and figures, none of the COPCs are present above unrestricted SCOs. (Methylene chloride is a common laboratory artifact and believed to be not present at

the Site at elevated concentrations) Further, all of these locations are located in areas that are planned to be covered by the future Site building.

Once the Site is re-developed, consequential contact with the soil/fill will be highly unlikely, as all daily activity will take place inside of the on-site building, which will have a concrete foundation and sidewalls. The Site will be used for residential use and will remain residential as dictated by City zoning. Potential future excavation of soil/fill will be managed with the Excavation Work Plan (Appendix A).

4.4 Health and Safety

Invasive work performed at the Site will be completed in accordance with applicable local, state, and federal regulations to protect worker and public health and safety. Contractors performing redevelopment or maintenance activities involving intrusive work at the Site are required to prepare a site-specific, activity-specific Health and Safety Plan that will include a Community Air Monitoring Plan (CAMP). A CAMP has been included in the Excavation Plan (Appendix A). Data summary tables provided in Section 2 of this report should be used by the contractor to facilitate the creation of an appropriate Health and Safety Plan.

4.5 Citizen Participation

As required in the Brownfield Cleanup Agreement, a Citizen Participation Plan was prepared by Malcolm Pirnie and was approved by the NYSDEC. The CPP was sent to the public document repository for public availability.

4.6 Schedule

A primary goal of the BCP applicant is to receive a Certificate of Completion (COC) from the NYSDEC in 2012 and place the new facility into service thereafter. The schedule for remediation and redevelopment of the Site is provided in **Figure 6**.

5. FINAL ENGINEERING REPORT

Once the Site remediation has been completed, a Final Engineering Report (FER) will be prepared and submitted to the NYSDEC. The purpose of the FER will be to fully document the implementation of the Site remedy and to certify, by a registered professional engineer, that the remedial program activities were implemented in conformance with the Department-approved Remedial Work Plan.

The FER will include a description of the selected remedy, details and supporting documentation of remedial actions performed, and required certifications.

A Checklist for FER approval, as provided by the NYSDEC will be used during FER preparation to assist with completeness and will be provided along with the FER submittal.

Also, a NYSDEC-prepared FER Template will be used to prepare the FER to achieve consistency with NYSDEC expectations and to expedite NYSDEC review and approval of the FER.

6. REFERENCES

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Tables

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TABLE 1
HISTORICAL RESULTS- SOIL SAMPLES
FORMER TEUTONIA HALL SITE

Investigation	NYS SCO's	NYS SCO's	NYS SCO's	Urban Background	January 2005							November 2005																				May 2006										
Sample ID				Concentrations(2)(3)	HB-1	HB-3	HB-3	HB-4	HB-6	HB-7	HB-8	2HB-1	2HB-1	2HB-2	2HB-2	2HB-3	2HB-3	2HB-4	2HB-5	2HB-5	2HB-6	2HB-6	2HB-7	2HB-7	2HB-8	2HB-8	2HB-9	2HB-9	2HB-10	2HB-10	SB-1	SB-2	SB-3	SB-3	SB-4	SB-4	SB-5	SB-5	SB-6	SB-7	SB-8	SB-9
Depth (ft bgs)	Unrestricted	Restricted Residential	Restricted Commerical		0-2	0-2	2-4	4-6	0-2	8-10	0-2	4-6	8-10	0-2	6-8	0-2	6-8	4-6	0-2	6-8	0-2	4-6	0-2	8-10	5-6	9-10	0-2	9-10	0-2	7.0	0-2	0-0.5	0-0.5	8-10	0-0.5	8-10	8	10-12	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)																																									
1,2,4-Trimethylbenzene	3600	52,000	190,000	NA	ND	11	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	8400	52,000	190,000	NA	ND	16	9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene (PCE)	1300	19,000	150,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1300	ND	ND	ND	ND	ND	ND	ND	ND	12,000	ND	ND	ND	25 J
Semi-Volatile Organic Chemicals (ug/kg)																																									
Acenaphthene	20000	100000	500000	NA	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	6,700	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	100000	100000	500000	NA	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	790 J	800 J	ND	4,800	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	1000	1000	5600	169-59,000	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,100 J	2,200 J	ND	16,000	ND	ND	ND	ND	63 J	ND	1,300 J	ND
Benzo(a)pyrene	1000	1000	1000	165-220	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	***1,800 J***	***1,800 J***	ND	***11,000***	ND	ND	ND	ND	ND	ND	***1,400 J***	ND
Benzo(b)fluoranthene	1000	1000	5600	15,000-62,000	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,200 J	2,300 J	910 J	21,000	ND	ND	ND	ND	88 J	ND	1,500 J	ND
Benzo(ghi)perylene	100000	100000	500000	900-47,000	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	600 J	890 J	ND	4,600	ND	ND	ND	ND	ND	ND	850 J	ND
Benzo(k)fluoranthene	800	3900	56000	300-26,000	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	7,400	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate					N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,500 J	2,100 J	ND	950 J	ND	ND	1,900 J	1,000 J	ND	ND	ND	ND
Carbazole				NA	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	3,500	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	1000	3900	56000	251-640	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,200 J	2,200 J	ND	***16,000***	ND	ND	ND	ND	70 J	ND	***1,200 J***	ND
Di-n-butyl phthalate				NA	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	1,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100000	100000	500000	200-166,000	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	4,600	1,500	27,000	78 J	ND	ND	ND	140 J	ND	2,000 J	ND
Fluorene	30000	100000	500000	NA	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	5,500	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1 2 3-cd)pyrene	500	500	5600	8,000-61,000	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	590 J	ND	2,800 J	ND	ND	ND	ND	ND	ND	810 J	ND
2-Methylnaphthalene					N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND	ND	6,500	ND	ND	680 J	ND	ND	ND	ND	ND
Naphthalene	12000	100000	500000	NA	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	700 J	ND	ND	35,000	ND	ND	1,000 J	ND	ND	ND	660 J	ND
Phenanthrene	100000	100000	500000	NA	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,800	3,400	ND	27,000	ND	ND	ND	ND	65 J	ND	ND	ND
Pyrene	100000	100000	500000	145-147,000	N/A	N/A	N/A	ND	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4,000	ND	1,600 J	27,000	77 J	ND	ND	ND	110 J	ND	1,800 J	ND
Metals (mg/kg)																																									
Aluminum				33,000	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4830	7810	5250	5150	7940	3870	4340	4740	8820	4980	4670	5750
Antimony				N/A	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.56	4550	5.59	3.66	5.79	0.344	0.38	2.6	13.9	0.357	0.904	3.53
Arsenic	13	16	16	3 - 12**	5.2	N/A	N/A	N/A	4	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.85	***33.9***	1.25	1.03	2.71	0.411	0.454	0.414	3.14	1.67	1.27	2.82
Barium	350	400	400	15 - 600	85.7	N/A	N/A	N/A	60	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	52.6	83.2	50.5	39.7	50.7	30.2	46	29.6	52.1	37.4	42.4	54.1
Beryllium	7.2	72	590	0 - 1.75	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.176	0.332	0.17	0.167	0.306	0.096	0.116	0.151	0.32	0.179	0.166	0.203
Cadmium	2.5	4.3	9.3	0.1 - 1	1.19	N/A	N/A	N/A	1	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.4	0.406	0.035	0.035	0.037	0.035	0.038	0.035	0.039	0.036	0.035	0.035
Calcium				130 - 35,000	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	50300	2690	4260	3560	4330	8450	1990	2160	3270	3500	2090	3150
Chromium	30	180	1500	1.5 - 40**	22.8	N/A	N/A	N/A	17	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.2	22.8	24.3	15.8	15.6	12.1	12.5	13.9	16.7	12.2	9.97	13.1
Cobalt				2.5 - 60**	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.75	1.19	6.3	5.47	6.93	8.58	5.03	4.77	7.28	4.92	4.47	5.23
Copper	50	270	270	1 - 50	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	***81.9***	***401***	35	35.1	21.6	27.4	22.7	30.3	22.5	24.2	26.9	30.4
Iron				2,000 - 550,000	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8630	5460	9490	8820	13400	8820	7710	7760	14200	8840	7810	9770
Lead	63	400[4]	1000	200-500	63	N/A	N/A	N/A	15	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	160	***44,200***	202	37.8	77.4	8.88	147	1.6	18.2	36.9	61	74.6
Magnesium				100 - 5,000	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	30500	1290	4200	3890	4190	8430	2550	2820	3520	2950	2490	2610
Manganese	1600	2000	10000	50 - 5,000	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	218	127	235	235	381	203	140	186	381	263	262	258
Mercury	0.18	0.81	2.8	0.001 - 0.2	0.26	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	***0.419***	***2***	***0.242***	0.106	0.146	0.012	ND	0.008 J	***3.3***	0.11	***2.8***	***0.799***
Nickel	30	310	310	0.5 - 25	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.68	***88.9***	13.8	13.1	12.9	***38.3***	10.4	1.0.8	13.3	10.8	10.3	11.8
Potassium				8,500 - 43,000**	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	958	748	1160	989	552	592	774	485	1270	914	676	712
Selenium	3.9	180	1500	0.1 - 3.9	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.363	1.6	0.488	0.363	0.379	0.357	0.395	0.36	0.668	0.371	0.361	0.372
Silver	2	180	1500	NA	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.084	48.7	0.084	0.084	0.088	0.083	0.091	0.083	0.093	0.086	0.084	0.084
Sodium				6,000 - 8,000	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	179	361	154	156	174	245	122	173	159	69	112	168
Thallium				NA	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.561	1.1	0.56	0.56	586	0.552	0.61	0.556	0.619	0.573	0.559	0.558
Vanadium				1 - 300	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15.3	21.4	16.2	14.9	19.4	11.7	13.7	13.6	22.3	14.6	13.1	15.6
Zinc	109	10000	10000	9 - 50	ND	N/A	N/A	N/A	ND	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	***116***	***1020***	***59.6***	45.8	***81***	23.2	20.4	19.2	39.9	***65.3***	36.6	***61.7***

Notes

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.

Yellow highlighted concentrations exceed NYS Restricted Residential SCOs. Red highlighted values exceed unrestricted SCOs

Bold/Italic values exceed upper limits of urban background concentrations.

(1) New York State Dept. of Environmental Conservation Recommended Soil Cleanup Objectives, Dec. 2006.

(2) TAL Inorganic Analytes from Eastern USA Background as shown in New York State Dept. of Environmental Conservation TAGM 4046, Dec. 2000.

(3) SVOCs background from Background Soil Concentrations of Poly Aromatic Hydrocarbons (PAHs), Urban Soils (U.S. and other), Toxicological Profile for PAHs, US Dept. of Health and Human Services, August 1995.

(4) USEPA Region 3 Soil Screening Level.

*** New York State background concentration.*

**** - The Soil Cleanup Objective refers to the sum of these compounds.*

B - indicates a value greater than or equal to the instrument detection limit, but less than the quantitation limit.

J - Indicates value detected below quantitation limit.

NA - Not Applicable or Not Available.

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TABLE 2
SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
FORMER TEUTONIA HALL SITE
YONKERS, NEW YORK

Sample Number Collection Date	NYSDEC SCOs Unrestricted	NYSDEC SCOs Restricted Residential	NYSDEC SCOs Restricted Commerical	Urban Background Concentrations[2][3]	SS-1 8/16/2007	SS-2 8/16/2007	SS-3 8/16/2007	SS-4 8/16/2007	SS-5 8/16/2007	SS-6 8/16/2007	SS-7 8/16/2007	SS-8 8/16/2007
VOCs - Method 8260 (ug/Kg)												
Methylene chloride	50	100000	500000	NA	14		18	11	10	15	7	5 J
SVOCs Method 8270 - (ug/Kg)												
4-Methylphenol												560 J
Naphthalene	12000	100000	500000	NA			3500 J			460 J	270 J	16000
2-Methylnaphthalene							1400 J			230 J	120 J	6700
Acenaphthylene	100000	100000	500000	NA							200 J	
Acenaphathene	20000	100000	500000	NA	720 J		2600 J			390 J	350 J	10000
Dibenzofuran				NA	500 J		3000 J			500 J	270 J	13000
Diethyl phthalate				NA	470 J					570 J		
Fluorene	30000	100000	500000	NA			2600 J			620 J	410 J	14000
Phenanthrene	100000	100000	500000	NA	7600 J	7600 J	26000	6100 J	3600 J	6100	4100	94000
Anthracene	100000	100000	500000	NA	1700 J	1800 J	6900 J	1400 J	720 J	1400 J	960 J	26000
Di-n-butyl phthalate				NA							3300	1700 J
Flouranthene	100000	100000	500000	200-166,000	8200 J	8800 J	22000	6300 J	4000 J	5700	4900	72000
Pyrene	100000	100000	500000	145-147,000	6400 J	7600 J	16000 J	4900 J	3300 J	4300	3700	49000
Benzo (a) anthracene	1000	1000	5600	169-59,000	4400 J	4800 J	9200 J	3800 J	2200 J	2700 J	2400	32000
Chrysene	1000	3900	56000	251-640	***3000 J***	***4600 J***	***7400 J***	***2600 J***	***1600 J***	***2200 J***	***1900***	***26000***
Bis(2-ethylhexyl) phthalate					3800 J				4600 J	1200 J	9000	2000 J
Benzo (b) fluoranthene	1000	1000	5600	15,000-62,000	3800 J	4100 J	10000 J	3100 J	2000 J	3200 J	3100	28000
Benzo (k) fluoranthene	800	3900	56000	300-26,000	1300 J	1700 J		1000 J	650 J			10000
Benzo (a) pyrene	1000	1000	1000	165-220	***3000 J***	***3500 J***	***7000 J***	***2600 J***	***1500 J***	***2000 J***	***1900***	***23000***
Indeno (1,2,3-cd) pyrene	500	500	5600	8,000-61,000	2000 J	2000 J	4200 J	1800 J	940 J	1200 J	1000 J	9900
Dibenzo (a,h) anthracene	330	330	560	NA	***880 J***		***1400 J***			310 J	370 J	***3600 J***
Benzo (ghi) perylene	100000	100000	500000	900-47,000	2000 J	2700 J	4300 J	1800 J	1100 J	1200 J	1000 J	10000
Total Metals - (mg/Kg)												
Aluminum				33,000	91700	53600	30900	35200	67000	147000	14600	9210
Antimony				N/A	36.3	6.3 J	27.0	11.6 B	15.8 J	20.0	4.1 J	5.6 J
Arsenic	13	16	16	3 - 12**	7.7	***13.0***	***20.4***	6.8	***20.2***	5.2	8.6	5.2
Barium	350	400	400	15 - 600	329	169	270	127	354	329	147	99.5
Beryllium	7.2	72	590	0 - 1.75	0.79	0.43	0.59	0.41	0.59	1.4	0.32	0.30
Cadmium	2.5	4.3	9.3	0.1 - 1	***11.4***	***5.0***	***6.8***	***4.5***	***7.6***	***5.7***	***4.1***	***2.1***
Calcium				130 - 35,000	8340	9200	6460	5720	11200	8600	6310	8980
Chromium	30	180	1500	1.5 - 40**	***141***	***63.8***	***87.1***	***62.9***	***78.9***	***107***	***44.3***	39.5
Cobalt				2.5 - 60**	19.9	10.5	33.6	14.0	12.1	28.7	8.7	8.8
Copper	50	270	270	1 - 50	***1470***	***427***	***1160***	***380***	***906***	***1740***	***2180***	***101***
Iron				2,000 - 550,000	40200	26900	163000	46900	22700	18800	23700	20300
Lead	63	400	1000	200-500	***1300***	***622***	***783***	***572***	***1100***	***3140***	***658***	***511***
Magnesium				100 - 5,000	3910	4560	3410	3700	***6050***	***5230***	3780	***5440***
Manganese	1600	2000	10000	50 - 5,000	532	410	765	451	518	482	289	277
Mercury	0.18	0.81	2.8	0.001 - 0.2	***0.911 J***	***0.859 J***	***1.5 J***	***0.609 J***	***1.1 J***	***0.586 J***	***0.823 J***	***0.626 J***
Nickel	30	310	310	0.5 - 25	***91.2***	***31.2***	***83.1***	***34.8***	***47.6***	***48.7***	24.8	20.9
Potassium				8,500 - 43,000**	1330	1700	1060	1400	1270	1070	1190	1510
Selenium	3.9	180	1500	0.1 - 3.9	2.5 J					1.1 J		
Silver	2	180	1500	NA	43.6	2.8	56.7	4.6	18.1	5.4	2.8	1.7
Sodium				6,000 - 8,000	510	218	291	180	331	374	117 J	80.4 J
Thallium				NA								
Vanadium				1 - 300	35.7	31.0	27.4	29.0	30.8	36.9	28.1	22.4
Zinc	109	10000	10000	9 - 50	***2590***	***1800***	***1420***	***2190***	***2710***	***2580***	***1100***	***354***

Notes:

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.

Yellow highlighted concentrations exceed NYS Restricted Residential SCOs. Red highlighted values exceed unrestricted SCOs.

Bold/Italic values exceed upper limits of urban background concentrations.

(1) New York State Dept. of Environmental Conservation Recommended Soil Cleanup Objectives, Dec. 2006.

(2) TAL Inorganic Analytes from Eastern USA Background as shown in New York State Dept. of Environmental Conservation TAGM 4046, Dec. 2000.

(3) SVOCs background from Background Soil Concentrations of Poly Aromatic Hydrocarbons (PAHs), Urban Soils (U.S. and other), Toxicological Profile for PAHs, US Dept. of Health and Human Services, August 1995.

(4) USEPA Region 3 Soil Screening Level.

*** New York State background concentration.*

DATA QUALIFIERS

J - indicated an estimated value. Results is < sample quantification limit but >0.

B - analyte found in associated blank as well as sample.

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TABLE 3
SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
FORMER TEUTONIA HALL SITE
YONKERS, NEW YORK

Sample Number	NYS SCO's	NYS SCO's	NYS SCO's	Urban	SB-1	SB-2	SB-3	SB-4D		SB-5	SB-6	SB-7D		SB-8	SB9	SB-10	SB-11	SB-13		SB-14	SB-15	SB-16	SB-17D		SB-18	SB-19D		SB-20	SB-21	SB-22D		SB-23	SB-24	MW-4/Temp		MW-6		DUP-1	DUP-2
Sampling Depth (ft. bgs)				Background	10.5-11	7-7.5	10-10.5	8.5-9	31-32	11.5-12	9-10	10-15	30-35	3-5	7-10	13-14	8-10	14-16	3-5	0.5-1.5	1-3	6-8	13-15	25-30	7-9	1-3	20-25	5-7	14-16	11-12	25-30	4-5	3-5	1-3	25-30	20-23	6-7		
Collection Date	Unestricted	Restricted Residential	Restricted Commerical	Concentrations (2)(3)	7/30/2007	7/30/2007	7/30/2007	7/30/2007	7/31/2007	7/30/2007	7/30/2007	7/31/2007	7/31/2007	7/31/2007	7/31/2007	7/31/2007	7/31/2007	8/01/2007	8/01/2007	8/02/2007	8/01/2007	8/02/2007	8/02/2007	8/02/2007	8/02/2007	8/02/2007	8/02/2007	8/01/2007	8/01/2007	8/02/2007	8/02/2007	8/03/2007	8/03/2007	7/31/2007	7/31/2007	8/02/2007	8/02/2007	7/31/2007	8/01/2007
VOCs - Method 8260 (ug/Kg)																																						
Methylene chloride	50	100000	500000	NA	56	84	97 J	85	75	88	78	88	71	55		84				55	43	53	41 J	65	56	42	40			63 J	68	50 J	56	59	65	65	56		48
Acetone	50	100000	500000	NA			750 J	25 J						10 J	10 J				22 J			5 J						11 J	31	11 J	6 J	8 J		13 J		36	14 J	
2-Butanone				NA			8 J																															
Tetrachloroethene	1300	19000	150000	NA														3 J	10		8																	
Toluene	700	100000	500000	NA	1 J		2 J	2 J					1 J	24 J						1 J					1 J						2 J	1 J		1 J	1 J	1 J		
Ethyl benzene	1000	41000	390000	NA			44 J	18 J																														
Total Xylenes	260	100000	500000	NA			14000 DJ	7100 DJ																														
Methylcyclohexane				NA			5 J	2 J																														
Isopropylbenzene				NA			14000 DJ	6700 DJ																														
SVOCs Method 8270 - (ug/Kg)																																						
Phenol	330	100000	500000	NA														34 J																				
4-Methylphenol																		38 J																				
Naphthalene	12000	100000	500000	NA		47 J	1400 J	4500 J						160 J	1500 J			58 J																38 J					
2-Methylnapthalene							530 J	1300 J						89 J	640 J			15 J																25 J					
Acenapthylene	20000	100000	500000	NA			280 J							160 J	270 J			300	25 J																			
Acenapthalene	100000	100000	500000	NA		75 J								180 J	750 J			28 J	8 J															41 J					
Dibenzofuran				NA		61 J	280 J							150 J	980 J			31 J																12 J					
Fluorene	30000	100000	500000	NA		75 J	380 J							200 J	1000 J			34 J																				
Phenanthrene	100000	100000	500000	NA		830 J	3300 J	77 J				24 J		2200 J	10000 J			680	190 J		17 J		11 J											200 J			12 J		
Anthracene	100000	100000	500000	NA		160 J	860 J							520 J	2400 J			170 J	30 J															29 J					
Di-n-butyl phthalate				NA											430 J																							
Fluoranthene	100000	100000	500000	200-166,000		940 J	3500 J	90 J		45 J		31 J		2500 J	9100 J			2,400	320		47 J		9 J											330			20 J		
Pyrene	100000	100000	500000	145-147,000		710 J	2700 J	120 J				30 J		2000 J	7000 J			2,300	290		47 J		10 J											290			18 J		
Butyl benzyl phthalate														370 J																								
Benzo(a)anthracene	1000	1000	5600	169-59,000	9 J	430 J	1500 J	89 J		44 J		19 J		1200 J	4000 J		15 J	2,100	190 J		52 J		11 J	9 J		10 J	10 J							170 J			14 J		
Chrysene	1000	3900	56000	251-640	9 J	370 J	***1200 J***					14 J		***1100 J***	***3600 J***		16 J	***1,800***	180 J		43 J					8 J								230			9 J		
Bis(2-ethylhexyl)phthalate				NA																																		
Di-n-octyl phthalate					10 J		49 J	90 J	10 J			8 J				9 J	20 J						16 J	16 J		14 J	14 J		8 J		23 J	14 J	10 J		21 J	22 J		
Benzo(b)fluoranthene	1000	1000	5600	15,000-62,000	8 J	560 J	1900 J	59 J				20 J		1300 J	3800 J		14 J	2,400	250		63 J													320 J			19 J		
Benzo(k)fluoranthene	800	3900	56000	300-26,000	10 J							7 J		320 J	1200 J		15 J	700	65 J		28 J													68 J					
Benzo(a)pyrene	1000	1000	1000	165-220			***350 J***	***1200 J***	52 J			19 J		***1000 J***	***3000 J***		8 J	***1,900***	180 J		48 J													210 J			10 J		
Indeno(1,2,3-cd)pyrene	500	500	5600	8,000-61,000	7 J	210 J	680 J					11 J		630 J	1700 J		13 J	1,000	120 J		31 J													160 J			8 J		
Dibenzo(a,h)anthracene	330	330	560	NA		72 J	220 J							220 J	540 J		12 J	380	40 J		12 J													49 J					
Benzo(ghi)perylene	100000	100000	500000	900-47,000		290 J	900 J	120 J				14 J		820 J	1900 J		12 J	1,000	140 J		36 J													190 J			8 J		
PCBs Method 8082 - (ug/Kg)																																						
Arochlor 1248	100	1000	1000	NA														42 J	29					26	41	34	38										19 J	55 J
Arochlor 1260	100	1000	1000	NA																5.8 J						17 J												
Pesticides - (ug/Kg)																																						
beta-BHC	36	360	3000																0.78 J																			
delta-BHC	40	100000	500000																				0.73 J															
Heptachlor epoxide	42	2100	15000															3.5 J		0.53 J																	
Endosulfan I	2400	24000	200000																				0.51 J															
4,4'-DDE	3.3	8900	62000				27 B											6.4 J		3.6 B				0.77 J	0.85 J	0.83 J	0.86 J									0.64 J	0.78 J
Endrin	14	11000	89000																				1.2 J								0.97 J						
Endosulfan II	2400	24000	200000												3.8 J			5.1 J																			
4,4'-DDD	3.3	13000	92000				120	140										6.1 J												0.76 J							
Endosulfan sulfate	2400	24000	200000															10 J																			
4,4'-DDT	3.3	7900	47000		1.5 J		20 J		1.6 J	19 J				36 J	40 J	1.6J		13	1.8 J	2.6 J				1.9 J					1.8 J					1.8 J				
Methoxyclor						39 J	79 J												2.1	2.9 J																	
Endrin ketone		11000	89000																0.86 J																		
Endrin aldehyde		11000	89000															9.0 J		1.1 J					1.4 J											0.85 J	
gamma-Chlordane							6.1 J	10 J				0.44 J						4.7 J	0.63 J				1.2 J	0.56 J	0.64 J	0.63 J	0.59 J	0.54 J			0.59 J					0.41 J	1.1 J
Total Metals - (mg/Kg)																																						
Aluminum				33,000	19400	9590	7360	6580	9390	6120	7340	7570	4700	26800 J	8480	17300	7750	7400	11000	13700	5060	4960	5380	8300	3460	11300	12000	4720	9990	6850 N	4270	3850	5020	8820	9860	7480	7960	5820	4400
Antimony				N/A										29.6	2.3 J				1.1 J																		42.1	
Arsenic	13	16	16	3 - 12**	0.67 J	3.3	1.8 J	1.2 J	0.86 J	1.4 J	0.80 J	1.2 J	0.77 J	7.9	6.4	0.68 J	1.5 J	4.3	4.7	2.7	1.3 J	1.0 J	1.1 J	2.0 J	0.57 J	2.9	2.5 J	1.1 J	8.5	1.2 J	0.54 J	0.68 J	1.0 J	4.2	2.3 J	2.0 J	1.5 J	8.1	1.1 J
Barium	350	400	400	15 - 600	126	142	48.2	51.7	55.7	54.5	24.7	59.5	39.4	103	106	77.6	54.3	103	86.6	52.7	23.6	26.6	31.5	56.8	24.0	35.7	84.0	30.7	103	40.0 J	58.3	27.2	32.8	107	73.8	52.8	41.0	86.5	23.1
Beryllium	7.2	72	590	0 - 1.75	0.28	0.31	0.29	0.21 J	0.34	0.19 J	0.21 J	0.23	0.20 J	0.61	0.36	0.29	0.26	0.36	0.48	0.48	0.31	0.18 J	0.17 J	0.51	0.07 J	0.36	0.73	0.21 J	0.47	0.26	0.27	0.16 J	0.13 J	0.37	0.72	0.46	0.21 J	0.58	0.12 J
Cadmium	2.5	4.3	9.3	0.1 - 1		0.06 J								***1.2 J***	0.87														0.07 J					0.13 J				J	
Calcium				130 - 35,000	4210	2600	7880	8600	5640	2900	3210	3220	4980	26900	5010	3030	2910	5530	1960	583	1040	1490	754	1760	1190	2720	2220	875 J	4410	5810 J	7200	739	1260	14300	3270	2240	11700	33300	400 J
Chromium	30	180	1500	1.5 - 40**	***184***	18.6	16.9	19.6	25.1	16.9	20.9	17.5	13.4	25.9 J	27.4	9.3	18.7	15.4	16.0	19.4	12.6	10.6	8.6	14.1	6.3	16.6	20.0	9.4	18.0	16.9	8.2	7.8	13.4	24.0	19.0	15.6	15.9	J	6.8
Cobalt				2.5 - 60**	18.6	10.7	6.0	5.9	6.9	6.9	8.5	7.2	4.4	7.9	7.4	4.4	7.0	7.0	6.7	8.0	4.5	3.9	4.4	7.9	3.1	7.3	11.5	4.7	6.6	5.0	2.5	2.9	4.7	7.1	9.3	8.0	5.4	6.9	3.0
Copper	50	270	270	1 - 50	31.8	20.1	14.3	14.4	31.6	28.3	31.4	22.4	21.1	***263 J***	***69.9***	46.5	21.7	24.6	16.1	15.8	12.5	11.8	9.7	17.9	7.9	13.0	23.5	12.5	37.8	11.8	8.0	7.5	11.0	33.4	19.5	18.3	13.8	103 J	8.2
Iron				2,000 - 550,000	26800	21800	13100	12500	15500	27300	12400	12500	9090	12400	17000	31600	14500	12800	16100	20400	13100	8960	10100 J	17800	6500	14900	25400	8680	15800	13100	5050	7340 J	10100	14700	21600	17200	12200	10700	7490
Lead	63	400	1000	200-500	0.68 J	5.2	5.4	2.9	4.7	2.9	2.4	5.1	2.4	460	180	2.3	8.1	235	127	12.6	2.9	2.1	2.7	8.9	1.8	10.4	12.1	2.6	231	22.2 J	2.2	1.8	2.0	189	10.2	8.2	5.1	317	2.3
Magnesium				100 - 5,000	17100	2970	6480	7420	8790	2790	5230	4820	4310	3690	3520	14200	3830	2940	3320	4940	2310	2210	2160 J	3670	1500	3090	4820	2050	2710	2910 J	3450	1640 *	2410	3860	4780	3260	3450	4860	1840
Manganese	1600	2000	10000	50 - 5,000	108	***4110***	283	141	495	545	232	290	237	205	298	331	334	293	419	432	337	130	295	419	142	316	595	202	325	315	188	223	201	507	520	461	250	156	172
Mercury	0.18	0.81	2.8	0.001 - 0.2		0.015 J								***0.262 J***	***1.0***		0.009 J	***0.475***	***0.282***	0.006 J						0.016 J	0.013 J		***1.1***					0.192 J				***0.268***	
Nickel	30	310	310	0.5 - 25	***83.6***	15.8	13.3	12.9	17.3	14.3	***30.2***	16.3	11.9	21.1	17.7	17.6	18.4	14.9	12.9	17.8	12.7	9.1	9.3	18.1	7.0	14.2	24.5	9.3	13.3	12.0	5.6	7.7	10.3	16.9	21.1	17.0	12.5	14.3	8.8
Potassium				8,500 - 43,000**	3110	863	1190	1510	1740	723	531	1200	645	679	1270	2130	1450	1030	578	811	549	827	476 J	1440	583	652	2130	675	759	848 J	709	497 J	807	2000	2230	1290	926	616	628
Selenium	3.9	180	1500	0.1 - 3.9										1.1 J	0.84 J			1.1 J	0.88 J				0.93 J					1.6 J									0.91 J
Silver	2	180	1500	NA										0.72	2.0															0.24 J						0.46 J	
Sodium				6,000 - 8,000	174	89.7 J	82.7 J	152 J	262	161 J	489	294	330	102 J	98.4 J	189	127 J	183	214	924	501	67.7 J	179 J	489	101 J	215	769	113 J	369	464	142 J	85.8 J	90.5 J	532	334	1550	462	65.8 J	178 J
Thallium				NA	0.79 J																																	
Vanadium				1 - 300	100	24.0	22.8	21.4	30.4	25.8	18.0	22.9	15.8	25.7	25.6	173	22.8	19.5	19.8	24.0	17.5	12.7	11.7	19.3	8.1	19.8	28.8	11.1	20.6	17.4	9.6	8.7	14.4	27.3	24.5	20.7	17.4	20.6	8.5
Zinc	109	10000	10000	9 - 50	76.0	29.5	29.9	28.7	37.5	23.7	19.5	27.0	24.7	645 J	184	142	30.0	73.3	78.2	42.0	23.0	19.3	19.2	38.5	13.6	29.7	52.9	18.2	88.9	23.7	12.3	13.7	23.1	72.9	44.5	37.7	27.0	179 J	16.9

Notes:

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.
Yellow highlighted concentrations exceed NYS Restricted Residential SCOs. Red highlighted values exceed unrestricted SCOs.
Bold/Italic values exceed upper limits of urban background concentrations.
(1) New York State Dept. of Environmental Conservation Recommended Soil Cleanup Objectives, Dec. 2006.
(2) TAL Inorganic Analytes from Eastern USA Background as shown in New York State Dept. of Environmental Conservation TAGM 4046, Dec. 2000.
(3) SVOCs background from Background Soil Concentrations of Poly Aromatic Hydrocarbons (PAHs), Urban Soils (U.S. and other), Toxicological Profile for PAHs, US Dept. of Health and Human Services, August 1995.
(4) USEPA Region 3 Soil Screening Level.
*** New York State background concentration.*
**** - The Soil Cleanup Objective refers to the sum of these compounds.*
B - indicates a value greater than or equal to the instrument detection limit, but less than the quantitation limit.
J - Indicates value detected below quantitation limit.
E - indicates an estimated value or not reported due to interferences.
N - Indicates spike sample recovery not within quality control limits.
NA - Not Applicable or Not Available.

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TABLE 4
HISTORICAL RESULTS - SOIL VAPOR
FORMER TEUTONIA HALL SITE

	Semi-site-specific [2] Target Soil Gas Concentration [3]			January 2005	June 2005								May 2006								July 2006					
	@ 10^{-6} target cancer risk and target HQ = 1	@ 10^{-4} target cancer risk and target HQ = 1	NYSDOH Air Guideline Value [1]	Bldg. 47	Bldg. 51			Bldg. 47			Bldg. 45	Bldg. 41	Bldg. 45	Bldg. 47	Bldg. 51					Bldg. 47	Bldg. 51	Bldg. 53					
				HB-5SG	2SG-1	2SG-2	2SG-3	2SG-4	2SG-5	2SG-6	2SG-7	2SG-8	3SG-1	3SG-2	3SG-3	3SG-4	3SG-5	3SG-6	3SG-7	3SG-8	3SG-9	3SG-10	4SG-1	4SG-2	4SG-3	4SG-4	4SG-5	4SG-6
Volatile Organic Compounds (µg/m ^{3})																										
1,1,1-Trichloroethane	1,100,000	1,100,000	100	ND	ND	ND	ND	30.5	52.7	33.3	18.9	ND	8.88	9.99	32.7	ND	ND	ND	ND	ND	6.1	ND	ND	77.7	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3,000	3,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	3	3.5	10	ND	ND	ND	ND	10	33.5	ND	21.5	17.5	17.5	145	18.5
1,3,5-Trimethylbenzene	3,000	3,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	6	ND	12.5	ND	ND	ND	ND
4-Ethyltoluene	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.49	4.49	4.99	1.2	ND	ND	ND	ND	27.5	54.9	ND	ND	ND	ND	ND	ND
Acetone	180,000	180,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	87	29	29	21.8	ND	ND	ND	ND	17.2	18.9	ND	ND	ND	ND	ND	ND
Benzene	160	16,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3	ND	ND	2.27	ND	ND	ND	ND	ND	11.4	ND	ND	ND	ND	ND	ND
Carbon Disulfide	350,000	350,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.53	8.87	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	22.1	4.2	2.8	ND	ND	ND	ND	ND	4.9	8.4	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethylene	18,000	18,000	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**766**	ND	ND	ND	ND	80.7
Ethylbenzene	1,100	110,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.27	13.7	ND	12.4	10.6	9.27	20.8	21.2
Isopropanol	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	190	ND	ND	ND	ND	ND	ND	ND	11.8	9.25	ND	ND	ND	ND	ND	ND
Methyl Ethyl ketone	500,000	500,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	17.4	ND	ND	ND	ND	ND	ND	ND	6	7.8	ND	ND	ND	ND	ND	ND
MTBE	1,500,000	1,500,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.66	ND	ND	ND	ND	ND	ND	ND
n-Heptane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.57	ND	ND	ND	ND	ND	ND
n-Hexane	100,000	100,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	18.6	4.29	24.3	ND	ND	ND	ND	ND	ND
o-xylene	3,500,000	3,500,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.21	4.86	ND	ND	ND	ND	9.72	17.2	ND	21.2	14.1	12.8	19.9	23.9
p-&m-Xylenes	3,500,000	3,500,000	NA	ND	6.18	ND	ND	ND	5.74	ND	ND	ND	2.21	1.77	3.09	7.07	2.21	ND	ND	ND	14.1	24.3	ND	27.4	20.8	17.7	36.2	38
Propylene	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.92	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	500,000	500,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.2	2.17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene (PCE)	410	41,000	100	ND	***9660***	***966***	***317***	69	***441***	82.8	***103***	29	60	55.9	***138***	31.7	***207***	***5380***	***1180***	***421***	***124***	***228***	***5380***	***1030***	***1100***	***586***	***290***	***2970***
Toluene	200,000	200,000	NA	4.22	8.05	4.22	3.83	4.6	5.75	ND	4.98	ND	3.45	2.68	7.67	19.9	65.2	ND	ND	3.45	29.5	65.2	ND	49.8	42.2	42.2	149	149
Trichloroethylene (TCE)	11	1,100	5	ND	***21.3***	***15.9***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	***5.47***	ND	ND	ND	ND	ND	***2460***	***92.9***	***32.8***	***24.6***	***17.5***	***656***
Trichlorofluoromethane	350,000	350,000	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.57	5.71	ND	ND	ND	ND	ND	ND

Notes

Highlighted concentrations exceed the semi-site specific target soil gas concentrations.

Bold/Italic values exceed NYSDOH air guidance value(s).

(1) New York State Department of Health Air Guideline Values (Table 3.1; NYSDOH, 2006)

(2) Semi-site-specific attenuation factor = 0.002 for sand substrate and 3' sample depth (Figure 3a; USEPA, 2002)

(3) Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (USEPA, 2002).

HQ = Hazard quotient for adverse, noncancer health effects

NA = Not Available

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TABLE 5
SUMMARY OF SOIL GAS ANALYTICAL RESULTS
FORMER TEUTONIA HALL SITE
YONKERS, NEW YORK

	NYSDOH Air Guideline Values[2]		Sample Collection Period - August 2007													
	Monitor or Mitigate	Mitgate	Building #53													Outside
Sample Number			SG-1	SG-2	SG-3	SG-4	SG-5	SG-6	SG-7	SG-8	SG-9	SG-10	SG-11	SG-12	SG-DUP[3]	SG-13	SG-14
Volatile Organic Compounds (ug/m^3) [1]																	
1,1,1-Trichloroethane	100	1,000					180				9.3		98			2.6	
1,2,4-Trimethylbenzene	NA	NA		8.8							7.9						
1,2-Dichloroethene	NA	NA				4,400								19	19		
1,3-Butadiene	NA	NA		**38**													3.3
2,2,4-Trimethylpentane	NA	NA									20						
Acetone	NA	NA	430	230					110	310	160		200			88	
Benzene	NA	NA		54						3.8				23	27	3.8	6.4
Chloroform	NA	NA											19	22	23		
cis-1,2-Dichloroethene	100	1,000				4,400								19	19		
Cyclohexane	NA	NA									41						
Ethyl benzene	NA	NA															1.7
Isopropyl Alcohol	NA	NA								71						22	
Methyl Ethyl Ketone	NA	NA	120	38						12	24				38	5.0	1.9
Methyl tert-Butyl Ether	NA	NA									54						
n-Heptane	NA	NA															1.8
n-Hexane	NA	NA		14							29						2.3
Tetrachloroethene	100	1,000	430	1,600	190,000	41,000	22,000	7,500	1,300	560	1,600	45,000	2,100	3,000	3,200	61	160
Toluene	NA	NA	23	49						8.7	13					4.1	6.0
Trichloroethene	5 or 50 [4]	250		12		2,000				54	30	9,100	59	130	150		
Trichloroflouromethane	NA	NA															1.1

Notes:

Yellow highlighted concentrations exceed the NYSDOH Air Guideline values in which the minimum recommended action is to monitor indoor air and sub-slab soil vapors. Mitigation may also be the recommended action, depending on indoor air concentrations. Since no indoor air samples were collected, values were evaluated based on the more conservative guidance value in which the recommended action was to monitor or mitigate.

Red highlighted concentrations exceed the NYSDOH Air Guideline values in which the only recommended action is to mitigate.

Blank space indicates analyte was not detected.

(1) Volatile Organic Compounds as measured by USEPA Compendium Method TO-15.

(2) New York State Department of Health Air Guideline Values as stated in Matrix 1 and 2 (NYSDOH, 2006).

(3) Duplicate collected at SG-12.

(4) Recommended monitor/mitigate actions levels on Matrix 1 are based on detected indoor air concentrations.

HQ = Hazard quotient for adverse, noncancer health effects

NA = Not Available

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TABLE 6
REMEDIAL COST ESTIMATE ALTERNATIVE #2
FORMER TUTONIA HALL SITE
YONKERS, NEW YORK

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LABOR	EST. TOTAL
1	Remedial Contractor Mobilization, Site prep, and demobilization	1	sum	$35,000	$35,000
2	Installation of sheet Piling for excavation stability/safety	1	sum	$88,000	$88,000
3	Excavation, stockpiling, and loading of soils	50,000	tons	$9.60	$480,000
5	Removal and disposal of USTs and related product/soils	2	sum	$12,500	$25,000
6	Transportation and disposal of non-hazardous soils (entire BCP site to a elev of adj railroad)	50,000	tons	$55	$2,750,000
	Total Remedial Contractor Costs before tax and contingency				**$3,378,000**
7	Sales tax on Remedial Contractor Costs	0.0875		$3,378,000.00	$295,575
8	Side-wall/bottom confirmation samples (full TCL/TAL standard TAT)	66	Samples	$450.00	$29,700
9	Engineering [(2)]	1	sum	$36,000	$36,000
	Sub-Total				**$3,739,275**
10	Health & Safety (10%)	10% of Subtotal	sum		$373,928
11	Contingency	30 % of subtotal	sum		$1,121,783
Total					**$5,234,985**

[(1)] Remedial Investigation results indicate soils area non-hazardous but will require disposal in a NYSDEC-permitted disposal facility.

[(2)] Includes time and expenses for collection of confirmatory samples and oversight of remedial/construction contractor (10 hrs/day x 30 days).

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TABLE 7
SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
(GREATER THAN 20 FEET BGS)
FORMER TEUTONIA HALL SITE
YONKERS, NEW YORK

Sample Number Sampling Depth (ft. bgs) Collection Date	NYS SCO's Unrestricted	NYS SCO's Residential	NYS SCO's Restricted Residential	NYS SCO's Restricted Commerical	Urban Background Concentrations (2)(3)	SB-4D 31-32 7/31/2007	SB-7D 30-35 7/31/2007	SB-17D 25-30 8/02/2007	SB-19D 20-25 8/02/2007	SB-22D 25-30 8/02/2007	MW-4/Temp 25-30 7/31/2007	MW-6 20-23 8/02/2007
VOCs - Method 8260 (ug/Kg)												
Methylene chloride	50	51,000	100,000	500,000	NA	75	71	65	40	68	65	65
Acetone	50	100,000	100,000	500,000	NA					11 J	13 J	
2-Butanone	120	100,000	100,000	500,000	NA							
Tetrachloroethene	1,300	5,500	19,000	150,000	NA							
Toluene	700	100,000	100,000	500,000	NA		1 J				1 J	1 J
Ethyl benzene	1,000	30,000	41,000	390,000	NA							
Total Xylenes	260	100,000	100,000	500,000	NA							
Methylcyclohexane					NA							
Isopropylbenzene					NA							
SVOCs Method 8270 - (ug/Kg)												
Phenol	330	100,000	100,000	500,000	NA							
4-Methylphenol												
Naphthalene	12,000	100,000	100,000	500,000	NA							
2-Methylnapthalene												
Acenapthylene	100,000	100,000	100,000	500,000	NA							
Acenapthalene	20,000	100,000	100,000	500,000	NA							
Dibenzofuran					NA							
Fluorene	30,000	100,000	100,000	500,000	NA							
Phenanthrene	100,000	100,000	100,000	500,000	NA							
Anthracene	100,000	100,000	100,000	500,000	NA							
Di-n-butyl phthalate					NA							
Fluoranthene	100,000	100,000	100,000	500,000	200-166,000							
Pyrene	100,000	100,000	100,000	500,000	145-147,000							
Butyl benzyl phthalate												
Benzo(a)anthracene	1,000	1,000	1,000	5,600	169-59,000			9 J	10 J			
Chrysene	1,000	1,000	3,900	56,000	251-640							
Bis(2-ethylhexyl)phthalate					NA							
Di-n-octyl phthalate						10 J		16 J	14 J			21 J
Benzo(b)fluoranthene	1,000	1,000	1,000	5,600	15,000-62,000							
Benzo(k)fluoranthene	800	1,000	3,900	56,000	300-26,000							
Benzo(a)pyrene	1,000	1,000	1,000	1,000	165-220							
Indeno(1,2,3-cd)pyrene	500	500	500	5,600	8,000-61,000							
Dibenzo(a,h)anthracene	330	330	330	560	NA							
Benzo(ghi)perylene	100,000	100,000	100,000	500,000	900-47,000							
PCBs Method 8082 - (ug/Kg)												
Arochlor 1248	100	1,000	1,000	1,000	NA			26	38			
Arochlor 1260	100	1,000	1,000	1,000	NA							

Notes:

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.
Highlighted concentrations exceed NYS Restricted Residential SCOs.
Bold/Italic values exceed upper limits of urban background concentrations.
(1) New York State Dept. of Environmental Conservation Recommended Soil Cleanup Objectives, Dec. 2006.
(2) TAL Inorganic Analytes from Eastern USA Background as shown in New York State Dept. of Environmental
(3) SVOCs background from Background Soil Concentrations of Poly Aromatic Hydrocarbons (PAHs), Urban Soils (U.S.
(4) USEPA Region 3 Soil Screening Level.
*** New York State background concentration.*
**** - The Soil Cleanup Objective refers to the sum of these compounds.*
B - indicates a value greater than or equal to the instrument detection limit, but less than the quantitation limit.
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TABLE 7
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(GREATER THAN 20 FEET BGS)
FORMER TEUTONIA HALL SITE
YONKERS, NEW YORK

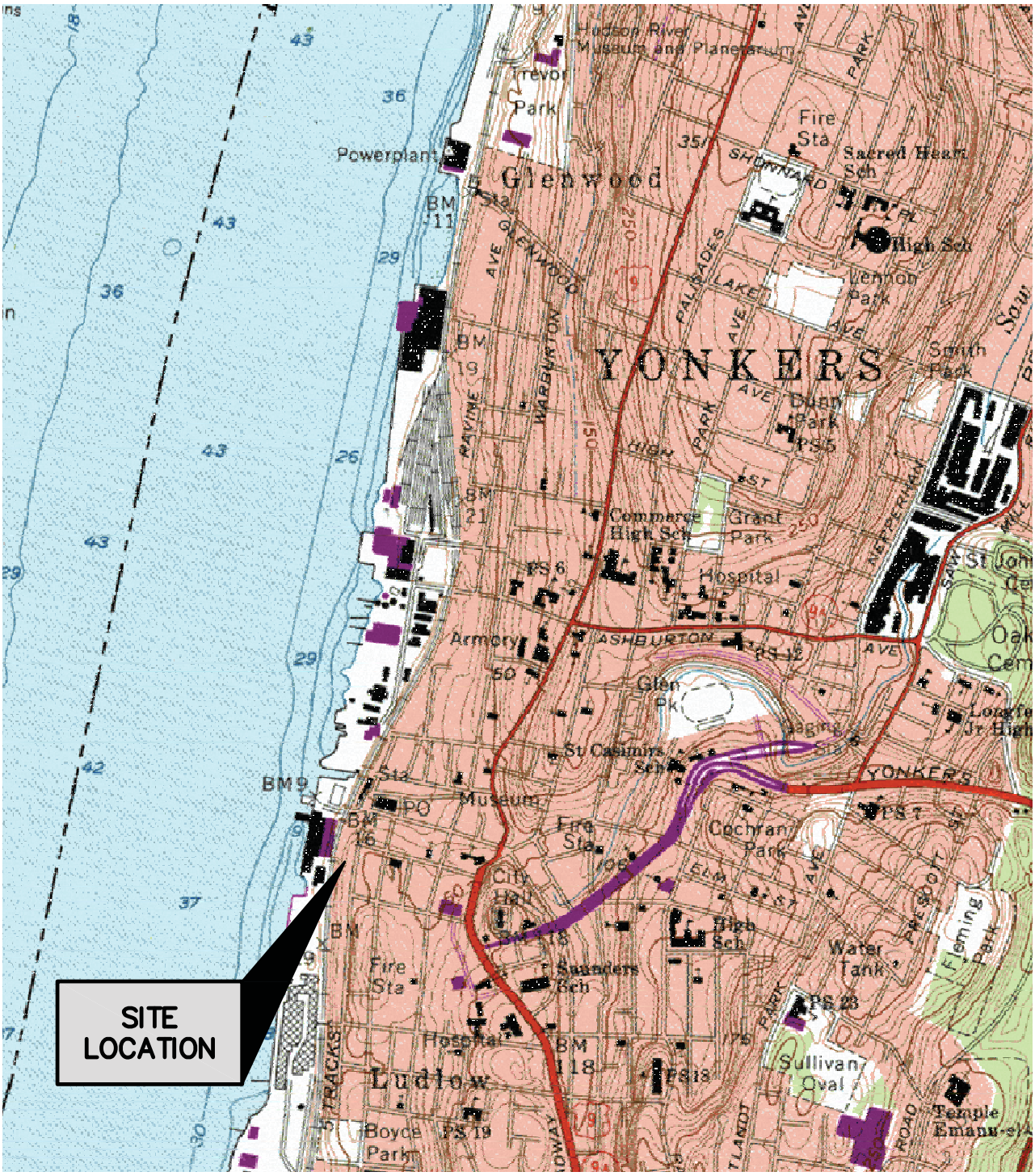
Sample Number Sampling Depth (ft. bgs) Collection Date	NYS SCO's Unrestricted	NYS SCO's Residential	NYS SCO's Restricted Residential	NYS SCO's Restricted Commerical	Urban Background Concentrations (2)(3)	SB-4D 31-32 7/31/2007	SB-7D 30-35 7/31/2007	SB-17D 25-30 8/02/2007	SB-19D 20-25 8/02/2007	SB-22D 25-30 8/02/2007	MW-4/Temp 25-30 7/31/2007	MW-6 20-23 8/02/2007
Pesticides - (ug/Kg)												
beta-BHC	36	72	360	3,000								
delta-BHC	40	100,000	100,000	500,000								
Heptachlor epoxide	42	420	2,100	15,000								
Endosulfan I	2,400	4,800	24,000	200,000								
4,4'-DDE	3	1,800	8,900	62,000				0.77 J	0.86 J			
Endrin	14	2,200	11,000	89,000						0.97 J		
Endosulfan II	2,400	4,800	24,000	200,000								
4,4'-DDD	3	2,600	13,000	92,000						0.76 J		
Endosulfan sulfate	2,400	4,800	24,000	200,000								
4,4'-DDT	3	1,700	7,900	47,000		1.6 J		1.9 J				1.8 J
Methoxyclor												
Endrin ketone	14	2,200	11,000	89,000								
Endrin aldehyde	14	2,200	11,000	89,000								
gamma-Chlordane								0.56 J	0.59 J			
Total Metals - (mg/Kg)												
Aluminum					33,000	9390	4700	8300	12000	4270	9860	7480
Antimony					N/A							
Arsenic	13	16	16	16	3 - 12**	0.86 J	0.77 J	2.0 J	2.5 J	0.54 J	2.3 J	2.0 J
Barium	350	350	400	400	15 - 600	55.7	39.4	56.8	84.0	58.3	73.8	52.8
Beryllium	7	14	72	590	0 - 1.75	0.34	0.20 J	0.51	0.73	0.27	0.72	0.46
Cadmium	3	3	4	9	0.1 - 1							
Calcium					130 - 35,000	5640	4980	1760	2220	7200	3270	2240
Chromium	30	36	180	1,500	1.5 - 40**	25.1	13.4	14.1	20.0	8.2	19.0	15.6
Cobalt					2.5 - 60**	6.9	4.4	7.9	11.5	2.5	9.3	8.0
Copper	50	270	270	270	1 - 50	31.6	21.1	17.9	23.5	8.0	19.5	18.3
Iron					2,000 - 550,000	15500	9090	17800	25400	5050	21600	17200
Lead	63	400	400	1,000	200-500	4.7	2.4	8.9	12.1	2.2	10.2	8.2
Magnesium					100 - 5,000	8790	4310	3670	4820	3450	4780	3260
Manganese	1,600	2,000	2,000	10,000	50 - 5,000	495	237	419	595	188	520	461
Mercury	0.18	1	1	3	0.001 - 0.2				0.013 J			
Nickel	30	140	310	310	0.5 - 25	17.3	11.9	18.1	24.5	5.6	21.1	17.0
Potassium					8,500 - 43,000**	1740	645	1440	2130	709	2230	1290
Selenium	4	36	180	1,500	0.1 - 3.9							
Silver	2	36	180	1,500	NA					0.24 J		
Sodium					6,000 - 8,000	262	330	489	769	142 J	334	1550
Thallium					NA							
Vanadium					1 - 300	30.4	15.8	19.3	28.8	9.6	24.5	20.7
Zinc	109	2,200	10,000	10,000	9 - 50	37.5	24.7	38.5	52.9	12.3	44.5	37.7

Notes:

Only those analytes detected at a minimum of one location and greater than the reporting limit are shown.
Highlighted concentrations exceed NYS Restricted Residential SCOs.
Bold/Italic values exceed upper limits of urban background concentrations.
(1) New York State Dept. of Environmental Conservation Recommended Soil Cleanup Objectives, Dec. 2006.
(2) TAL Inorganic Analytes from Eastern USA Background as shown in New York State Dept. of Environmental
(3) SVOCs background from Background Soil Concentrations of Poly Aromatic Hydrocarbons (PAHs), Urban Soils (U.S.
(4) USEPA Region 3 Soil Screening Level.
*** New York State background concentration.*
**** - The Soil Cleanup Objective refers to the sum of these compounds.*
B - indicates a value greater than or equal to the instrument detection limit, but less than the quantitation limit.
J - Indicates value detected below quantitation limit.
E - indicates an estimated value or not reported due to interferences.
N - Indicates spike sample recovery not within quality control limits.
NA - Not Applicable or Not Available.

ARCADIS

Figures

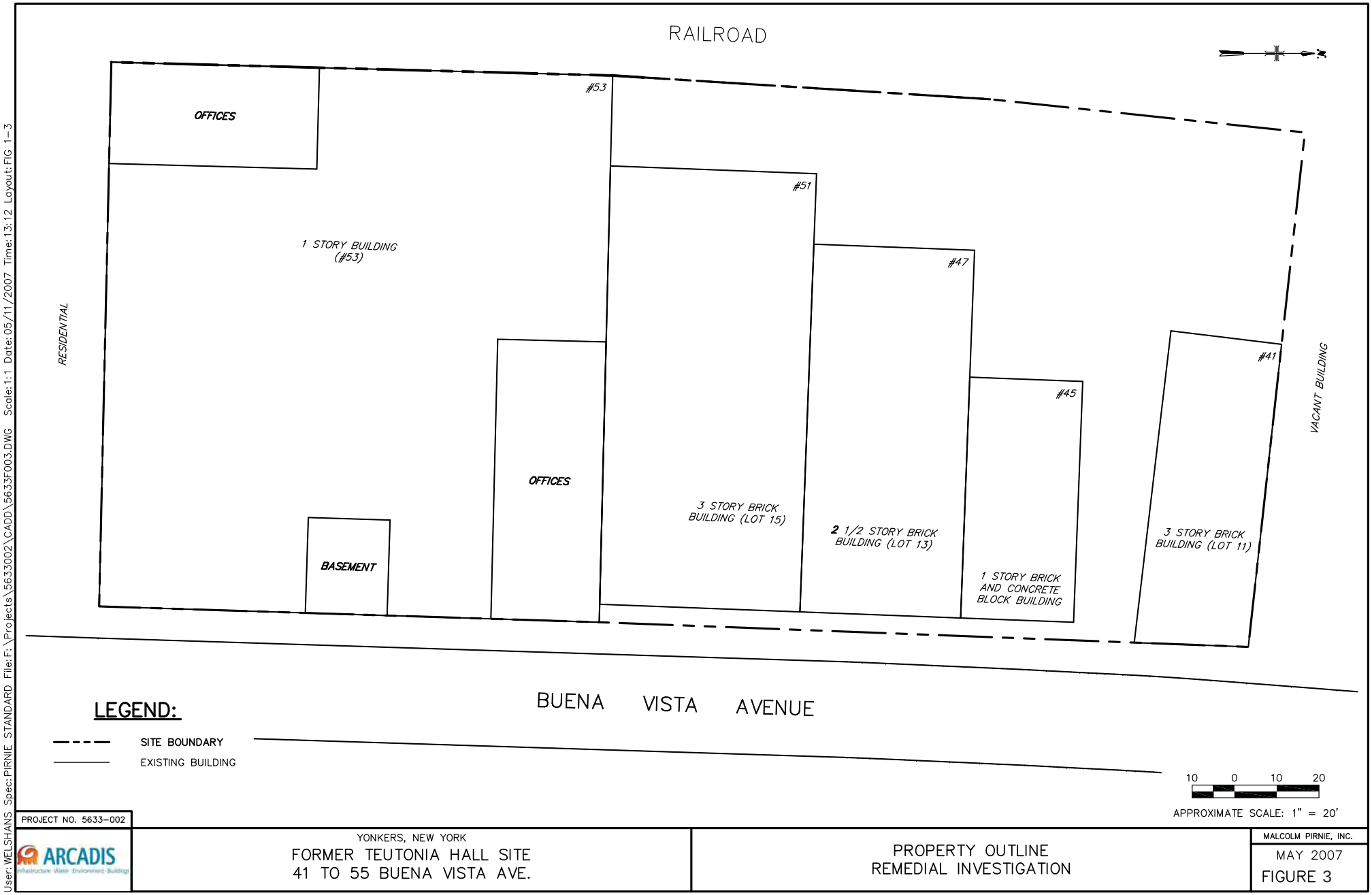


PROJECT NO. 5633-002			
ARCADIS Infrastructure · Water · Environment · Buildings	YONKERS, NEW YORK FORMER TEUTONIA HALL SITE 41 TO 55 BUENA VISTA AVE.	VICINITY MAP	MALCOLM PIRNIE, INC. MAY 2007 FIGURE 1

XREFS: IMAGES:F:\Projects\5633002\CADD\Image-02.tif
User: WELSHANS Spec: PIRNIE STANDARD File:F:\Projects\5633002\CADD\5633F005.DWG Scale: 1:1 Date: 05/11/2007 Time: 13:06 Layout: Figure 1-1

PROJECT NO. 5633–002	YONKERS, NEW YORK FORMER TEUTONIA HALL SITE 41 TO 53 BUENA VISTA AVE.	SITE LOCATION	MALCOLM PIRNIE, INC. MARCH 2008 FIGURE 2

ARCADIS
Infrastructure · Water · Environment · Buildings



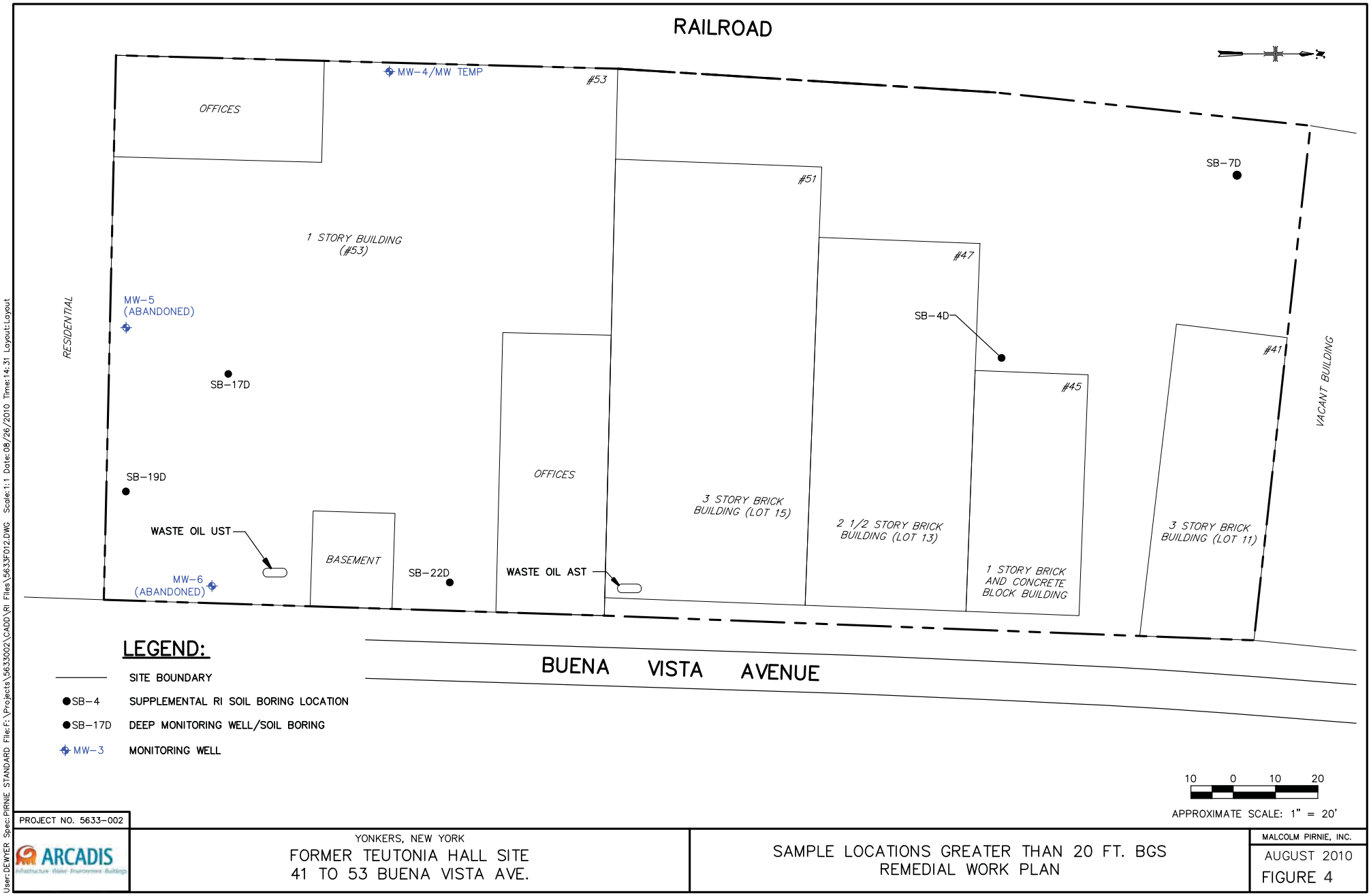
PROJECT NO. 5633-002

ARCADIS Infrastructure Water Environment Buildings

YONKERS, NEW YORK
FORMER TEUTONIA HALL SITE
41 TO 55 BUENA VISTA AVE.

PROPERTY OUTLINE
REMEDIAL INVESTIGATION

MALCOLM PIRNIE, INC.
MAY 2007
FIGURE 3



PROJECT NO. 5633-002

ARCADIS

YONKERS, NEW YORK
FORMER TEUTONIA HALL SITE
41 TO 53 BUENA VISTA AVE.

SAMPLE LOCATIONS GREATER THAN 20 FT. BGS
REMEDIAL WORK PLAN

MALCOLM PIRNIE, INC.
AUGUST 2010
FIGURE 4

XREFS: \XREF\B-V_AVE-GSP - FIGURE 4-1-1.dwg . \XREF\11x17-BOR-AUG.dwg IMAGES:None
User:DEWYER Spec:PIRNIE STANDARD File:F:\Projects\5633002\CADD\RI Files\5633F012.DWG Scale:1:1 Date:08/26/2010 Time:14:31 Layout:Layout

RAILROAD

OFFICES

#53

#51

#47

#45

#41

RESIDENTIAL

1 STORY BUILDING (#53)

VACANT BUILDING

OFFICES

BASEMENT

3 STORY BRICK BUILDING (LOT 15)

2 1/2 STORY BRICK BUILDING (LOT 13)

1 STORY BRICK AND CONCRETE BLOCK BUILDING

3 STORY BRICK BUILDING (LOT 11)

BUENA VISTA AVENUE

LEGEND:

- SITE BOUNDARY
- EXISTING BUILDING
- EXCAVATION SIDEWALL SAMPLE LOCATION
- PRE-CHARACTERIZATION SAMPLE LOCATION/ COMPOSITES
- EXCAVATION BOTTOM CONFIRMATION SAMPLE LOCATIONS

10 0 10 20

APPROXIMATE SCALE: 1" = 20'

PROJECT NO. 5633-002

MALCOLM PIRNIE

YONKERS, NEW YORK

FORMER TEUTONIA HALL SITE
41 TO 55 BUENA VISTA AVE.

PROPOSED SAMPLE LOCATIONS

MALCOLM PIRNIE, INC.

MAY 2011

FIGURE 5

XREFS: F:\5633002\CADD\Working Files\XREF\B-V_AVE-GSP.dwg F:\5633002\CADD\Working Files\XREF\11x17-BOR.dwg IMAGES: None
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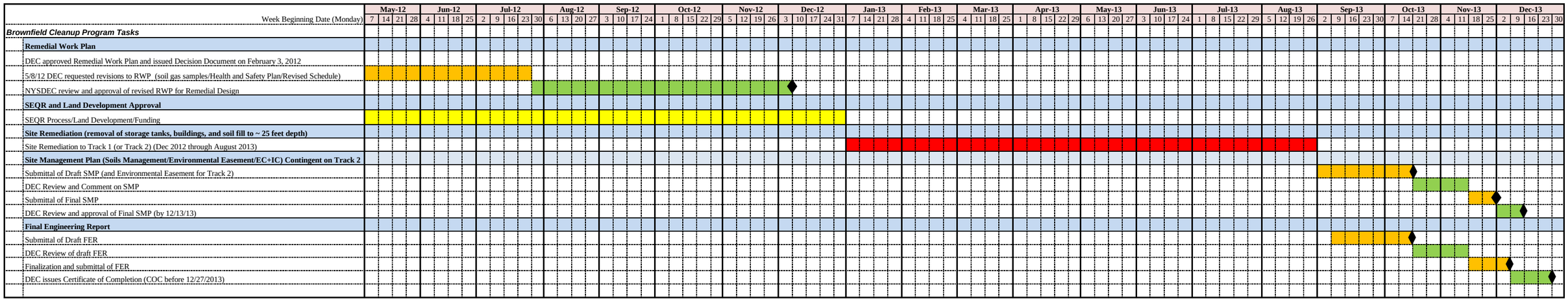
Figure 6
BROWNFIELD CLEANUP PROGRAM SCHEDULE
FORMER TEUTONIA HALL SITE
YONKERS, NEW YORK



Revised 110112

ARCADIS

Appendix **A**

Excavation Work Plan

APPENDIX A

EXCAVATION WORK PLAN

A-1 NOTIFICATION

At least 15 days prior to the start of remedial excavation activity, the Site owner or their representative will notify the Department. Currently, this notification will be made to:

Mike Haggerty, NYSDEC
Project Manager New York State Department of Environmental Conservation
Remedial Bureau B
625 Broadway
Albany, New York 12233-7016

This notification will include:

- Identification of disposal facilities for potential waste streams,
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

A-2 SOIL SCREENING METHODS

Although soil will be analytically pre-characterized before excavation, soil will be screened in accordance with the Standard Operating Procedure presented in Section A-17.

Visual, olfactory and instrument-based soil screening will be performed by a professional engineer (PE) or an engineer/scientist, with whom the PE is directly responsible for (Designee), during all remedial and development excavations throughout the site. Soil screening will include all excavation and invasive work performed during development, such as excavations for foundations and utility work.

The soil/fill removed during excavation will be inspected for staining or odor and will be field screened for the presence of volatile organic compounds (VOCs) with a photo ionization detector (PID).

Excavated soil/fill that is visibly stained, exhibiting odor, or produces elevated PID readings (i.e., sustained 10 ppm or greater) will be considered potentially contaminated soil/fill. Potentially contaminated soil/fill will be stockpiled on polyethylene sheeting and then re-sampled for disposal.

Sampling and analysis of soil/fill exhibiting staining, odor, and/or elevated PID measurements will be completed in accordance with the protocols described in this Excavation Work Plan (EWP). Sampling and analysis will also be completed in accordance with the requirements of the disposal facility at which the soil/fill with concentrations of contaminants above the soil cleanup objectives (SCOs) for unrestricted use (per NYCRR subpart 375-6.8(a)) will be disposed.

All excavated and stockpiled soil with evidence of contamination will be sampled and classified for disposal. Initially, one composite soil sample, and one duplicate sample will be collected, in the manner described in the Standard Operating Procedures (SOPs) included in Section A-17 and Quality Assurance / Quality Control Procedures included in Section A-18, from five locations within each stockpile. PID measurements will be recorded for each of the five composite sample locations, and one grab sample and one duplicate will be collected from the location with the highest PID measurement of the five composite locations. The composite sample will be analyzed by a NYSDOH ELAP-certified analytical laboratory for Target Compound List (TCL), semi-volatile organic compounds (SVOCs), TAL metals, PCBs, and pesticides. The grab sample will be analyzed for TCL volatile organic compounds (VOCs), PCBs, and pesticides. At a minimum, the duplicate sample will be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) for the particular analytes that were detected at concentrations exceeding the unrestricted SCO. The duplicate sample may also be analyzed for RCRA Characteristics including reactivity, corrosivity, and ignitability.

Excavated soil/fill that exhibits no evidence of contamination (staining, odor, or elevated PID measurements) will already have been pre-characterized and will not require additional characterization.

If the analysis of the soil/fill samples reveal unacceptably high levels of any analyte (i.e., greater than one or more SCOs), additional analyses may be necessary to further classify the material for hazardous characteristics for disposal purposes.

A-3 STOCKPILE METHODS

Stockpiling of soil is not anticipated as current plans are to direct load during excavation. However, stockpiling will be allowed under the following conditions if necessary.

Stockpiling on-site soil/fill with no evidence of contamination (no staining, odor, or elevated PID measurements) may take place in approved areas in approximately 50 cubic yard piles, until removed. If stockpiling is to take place; place, grade, and shape stockpiles for proper drainage. Soil materials will be located and retained away from the edges of excavations and excess soil and waste materials will be disposed of appropriately.

Stockpiling on-site soil/fill with evidence of contamination (staining, odor, and/or elevated PID measurements) may take place in approved areas in approximately 50 cubic yard piles, until expedited sample analysis is completed. Place, grade and shape stockpiles for proper drainage to ensure effective weather proofing of potentially contaminated soil stockpiles. Soil materials will be located and retained away from the edges of excavations.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced. The stockpiled soil/fill will be placed on top of and be completely covered using polyethylene sheeting with a minimum thickness of 8-mil to reduce the infiltration of precipitation and the entrainment of dust. The stockpile area shall be protected from stormwater runoff. Edges of the sheeting shall overlap a minimum of two feet and duct tape shall be applied along all seams to prevent movement of sheeting and infiltration of precipitation into the stockpiled soil. Non-soil weights (e.g. tires) may be necessary to inhibit movement of the cover sheeting by wind.

Soil stockpiles will be continuously encircled with a berm and/or silt fence. The berm wall shall be constructed around the stockpile using uncontaminated material covered with the same sheeting as the stockpiled material. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC.

A-4 MATERIALS EXCAVATION AND LOAD OUT

The PE or Designee will oversee all invasive work and the excavation and load-out of all excavated material. \

The presence of utilities and easements on the Site will be investigated by the PE or Designee. It will be determined whether a risk or impediment to the planned work under this EWP is posed by utilities or easements on the Site.

The excavation shall be performed in a manner that will meet the requirements of all appropriate rules and regulations and be completed in accordance with the following measures:

- Employ a temporary transport vehicle pad for vehicle loading operations to control and contain contaminated soil and debris spillage.
- Excavations for structures and utilities shall be open excavations. Provide excavation protection system(s) required by ordinances, codes, law and regulations to prevent injury to workmen and to prevent damage to new and existing structures or pipelines. Unless shown or specified otherwise, protection system(s) shall be utilized under the following conditions.
    - Excavation Less Than 4 Feet Deep: Excavations in stable rock or in soil conditions where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded, or shored and braced.

- Excavations More Than 4 Feet Deep: Excavations in stable rock may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded or shored and braced.

- Utility Trench Preparation:
  - No more than 50 feet of trench may be opened in advance of utility laying. Trench width shall be minimized to greatest extent practical but shall conform to the following:
    - Sufficient to provide room for installing, jointing and inspecting utilities. Enlargements at pipe joints may be made if required.
    - Sufficient for shoring and bracing, or shielding and dewatering.
    - Sufficient to allow thorough compaction of acceptable backfill adjacent to bottom half of utility.
    - Excavating equipment that requires the trench to be excavated to excessive width or depth shall not be used.

- Conduct all loading and transportation activities in accordance with all applicable federal, state, and local regulations, including but not limited to United States Department of Transportation and USEPA regulations 40 CFR 172-179.
- Notify the NYSDEC in writing when loading of contaminated soil/fill will occur and include the name and location of the disposal facility to be used. Submit to the NYSDEC, if requested, a full description of the disposal facility, licenses, permits, and compliance status.
- Do not load and transport contaminated soil and debris until receipt of approval from the disposal facility in which the contaminated soil and debris will be disposed.
- Conduct all loading activities to minimize the formation of dust. Contaminated soil and debris transport containers shall be covered to prevent release of dust and particulates and exposure of the contaminated soil and debris to precipitation.

- § Locations where vehicles enter or exit the Site shall be inspected daily for evidence of off-site soil tracking.
- § Inspect and clean loaded transport vehicle tires and undercarriage to remove any adhering contaminated soil and debris prior to vehicle departure from the Site.

Loaded vehicles leaving the Site will be appropriately lined, tarped, securely covered, manifested, secured, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements). Any liner that cannot be decontaminated shall be disposed of with the contaminated soil and debris. Trucks used for transportation of contaminated soil and debris shall travel on authorized roads in accordance with all federal, state and local regulations. Contaminated soil and debris shall be transported for disposal in containers that are watertight. Leaking containers shall be unloaded at the Site and any leaked liquids cleaned up as spills.

A truck wash will be operated on-site. The PE or Designee will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the Site until the activities performed under this section are complete. Truck wash waters will be collected and disposed of off-site in an appropriate manner, as described in Section A-8.

The PE or Designee will be responsible for ensuring that all egress points for truck and equipment transport from the Site are clean of dirt and other materials derived from the Site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

A-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the Site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

All trucks will be washed prior to leaving the Site. Truck wash waters will be collected and disposed of off-site in an appropriate manner, and as further described in the Fluids Management section below.

Planned truck transport routes are as follows: Trucks coming from Interstate Route 87 will approach the Site from the north at the intersection of Main Street and Buena Vista Ave. While heading in the southerly direction on Buena Vista Ave., trucks will enter the Site at a southern driveway, drive north in front of the work site, turn west at the northern Site boundary, then head south then east, exiting the Site at the same point as they entered, and then head north away from the Site to avoid sensitive areas to the south, see Figure A1. All trucks loaded with site materials will exit the vicinity of the Site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport. Trucks will be prohibited from stopping and idling in the neighborhood outside the project Site.

Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

Prepare a waste transportation and disposal manifest, and all other documents required for waste shipment, for each load of waste material that is transported from the Site. Maintain a waste disposal log on-site containing pertinent waste disposal information. If requested, the NYSDEC on-site representative may review the log.

A-6 MATERIALS DISPOSAL OFF-SITE

All soil/fill/solid waste excavated and removed from the Site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this Site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this Site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Final Engineering Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

Soil/Fill with concentrations of contaminants above the SCOs will be disposed off-site within 90 days of excavation at an appropriate, permitted disposal facility.

If the analytical results indicate that concentrations exceed the standards for either TCLP or RCRA Characteristic analysis, the material will be considered a hazardous waste and must be properly disposed of off-site at a permitted disposal facility within 90 days of excavation. Additional characterization sampling for off-site disposal may be required by the disposal facility. There is a potential to characterize each stockpile individually to reduce off-site disposal requirements/costs.

A-7 MATERIALS REUSE ON-SITE

On-Site reuse of excavated materials is not anticipated.

A-8 FLUIDS MANAGEMENT

Liquids to be removed from the Site associated with excavation, including dewatering, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering fluids will not be recharged back to the land surface or subsurface of the Site, but will be managed off-site.

All trucks will be washed prior to leaving the Site. A geomembrane-lined truck wash pad will be installed, and will include a wash water collection sump or trench. Waste fluids from the sump or trench will be collected and disposed of properly, consistent with any water removed from excavations.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

Pumping of water from excavations, if necessary, shall be done in such a manner to prevent the carrying away of particulates, soil/fill, or unsolidified concrete materials, and to prevent damage to the existing subgrade.

Water from the excavations will be disposed properly in accordance with all applicable regulations in such a manner as not to endanger public health, property, or any portion of the work under construction or completed.

A-9 COVER SYSTEM RESTORATION

The Track 1 Site remedy does not rely on a cover system to protect human health and environment. However, regardless of the level of cleanup achieved (Track 1 or Track 2); the entire Site will be covered by the subsurface parking facility and the new apartment building. Therefore, cover system restoration will be achieved by regular maintenance of the buildings, underground parking structures, driveways, and walkways.

A-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the Site will be approved by the PE or Designee will be in compliance with provisions in this EWP, and approved by the NYSDEC prior to receipt at the Site.

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). The Track 1 remedy requires that all soils meet the unrestricted soil cleanup objectives, as listed in 6NYCRR Table 375-6.8(a).

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the Site.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

Off-site borrow soils will be documented as having originated from locations having no evidence of disposal or release of hazardous, toxic or radioactive substances, wastes or petroleum products.

If the contractor designates a source as "virgin" soil, it shall be further documented in writing to be native soil material from areas not having supported any known prior industrial or commercial development or agricultural use. Virgin soils should be subject to collection of a minimum of one representative composite sample per source. The sample should be analyzed for TCL VOCs, SVOCs, pesticides, PCBs, and the metals arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver plus cyanide. The soil will be acceptable for use as backfill provided that all parameters meet the applicable (un-restricted for Track 1, restricted residential for Track 2) Allowable Constituent Levels for Imported Fill or Soil, provided as Appendix 5 of DER-10 (May 2010).

Non-virgin soils will be tested via collection of a combination of grab samples for VOC analysis and composite samples for analysis of SVOCs, PCBs, Pesticides, and Metals

as specified in DER-10 subdivision 5.4(e)10. The attached Table A-1 provides the sample frequency by volume and analyses to be performed for non-virgin soils prior to use on Site. Based on DER-10 subdivision 5.4(e)3, for borrow sources greater than 5,000 cubic yards, sampling frequency may be reduced to two VOC grab samples and one composite sample (SVOC, metals, pesticides, PCBs) per 5,000 cubic yards as approved by NYSDEC once a trend of compliance is established.

A-11 STORMWATER POLLUTION PREVENTION

When remedial actions require the disturbance of more than one acre of land, federal and state laws[1] require that the project obtain coverage under the NYSDEC SPDES General Permit for Storm Water Discharges from Construction Activities Permit #GP-0-10-001 (Construction Storm Water General Permit). Although the BCP Site is 0.78 acres, the overall project will affect a total of 1.0± contiguous acres. Requirements for coverage under the Construction Storm Water General Permit include the submittal and NYSDEC approval of a Notice of Intent Form and a Storm Water Pollution Prevention Plan (SWPPP). For this project, MS4 approval of the SWPPP will be required prior to submission of the NOI to NYSDEC. The SWPPP for the Site will be prepared by the Construction Contractor in accordance with the New York State Storm Water Management Design Manuel (2010) The SWPPP will provide the following information:

- A background discussion of the scope of the construction project.
- A statement of the storm water management objectives.
- An evaluation of post-development runoff conditions.
- A description of proposed storm water control measures.
- A description of the type and frequency of maintenance activities required to support the control measure.

[1] The Federal Water Pollution Control Act (as amended, 33 U.S.C. 1251 et Seq.) and the New York State Environmental Conservation Law: Article 17, Titles 7 and 8 and Article 70.

The SWPPP will also address issues such as erosion prevention, sedimentation control, hydraulic loading, pollutant loading, ecological protection, physical site characteristics that impact design, and site management planning. The SWPPP will also include a contingency plan to be implemented in the event that heavy rain events are determined to be impacting water quality in the Site due to closure or redevelopment activities. All descriptions of proposed features and structures at the Site includes a description of structure placement, supporting engineering data and calculations, construction scheduling, and references to established detailed design criteria.

The use of appropriate temporary erosion control measures such as silt fencing and/or hay bales will be required around all soil/fill stockpiles and unvegetated soil surfaces during redevelopment activities. Stockpiles shall be graded and compacted as necessary for positive surface water runoff and dust control. Stockpiles of soil/fill will be placed a minimum of ten feet from the property boundary.

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the EWP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

A-12 CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for the full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the Site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager and a removal plan will be submitted for NYSDEC approval. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Final Engineering Report.

A-13 COMMUNITY AIR MONITORING PLAN

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

activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

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

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

Community Air Monitoring Plan

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

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

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

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a **continuous** basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of

contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

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

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

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

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

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored **continuously** at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations.

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

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3) above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3) above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3) of the upwind level and in preventing visible dust migration.

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

A-14 ODOR CONTROL PLAN

Based on the primary constituents of concern, metals and BAPs, having no odor, as well as the field experience that odors were not observed on-site, odors are not anticipated to be an issue or concern.

This odor control plan is capable of controlling emissions of nuisance odors off-site. If nuisance odors are identified at the Site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will

not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the property owner's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

A-15 OTHER NUISANCES

If buried drums or previously unknown underground storage tanks are encountered during soil excavation activities, excavation will cease and NYSDEC will be immediately notified. All drums and/or underground storage tanks encountered will be evaluated and a removal plan will be submitted for NYSDEC approval. Appropriately trained personnel will excavate all of the drums and/or underground storage tanks while following all applicable federal, state, and local regulations. Removed drums and storage tanks will be properly characterized and disposed off-site. The soil/fill surrounding the buried drums or underground storage tanks will be considered as potentially contaminated and will be stockpiled and characterized.

A-16 HEALTH AND SAFETY PROCEDURES FOR INTRUSIVE ACTIVITIES

Contractors engaged in subsurface construction activities (e.g., foundation and utility workers) will be required to implement appropriate health and safety procedures. These procedures will involve, at a minimum, donning adequate personal protective equipment, performing appropriate air monitoring, and implementing other engineering controls as necessary to mitigate potential ingestion, inhalation and contact with residual constituents in the soils. A site-specific, activity-specific health and safety plan will be prepared for the Site by the Construction Contractor (Contactor). Recommended health and safety procedures include the following:

- While conducting invasive work at the Site, the Contractor should provide working conditions on each operation that shall be as safe and healthful as the nature of that operation permits. The Contractor shall comply with all New York State Department of Labor regulations and published recommendations and regulations promulgated under the Federal Occupational Safety and Health Act of 1970 and the Construction Safety Act of 1969, as amended, and with laws, rules, and regulations of other authorities having jurisdiction. Compliance with governmental requirements is mandated by law and considered only a minimum level of safety performance. The Contractor shall ensure that all work is performed in accordance with recognized safe work practices.
- The Contractor is responsible for the safety of the Contractor's employees, the public and all other persons at or about the Site of the work. The Contractor is solely responsible for the adequacy and safety of all construction methods, materials, equipment and the safe prosecution of the work.
- The Contractor shall stop work whenever a work procedure or a condition at a work Site is deemed unsafe by the safety professional or his trained safety representative(s).
- The Contractor shall employ a properly qualified safety professional whose duties shall be to initiate, review and implement measures for the protection of health and prevention of accidents. The Contractor shall also employ safety

representative(s) whose duties, working under the direct supervision of the safety professional, shall include the implementation the safety program for the work at the Site.

§ Recognition as a safety professional shall be based on a minimum of certification by the Board of Certified Safety Professionals as a Certified Safety Professional and 5 years of professional safety management experience in the types of construction and conditions expected to be encountered on the Site.

§ The safety representative(s) who will work under the direction of the safety professional will have appropriate qualifications. The required qualifications shall include a minimum of: five years of relevant construction experience, two years of which were exclusively in construction safety management; successful completion of a 30-hour OSHA Construction Safety and Health training course; 40-hour training as per 29 CFR 1926.65, Hazardous Waste Operations and Emergency Response; and, if confined space entry is required, training as per 29 CFR 1910.146, Permit-Required Confined Spaces.

§ The safety professional shall visit and audit all work areas as often as necessary but at least once each week and shall be available for consultation whenever necessary.

§ The safety representative(s) must be at the job site full-time (a minimum of 8 hours per working day) whenever work is in progress. When multiple shift work is in progress more than one safety representative may be required.

§ The safety professional and his safety representative(s) shall be responsible for ensuring Contractor compliance with governing laws, rules and regulations as well as of good safety practice.

§ The safety staff shall maintain and keep available safety records, up-to-date copies of all pertinent safety rules and regulations, Material Safety Data Sheets, and the Contractors' site specific health and safety plans (HASPs) and the Site emergency response plan with emergency and telephone contacts for supportive actions.

- The responsible safety professional shall sign and seal the Contractor's written site-specific HASP and the Plan shall be available to workers on Site. The Contractor shall provide copies of the HASP to the Contractors' insurer, if required.

- The safety professional and/or his trained safety representative(s) shall as a minimum:

    - Schedule and conduct safety meetings and safety training programs as required by law, the health and safety plan, and good safety practice. A specific schedule of dates of these meetings and an outline of materials to be covered shall be provided with the health and safety plan. All employees shall be instructed on the recognition of hazards, observance of precautions, of the contents of the health and safety plan and the use of protective and emergency equipment.

    - Determine that operators of specific equipment are qualified by training and/or experience before they are allowed to operate such equipment.

    - Develop and implement emergency response procedures. Post the name, address and hours of the nearest medical doctor, name and address of nearby clinics and hospitals, and the telephone numbers of the appropriate ambulance service, fire, and the police department.

    - Post all appropriate notices regarding safety and health regulations at locations that afford maximum exposure to all personnel at the job Site. Post appropriate instructions and warning signs in regard to all hazardous areas or conditions that cannot be eliminated. Identification of these areas shall be based on experience, on-site surveillance, and severity of hazard. Such signs shall not be used in place of appropriate workplace controls.

    - Ascertain by personal inspection that all safety rules and regulations are enforced. Make inspections at least once a shift to ensure that all machines, tools and equipment are in a safe operating condition; and that all work areas are free of hazards. Take necessary and timely corrective

actions to eliminate all unsafe acts and/or conditions, and submit to the Engineer each day a copy of his findings on the inspection check list report forms established in the health and safety plan.

- Provide safety training and orientation to authorized visitors to ensure their safety while occupying the job Site.
- Perform all related tasks necessary to achieve the highest degree of safety that the nature of the work permits.
- The Contractor shall have proper safety and rescue equipment, adequately maintained and readily available, for foreseeable contingencies. This equipment may include such applicable items as: proper fire extinguishers, first aid supplies, safety ropes and harnesses, stretchers, water safety devices, oxygen breathing apparatus, resuscitators, gas detectors, oxygen deficiency indicators, combustible gas detectors, etc. This equipment should be kept in protected areas and checked at scheduled intervals. A log shall be maintained indicating who checked the equipment, when it was checked, and that it was acceptable. This equipment log shall be updated monthly and be submitted with the monthly report. Equipment that requires calibration shall have copies of dated calibration certificates on-site. Substitute safety and rescue equipment must be provided while primary equipment is being serviced or calibrated.
- All personnel employed by the Contractor or his subcontractors or any visitors whenever entering the job Site, shall be required to wear appropriate personal protection equipment required for that area. The Contractor may remove from the Site any person who fails to comply with this or any other safety requirement.

A-17 STANDARD OPERATING PROCEDURES

SCREENING SOIL SAMPLES

This guideline presents a method for screening soil samples. During soil/fill excavation activities, a photo ionization detection (PID) or flame ionization detector (FID) will be used to monitor the excavated soils. The monitoring results provide criteria for sampling of soil potentially impacted by volatile organic substances.

Equipment Requirements

- 40 ml. precleaned and prelabeled glass VOA vials with teflon-lined septum caps.
- Ice and ice chest.
- Wide mouthed glass jars with screw caps.
- Aluminum foil.
- Photoionization detector.

Methodology

- During excavation, the excavated soil will be examined for contaminated (stained or odorous) soils. If present, these areas will be sampled first. If no staining or odor is observed, collect samples from each stockpile at random locations. The observations made during excavation, as well as where and why samples were collected, will be recorded (i.e., in a field log), made available upon request, and included in the FER.
- Place the sample in a labeled wide-mouthed glass jar. Seal the jar with aluminum foil and a screw top cap.
- Keep these samples at as near to 70°F as possible.

- Check head space of each sample for any organic vapor present by inserting the probe of the PID through the aluminum foil seal.

- The soil sample from each excavation location will be noted where VOA's were detected and removal of the contaminated soil will be coordinated per project requirements.

COLLECTING COMPOSITE SAMPLES

This guideline addresses the procedure to be used when soil samples are to be composited in the field.

- Transfer equal portions of soil from individual split-spoon samples to a large precleaned stainless steel (or Pyrex glass) mixing bowl.

- Thoroughly mix (homogenize) and break up the soil using a stainless steel scoop or trowel.

- Spread the composite sample evenly on a stainless steel tray and quarter the sample.

- Discard alternate (i.e. diagonal) quarters and, using a small stainless steel scoop or spatula, collect equal portions of subsample from the remaining two (2) quarters until the amount required for the composite sample is acquired. Transfer these subsamples to a precleaned stainless steel (or glass Pyrex) mixing bowl and re-mix.

- Transfer the composite sample to an appropriate precleaned jars provided by the laboratory and label. Store any excess sample from the stainless steel tray in separate, precleaned, sample containers, and submit to the laboratory for holding in case additional analysis is necessary.

- Decontaminate all stainless steel (or glass Pyrex) trays, spoons, spatulas, and bowls in accordance with the sampling equipment decontamination procedure provided.

A-18 QUALITY ASSURANCE / QUALITY CONTROL

All characterization samples collected during redevelopment activities will be analyzed using EPA-approved analytical methods using the most recent edition of the EPA's "Test Methods for Evaluating Solid Waste" (SW-846). Methods for Chemical Analysis of Water and Wastes "(EPA 600/4-79-020), Standard Methods for Examination of Waste and Wastewater" (prepared and published jointly by the American Public Health Association, American Waterworks Association and Water Pollution Control Federation).

The laboratory proposed to perform the analyses will be certified through the New York State Department of Health Environmental Laboratory Approval Program (ELAP) to perform analysis and Solid Waste and Hazardous Waste Analytical testing on all media to be sampled during this investigation. The laboratory will maintain this certification for the duration of the project.

The laboratory will perform the analysis of samples in accordance with the most recent NYSDEC Analytical Services Protocol (ASP). Analytical data will be submitted in complete ASP Category B data packs including documentation of laboratory QA/QC procedures that will provide legally defensible data in a court of law. If requested, the Category B data packs will be submitted to the NYSDEC. In addition, the analytical data packs shall also be formatted such that they are consistent with EqUIS,

Procedures for chain of custody, laboratory instrumentation calibration, laboratory analyses, reporting of data, internal quality control, and corrective actions shall be followed as per SW-846 and as per the laboratory's Quality Assurance Plan. Where appropriate, trip blanks, field blanks, field duplicates, and matrix spike, matrix spike duplicate shall be performed at a rate of 10% and will be used to assess the quality of the data. The laboratory's in-house QA/QC limits will be utilized whenever they are more stringent than those suggested by the EPA methods.

After receipt of analytical results, the data package will be sent to a qualified, third party, data validation specialist for evaluation. A Data Usability Summary Report (DUSR) will

be prepared. The DUSR will provide a determination of whether or not the data meets the project specific criteria for data quality and data use.

A Quality Assurance Officer (QAO), experienced in data validation and laboratory QA/QC measures will be assigned to the project. The QAO contact information will be provided to NYSDEC upon request.

Table A-1
Sample Frequency and Analysis for Non-Virgin Imported Soil/Fill Characterization
Former Teutonia Hall Site
Yonkers, NY

	VOCs [1]	SVOCs, PCBs/Pesticides & Metals [1]	
Soil Quantity (cubic yards)	**Discrete Samples**	**Composite**	**Discrete Samples/Composite**
0-50	1	1	3-5 discrete samples from different locations in the fill will comprise a composite sample for analysis.
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
>1000	Add an additional 2 VOC and 1 composite for each additional 1000 cubic yards or consult with DER.		

[1] Specific analyte lists provided in DER -10 Appendix 5

Table A-2
Allowable Constituent Levels for Imported Soil/Fill

Former Teutonia Hall Site
Yonkers, NY

Contaminant	Unrestricted Use Allowable Maximum Concentration
Metals	
Arsenic	13
Barium	350
Beryllium	7.2
Cadmium	2.5
Chromium, Hexavalent [1]	1 [3]
Chromium, Trivalent [1]	30
Copper	50
Cyanide	27
Lead	63
Manganese	1600
Mercury (total)	0.18
Nickel	30
Selenium	3.9
Silver	2
Zinc	109
PCBs/Pesticides	
2,4,5-TP Acid (Silvex)	3.8
4,4'-DDE	0.0033 [3]
4,4'- DDT	0.0033 [3]
4,4'- DDD	0.0033 [3]
Aldrin	0.005
Alpha-BHC	0.02
Beta-BHC	0.036
Chlordane (alpha)	0.094
Delta BHC	0.04
Dibenzofuran	7
Dieldrin	0.005
Endosulfan I	2.4 [2]
Endosulfan II	2.4 [2]
Endosulfan Sulfate	2.4 [2]
Endrin	0.014
Heptachlor	0.042
Lindane	0.1
Total Polychlorinated biphenyls	0.1
Semivolatiles	
Acenaphthene	20
Acenapthylene	100
Anthracene	100
Benz(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	0.8
Chrysene	1
Dibenz(a,h)anthracene	0.33 [3]
Fluoranthene	100
Fluorene	30
Indeno(1,2,3-cd)pyrene	0.5
m-Cresol	0.33 [3]
Naphthalene	12
o-Cresol	0.33 [3]

Table A-2
Allowable Constituent Levels for Imported Soil/Fill

Former Teutonia Hall Site
Yonkers, NY

Contaminant	Unrestricted Use Allowable Maximum Concentration
p-Cresol	0.33
Pentachlorophenol	0.8 [3]
Phenanthrene	100
Phenol	0.33 [3]
Pyrene	100
Volatiles	
1,1,1-Trichloroethane	0.68
1,1-Dichloroethane	0.27
1,1-Dichloroethene	0.33
1,2-Dichlorobenzene	1.1
1,2-Dichloroethane	0.02
cis-1,2-Dichloroethene	0.25
trans-1,2-Dichloroethene	0.19
1,3-Dichlorobenzene	2.4
1,4-Dichlorobenzene	1.8
1,4-Dioxane	0.1 [3]
Acetone	0.05
Benzene	0.06
Butylbenzene	12
Carbon tetrachloride	0.76
Chlorobenzene	1.1
Chloroform	0.37
Ethylbenzene	1
Hexachlorobenzene	0.33 [3]
Methyl ethyl ketone	0.12
Methyl tert-butyl ether	0.93
Methylene chloride	0.05
n-Propylbenzene	3.9
sec-Butylbenzene	11
tert-Butylbenzene	5.9
Tetrachloroethene	1.3
Toluene	0.7
Trichloroethene	0.47
1,2,4-Trimethylbenzene	3.6
1,3,5- Trimethylbenzene	8.4
Vinyl chloride	0.02
Xylene (mixed)	0.26

NOTES:

All soil cleanup objectives (SCOs) are in units of parts per million (ppm).

[1] The SCO for Hexavalent or Trivalent Chromium is considered to be met if the analysis for the total species of this contaminant is below the SCO for Hex Chrom.

[2] The SCO is the sum of endosulfan I, endosulfan II, and endosulfan sulfate.

[3] For consitituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the Track 1 SCO value.

XREFS: IMAGES:F:\5633002\CADD\image.jpg F:\5633002\CADD\SITE.jpg
User:DEWYER Spec:PIRNIE STANDARD File:F:\5633002\CADD\RI Files\5633F014.DWG Scale:1:1 Date:09/22/2011 Time:14:39 Layout:Layout1

PROJECT NO. 5633-002

ARCADIS

YONKERS, NEW YORK
FORMER TEUTONIA HALL SITE
41 TO 55 BUENA VISTA AVE.

PLANNED TRUCK ROUTE

ARCADIS U.S., INC.
SEPTEMBER 2011
FIGURE A1

ARCADIS

Appendix **B**

Health and Safety Plan

ARCADIS
Infrastructure · Water · Environment · Buildings

Site Specific Health and Safety Plan

Revision 10 4/16/2012

Project Name: Former Teutonia Hall
Teutonia Buena Vista, LLC.

Project Number: 05633002.0000
Client Name: Main Street Lofts LLC
Date: 7/26/2012
Revision: 1

Approvals:

HASP Developer: Michael Nasca

HASP Reviewer: Greg Ertel

Project Manager: Ben Girard

Emergency Information

Site Address: #41, 45, 47, 51 and 53 Buena Vista Avenue
Yonkers, NY

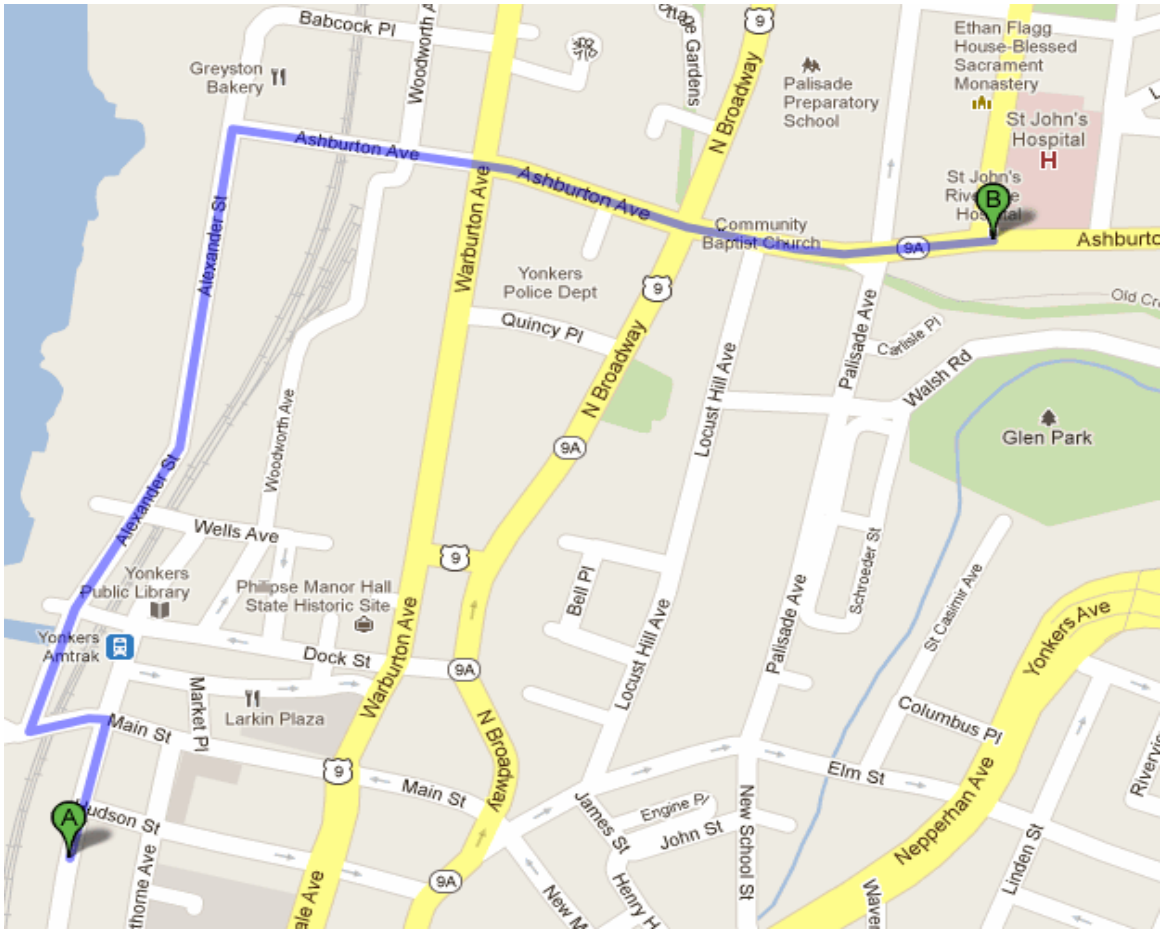
Emergency Phone Numbers:

Emergency (fire, police, ambulance)	911
Emergency (facility specific, if applicable)	
In plant phone	
Cell phone	
Guard	
Emergency Other (specify) _____	
WorkCare	1-800-455-6155
Project H&S (specify) _____	
Corporate Health and Safety	1-720-344-3500

Hospital Name and Address: St. John's Riverside Hospital
2 Park Ave.
Yonkers, NY

Hospital Phone Number: 1-914-964-7300

Route to the Hospital



A 53 Buena Vista Ave, Yonkers, NY 10701

	1. Head **north** on **Buena Vista Ave** toward **Hudson St**	go 0.1 mi total 0.1 mi
↰	2. Take the 1st left onto **Main St**	go 253 ft total 0.1 mi
↱	3. Take the 1st right onto **Van Der Donck St**	go 453 ft total 0.2 mi
	4. Continue onto **Alexander St** About 59 secs	go 0.3 mi total 0.6 mi
↱	5. Turn right onto **Ashburton Ave** Destination will be on the left About 2 mins	go 0.5 mi total 1.0 mi

B **St John's Riverside Hospital**
St John's Riverside Hospital, 2 Park Avenue, Yonkers, NY 10703

General Information

Site Type (select all applicable):

☐ Active	☐ Utility
☑ Inactive	☐ Landfill
☐ Secure	☐ Roadway
☐ Unsecured	☐ Railroad
☐ Residential	☐ Marine
☐ Retail	☐ Remote Area
☑ Commercial	☐ Unknown
☑ Industrial	☐ Other (specify): _____
☐ Government	

Surrounding Area and Topography (select one):

☑ Surrounding area and topography are presented in the project work plan
☐ Surrounding area and topography (*briefly describe*):

Site Background (select one):

☐ Site background is presented in the project work plan
☑ Site background (*briefly describe)* :
The overall scope of work for the project includes:

- Removal of 3 tanks (2 aboveground, 1 underground), oversight by ARCADIS

- Building Demolition, oversight by ARCADIS

- Pre-characterization of soil (in-situ sampling), performed by ARCADIS

- Excavation of soil to 20-25' below ground surface (removal of contaminants), oversight by ARCADIS

- Soil and Soil Vapor Sampling at bottom of final excavation limits (to verify removal of contaminants), performed by ARCADIS

- Construction, oversight by ARCADIS

Project Tasks
The following tasks are identified for this project:

Examples: "Drilling/soil sampling", "Surveying", "Inspections"

1 General Site Work
2 Contractor Oversight during Tank Removal and Demolition
3 In-Situ Soil Sampling (pre-characterization)
4 Post Excavation Soil & Soil Vapor Sampling
5 Construction Oversight

☐ Subcontractor supplied H&S information is attached

☑ Utility clearance required.

Comments:

Roles and Responsibilities

	Name	*Role*	*Additional Responsibilities (Describe)*
1	Ben Girard	PM	
2	TBD	TM	
3	Jeff Dekoski	Field Lead	
4	TBD	SSO	
5			
6			

Training

All ARCADIS employees are required to have the following training:	*Selected ARCADIS employees are required to have the following additional training:*	Names or Numbers from above
☑ 40 hr HAZWOPER w current refresh.	☐ Not applicable	
☐ 24 hr HAZWOPER	☑ First aid/CPR/BBP	
☐ 10 hr Construction	☐ 30 hr Construction	
☐ HazMat #1 (Ground/Air/MOT)	☐ 10 hr Construction	
☐ HazMat #4 (MOT)	☑ HazMat #1 (Gr./Air/MOT)	
☐ HazCom/Emergency Action Plan	☐ HazMat #4 (MOT)	
☑ H&S Orientation (classroom); or	☐ Confined space entrant	
☐ H&S Orientation (on-line)	☐ Confined space rescue	
☐ PPE	☐ Excavation CP	
☐ Respiratory protection	☐ Electrical (NFPA 70E)	
☐ Smith System (hands on)	☐ Lockout/Tagout	
☑ Smith System (on-line)	☐ H&S Orientation (class)	
☐ OTS/eRailsafe	☐ OTS/eRailsafe	
☐ Client specific:	☐ Smith Sys. (hands on)	
	☐ Boating safety	
☐ Other:	☐ Other:	

Hazard Analysis

Risk Assessment Matrix		Likelihood Ratings** (likelihood that incident would occur)			
Consequences Ratings*		A	B	C	D
People	Property	0 Almost impossible	1 Possible but unlikely	2 Likely to happen	3 Almost certain to happen
1 - Slight or no health	Slight or no damage	0 - Low	1 - Low	2 - Low	3 - Low
2 - Minor health effect	Minor damage	0 - Low	2 - Low	4 - Medium	6 - Medium
3 - Major health effect	Local damage	0 - Low	3 - Low	6 - Medium	9 - High
4 - Fatalities	Major damage	0 - Low.	4 - Medium.	8 - High	12 - High

Division
Environment

Business Unit
REM

Task 1: General Site Work

Hazardous Activity #1

General-Noise - exposure when working in areas of loud equipment or machinery

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-	Driving	-	Electrical	-
Environmental	-	Gravity	-	Mechanical	-	Motion	-
Personal Safety	-	Pressure	-	Radiation	-	Sound	M

Overall Unmitigated Risk: Medium Mitigated Risk: Low if utilizing:

Primary Controls: TRACK H&S Standards Engineering Controls PPE (see HASP "PPE" section)

Secondary Controls: See HASP "Monitoring" section Job Briefing/Site Awareness Admin. Controls

Hazardous Activity #2

Field-Mobilization/Demobilization - from a site

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	L	Driving	M	Electrical	-
Environmental	-	Gravity	M	Mechanical	-	Motion	L
Personal Safety	-	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: Medium Mitigated Risk: Low if utilizing:

Primary Controls: TRACK Field H&S Handbook Engineering Controls

Secondary Controls: JSAs Job Briefing/Site Awareness PPE (see HASP "PPE" section) Admin. Controls

Hazardous Activity #3

General-Housekeeping - poor

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-	Driving	-	Electrical	-
Environmental	-	Gravity	M	Mechanical	-	Motion	-
Personal Safety	M	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: Medium Mitigated Risk: Low if utilizing:

Primary Controls: TRACK Housekeeping Inspections

Secondary Controls: JSAs Job Briefing/Site Awareness

Hazardous Activity #4

Field-Ambient environment - exposure heat, cold, sun, weather, etc

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-	Driving	M	Electrical	L
Environmental	L	Gravity	H	Mechanical	-	Motion	L
Personal Safety	M	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: Medium Mitigated Risk: Medium if utilizing:

Primary Controls:	TRACK PPE (see HASP "PPE" section) Field H&S Handbook
Secondary Controls:	H&S Standards Engineering Controls Admin. Controls Specialized Equipment

Risk Assessment Matrix		Likelihood Ratings** (likelihood that incident would occur)			
Consequences Ratings*		A	B	C	D
People	Property	0 Almost impossible	1 Possible but unlikely	2 Likely to happen	3 Almost certain to happen
1 - Slight or no health	Slight or no damage	0 - Low	1 - Low	2 - Low	3 - Low
2 - Minor health effect	Minor damage	0 - Low	2 - Low	4 - Medium	6 - Medium
3 - Major health effect	Local damage	0 - Low	3 - Low	6 - Medium	9 - High
4 - Fatalities	Major damage	0 - Low.	4 - Medium.	8 - High	12 - High

Task 2: Contractor Oversight during Tank Removal and Demolition

Hazardous Activity #1

Field-Equipment - working on ground in the vicinity of heavy equipment

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-	Driving	-	Electrical	-
Environmental	-	Gravity	H	Mechanical	H	Motion	H
Personal Safety	-	Pressure	-	Radiation	-	Sound	M

Overall Unmitigated Risk: High Mitigated Risk: Medium. if utilizing:

Primary Controls: TRACK JSAs Job Briefing/Site Awareness Site Awareness

Secondary Controls: HASP H&S Standards Field H&S Handbook Engineering Controls Admin. Controls Specialized Equipment Inspections

Hazardous Activity #2

Field-Contaminated media (contact with impacted soil, water, air, sediment, etc)

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	H	Driving	-	Electrical	-
Environmental	M	Gravity	-	Mechanical	-	Motion	-
Personal Safety	-	Pressure	-	Radiation	M	Sound	-

Overall Unmitigated Risk: High Mitigated Risk: Low if utilizing:

Primary Controls: TRACK JSAs Engineering Controls PPE (see HASP "PPE" section)

Secondary Controls: H&S Standards HASP Admin. Controls HAZWOPER Training

Hazardous Activity #3

Field-Excavation - soil removal, installation or removal piping, tanks or utilities, geologic investigations, etc

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-	Driving	-	Electrical	-
Environmental	-	Gravity	H	Mechanical	H	Motion	H
Personal Safety	-	Pressure	-	Radiation	-	Sound	M

Overall Unmitigated Risk: High Mitigated Risk: Medium if utilizing:

Primary Controls: TRACK H&S Standards Excavation Awareness Training Excavation Competent Person Training (designated person) Engineering Controls

Secondary Controls: JSAs HASP Job Briefing/Site Awareness Client Training/Briefing Cont/Emerg. Planning PPE (see HASP "PPE" section) Specialized Equipment Housekeeping Inspections

Hazardous Activity #4

Field-Demolition activities

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	M	Driving	-	Electrical	H
Environmental	-	Gravity	M	Mechanical	M	Motion	M
Personal Safety	-	Pressure	-	Radiation	-	Sound	H

Overall Unmitigated Risk: High Mitigated Risk: Low if utilizing:

Primary Controls: TRACK 10 hr Construction Training Engineering Controls JSAs

Secondary Controls: HASP H&S Standards Job Briefing/Site Awareness Cont/Emerg. Planning Admin. Controls Specialized Equipment Housekeeping Inspections

Risk Assessment Matrix		Likelihood Ratings** (likelihood that incident would occur)			
Consequences Ratings*		A	B	C	D
People	Property	0 Almost impossible	1 Possible but unlikely	2 Likely to happen	3 Almost certain to happen
1 - Slight or no health	Slight or no damage	0 - Low	1 - Low	2 - Low	3 - Low
2 - Minor health effect	Minor damage	0 - Low	2 - Low	4 - Medium	6 - Medium
3 - Major health effect	Local damage	0 - Low	3 - Low	6 - Medium	9 - High
4 - Fatalities	Major damage	0 - Low.	4 - Medium.	8 - High	12 - High

Task 3: **In-Situ Soil Sampling (pre-characterization)**

Hazardous Activity #1

Field-Sampling - manual soil sampling (hand auger, trowel, etc)

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	M	Driving	-	Electrical	-
Environmental	L	Gravity	L	Mechanical	-	Motion	M
Personal Safety	-	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: Medium Mitigated Risk: Low if utilizing:

Primary Controls: TRACK JSAs PPE (see HASP "PPE" section) Job Rotation Job Briefing/Site Awareness

Secondary Controls: Inspections Specialized Equipment

Hazardous Activity #2

Chemical-Corrosives - working with or exposure to corrosives in laboratory work, sample bottle preservatives, decon chemicals, etc

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	H	Driving	-	Electrical	-
Environmental	L	Gravity	-	Mechanical	-	Motion	-
Personal Safety	-	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: Medium Mitigated Risk: Low if utilizing:

Primary Controls: TRACK JSAs Engineering Controls PPE (see HASP "PPE" section)

Secondary Controls: H&S Standards Job Briefing/Site Awareness Hazcom Training MSDS (see also HASP Hazcom section) Admin. Controls Specialized Equipment Housekeeping

Hazardous Activity #3

Field-HazMat and wastes - handling and storage at site locations (investigation derived wastes, process wastes, etc)

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	M	Driving	-	Electrical	-
Environmental	M	Gravity	-	Mechanical	-	Motion	-
Personal Safety	-	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: Medium Mitigated Risk: Low if utilizing:

Primary Controls: TRACK JSAs Work Plan Engineering Controls PPE (see HASP "PPE" section)

Secondary Controls: Hazcom Training HAZWOPER Training Cont/Emerg. Planning Admin. Controls Specialized Equipment Housekeeping Inspections

Hazardous Activity #4

General-Shipping - HazMat samples to laboratories for analysis

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	M	Driving	-	Electrical	-

Environmental	M	Gravity	-	Mechanical	-	Motion	-
Personal Safety	-	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: Medium Mitigated Risk: Medium if utilizing:

Primary Controls: TRACK HazMat #1 Training Shipping Determination Admin. Controls Inspections

Secondary Controls: PPE (see HASP "PPE" section) Housekeeping

Risk Assessment Matrix		Likelihood Ratings** (likelihood that incident would occur)			
Consequences Ratings*		A	B	C	D
People	Property	0 Almost impossible	1 Possible but unlikely	2 Likely to happen	3 Almost certain to happen
1 - Slight or no health	Slight or no damage	0 - Low	1 - Low	2 - Low	3 - Low
2 - Minor health effect	Minor damage	0 - Low	2 - Low	4 - Medium	6 - Medium
3 - Major health effect	Local damage	0 - Low	3 - Low	6 - Medium	9 - High
4 - Fatalities	Major damage	0 - Low.	4 - Medium.	8 - High	12 - High

Task 4: Post Excavation Soil & Soil Vapor Sampling

Hazardous Activity #1

Field-Sampling - subslab vapor screening/sampling

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	M	Driving	-	Electrical	M
Environmental	-	Gravity	L	Mechanical	M	Motion	L
Personal Safety	-	Pressure	L	Radiation	-	Sound	M

Overall Unmitigated Risk: Medium Mitigated Risk: Low if utilizing:

Primary Controls: TRACK JSAs Engineering Controls PPE (see HASP "PPE" section) See HASP "Monitoring" section

Secondary Controls: Job Briefing/Site Awareness Admin. Controls Work Plan

Hazardous Activity #2

Field-Excavations - working adjacent to or within trenches and excavations

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-	Driving	-	Electrical	-
Environmental	-	Gravity	H	Mechanical	-	Motion	-
Personal Safety	-	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: High Mitigated Risk: Medium. if utilizing:

Primary Controls: TRACK Competent Person Required (designated person) H&S Standards Excavation Awareness Training Engineering Controls

Secondary Controls: JSAs Job Briefing/Site Awareness Specialized Equipment Housekeeping Inspections

Hazardous Activity #3

Field-Walking or working below elevated work or construction operations

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-	Driving	-	Electrical	-
Environmental	-	Gravity	H	Mechanical	-	Motion	-
Personal Safety	H	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: High Mitigated Risk: Medium. if utilizing:

Primary Controls: TRACK Engineering Controls PPE (see HASP "PPE" section)

Secondary Controls: JSAs H&S Standards Job Briefing/Site Awareness Admin. Controls Inspections

Hazardous Activity #4

Field-Walking - ascending and descending steep slopes

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-	Driving	-	Electrical	-
Environmental	-	Gravity	M	Mechanical	-	Motion	-
Personal Safety	-	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk:	Medium		Mitigated Risk: Medium	if utilizing:
Primary Controls:	TRACK	Field H&S Handbook	PPE (see HASP "PPE" section)	Job Briefing/Site Awareness
Secondary Controls:	JSAs	Specialized Equipment		

Risk Assessment Matrix		Likelihood Ratings** (likelihood that incident would occur)			
Consequences Ratings*		A	B	C	D
People	Property	0 Almost impossible	1 Possible but unlikely	2 Likely to happen	3 Almost certain to happen
1 - Slight or no health	Slight or no damage	0 - Low	1 - Low	2 - Low	3 - Low
2 - Minor health effect	Minor damage	0 - Low	2 - Low	4 - Medium	6 - Medium
3 - Major health effect	Local damage	0 - Low	3 - Low	6 - Medium	9 - High
4 - Fatalities	Major damage	0 - Low.	4 - Medium.	8 - High	12 - High

Task 5: Construction Oversight

Hazardous Activity #1

Field-Construction- general construction/renovation activities

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	M	Driving	-	Electrical	H
Environmental	M	Gravity	-	Mechanical	-	Motion	M
Personal Safety	-	Pressure	-	Radiation	-	Sound	H

Overall Unmitigated Risk: High Mitigated Risk: Medium if utilizing:

Primary Controls: TRACK H&S Standards 10 hr Construction Training Engineering Controls PPE (see HASP "PPE" section)

Secondary Controls: JSAs Field H&S Handbook Job Briefing/Site Awareness Cont/Emerg. Planning Admin. Controls Specialized Equipment Housekeeping Inspections

Hazardous Activity #2

Field-Security - work activities in dangerous/ unsafe areas

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-	Driving	-	Electrical	-
Environmental	-	Gravity	-	Mechanical	-	Motion	-
Personal Safety	M	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: Medium Mitigated Risk: Low if utilizing:

Primary Controls: TRACK Cont/Emerg. Planning Communications Plan Admin. Controls

Secondary Controls: JSAs Job Briefing/Site Awareness

Hazardous Activity #3

General-Vehicle -motor vehicle operation (all types on roadways)

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological	-	Chemical	-	Driving	M	Electrical	-
Environmental	-	Gravity	-	Mechanical	-	Motion	-
Personal Safety	-	Pressure	-	Radiation	-	Sound	-

Overall Unmitigated Risk: Medium Mitigated Risk: Low if utilizing:

Primary Controls: TRACK Smith System (on line) Inspections

Secondary Controls: JSAs Admin. Controls

Hazardous Activity #4

None

Hazard Types (unmitigated ranking H-High, M-Medium, L-Low):

Biological		Chemical		Driving		Electrical	
Environmental		Gravity		Mechanical		Motion	
Personal Safety		Pressure		Radiation		Sound	

Overall Unmitigated Risk: Not Ranked Mitigated Risk: Not Ranked if utilizing:

Primary Controls:

Secondary Controls:

Hazard Communication (HazCom)

List the chemicals anticipated to be used by ***ARCADIS*** *on this project subject to HazCom requirements.*
(Modify quantities as needed)

	Acids/Bases	Qty
☑	Not applicable	
☐	Hydrochloric acid	<500 ml
☐	Nitric acid	<500 ml
☐	Sulfuric acid	<500 ml
☐	Sodium hydroxide	<500 ml
☐	Zinc acetate	<500 ml
☐	Ascorbic acid	<500 ml
☐	Acetic acid	<500 ml
☐	Other:	
	_____	
	_____	
	_____	
	_____	

	Decontamination	Qty
☐	Not applicable	
☑	Alconox	≤ 5 lbs
☐	Liquinox	≤ 1 gal
☐	Acetone	≤ 1 gal
☐	Methanol	≤ 1 gal
☐	Hexane	≤ 1 gal
☐	Isopropyl alcohol	≤ 4 gal
☐	Nitric acid	≤ 1 L
☐	Other:	
	_____	
	_____	
	_____	
	_____	

	Calibration	Qty.
☑	Not applicable	
☐	Isobutylene/air	1 cyl
☐	Methane/air	1 cyl
☐	Pentane/air	1 cyl
☐	Hydrogen/air	1 cyl
☐	Propane/air	1 cyl
☐	Hydrogen sulfide/air	1 cyl
☐	Carbon monoxide/air	1 cyl
☐	pH standards (4,7,10)	≤ 1 gal
☐	Conductivity standards	≤ 1 gal
☐	Other:	
	_____	
	_____	

	Fuels	Qty.
☑	Not applicable	
☐	Gasoline	≤ 5 gal
☐	Diesel	≤ 5 gal
☐	Kerosene	≤ 5 gal
☐	Propane	1 cyl
☐	Other:	
	_____	

	Kits	Qty.
☑	Not applicable	
☐	Hach (specify):	_____ 1 kit
☐	DTECH (specify):	_____ 1 kit
☐	EPA 5035 Soil (specify kit):	_____ 1 kit
☐	Other:	
	_____	_____
	_____	_____

	Remediation	Qty.
☑	Not applicable	
☐	_____	
☐	_____	
☐	_____	
☐	_____	
☐	_____	

	Other:	Qty.
☑	Not applicable	
☐	Spray paint	≤ 6 cans
☐	WD-40	≤ 1 can
☐	Pipe cement	≤ 1 can
☐	Pipe primer	≤ 1 can
☐	Mineral spirits	≤ 1 gal

		Qty.
☐	_____	
☐	_____	
☐	_____	
☐	_____	
☐	_____	
☐	_____	

Material safety data sheets (MSDSs) must be available to field staff. Manufacturer supplied MSDSs are preferred, however, if the manufacturer's MSDS can not be located, use the source provided below. Indicate below how MSDS information will be provided:

☑ Not applicable
☐ Printed copy in company vehicle
☐ Printed copy in the project trailer/office
☐ Printed copy attached
☐ Electronic copy on field computer

☐ Bulk quantities of the following materials will be stored: _____

Contact the project H&S contact for information in determining code and regulatory requirements associated with bulk storage of materials.

Monitoring

☐ Chemical air monitoring is not required for this project.

For projects requiring air monitoring, list the relevant constituents representing a hazard to site workers.

Constituent	Max. Conc.	Units	TWA	Units	STEL	Units	IDLH	Units	LEL/UEL (%)	VD Air=1	VP (mm Hg)	IP (eV)
PCE	28.02	ppm	25	p	100	p	150	p,N	NA/NA	5.7	14	9.32
TCE	1.69	ppm	10	p	25	p	1000	p,N	8/10.5	4.53	58	9.45
None			9999	-	0	-	0	-	0	0	0	0
None			9999	-	0	-	0	-	0	0	0	0
None			9999	-	0	-	0	-	0	0	0	0
None			9999	-	0	-	0	-	0	0	0	0

Notes: TWAs are ACGIH 8 hr-TLVs unless noted.
p-ppm s- skin r- resipirable
m-mg/m3 c-ceiling i-inhalable
c2- ceiling (2 hr) "9999" - NA N-NIOSH 10 hr REL
se-sensitizer O-OSHA PEL
"#N/A" -Constituent is not in database, manually enter information

Monitoring Equipment and General Protocols

Air monitoring is required for any task or activity where employees have potential exposure to vapors or particulates above the TWA. Action levels below are appropriate for most situations. Contact the project H&S contact for all stop work situations. Select monitoring frequency and instruments to be used.

Monitoring Frequency: 30 Minute intervals
Indicator Tube/Chip Frequency: Indicator tube/chip monitoring not required

	Instrument	Action Levels	Actions
☑	Photoionization Detector	< 16.799	Continue work
		16.799 - 33.598	Sustained >5 min. continuous monitor, review eng. controls and PPE, proceed with caution
	Lamp (eV): 9.8	> 33.598	Sustained >5 min. stop work, contact SSO
☐	Flame Ionization Detector (FID)	< 0.0	Continue work
		0.0 - 0.0	Sustained >5 min. continuous monitor, review eng. controls and PPE, use caution
		> 0.0	Sustained >5 min. stop work, contact SSO
☐	LEL/O2 Meter	0-10% LEL	Continue work
		>10-25% LEL	Continuous monitor, review eng. controls, proceed with caution
		>25% LEL	Stop work, evacuate, contact SSO
		19.5%-23.5% O2	Normal, continue work
		<19.5% O2	O2 deficient, stop work, evacuate, cont. SSO
		>23.5% O2	O2 enriched, stop work, evacuate, contact SSO
☐	Indicator: ☐tube ☐chip	≤PEL/TLV	Continue work
		>PEL/TLV	Stop work, review eng. controls and PPE, contact SSO
	Compound(s):		
☐	Particulate Monitor (mists, aerosols, dusts in mg/m^3)	< 2.5	Continue work
		2.5 - 5.00	Use engineering controls, monitor continuously
		> 5.00	Stop work, review controls, contact SSO
☐	Other:	Specify:	Specify:

Personal Protective Equipment (PPE)

See JSA for the task being performed for PPE requirements. *If the work is not conducted under a JSA, refer to the governing document for PPE requirements. At a minimum, the following checked PPE is required for* *all tasks during field work* *not covered by a JSA on this project:*

Level D or Level D Modified:

☑ Hard hat	☐ Snake chaps/guards	☐ Coveralls:	Specify Type:
☑ Safety glasses	☐ Briar chaps	☐ Apron:	
☐ Safety goggles	☐ Chainsaw chaps	☐ Chem. resistant gloves:	
☐ Face shield	☐ Sturdy boot	☐ Gloves other:	
☐ Hearing protection	☑ Steel toe boot	☐ Chemical boot:	
☐ Rain suit	☐ Metatarsal boot	☐ Boot other:	
☐ Other:		☐ Traffic vest:	
		☐ Life vest:	

Task specific PPE: Level C may be required during soil vapor sampling tasks. See Attached "Level C Suplement."

Comments:

Medical Surveillance (*check all that apply*)

☑ Medical Surveillance is not required for this project.
☐ HAZWOPER medical surveillance applies to all ARCADIS site workers on the project.
☐ HAZWOPER medical surveillance applies to all subcontractors on the project.
☐ HAZWOPER medical surveillance applies to all site workers on the project except:

☐ Other medical surveillance required (describe type and who is required to participate):

☐ Client drug and/or alcohol testing required.

Hazardous Materials Shipping and Transportation (*check all that apply*)

☐ Not applicable, no materials requiring a Shipping Determination will be transported or shipped
☐ A Shipping Determination has been reviewed and provided to field staff
☐ A Shipping Determination is attached
☑ All HazMat will be transported under Materials of Trade by ARCADIS
☐ Other (specify):

Roadway Work Zone Safety (*check all that apply*)

☑ Not applicable for this project.
☐ All or portions of the work conducted under a TCP
☐ All or portions of the work conducted under a STAR Plan
☐ TCP or STAR Plan provided to field staff
☐ TCP or STAR Plan attached
☐ Other (specify):

ARCADIS Commercial Motor Vehicles (CMVs)

This section is applicable to ARCADIS operated vehicles only

☑ This project will **not** utilize CMV drivers
☐ This project will utilize CMV drivers

Site Control (*check all that apply*)

- ☐ Not applicable for this project.
- ☐ Site control protocols are addressed in JSA or other supporting document (attach)
- ☑ Maintain an exclusion zone of 25 ft. around the active work area
- ☐ Site control is integrated into the STAR Plan or TCP for the project
- ☑ Level C site control - refer to Level C Supplement attached
- ☐ Other (specify):

Decontamination (*check all that apply*)

- ☐ Not applicable for this project.
- ☐ Decontamination protocols are addressed in JSA or other governing document (attach)
- ☐ Level D work- wash hands and face prior to consuming food, drink or tobacco.
- ☑ Level D Modified work- remove coveralls and contain, wash hands and face prior to consuming food, drink or tobacco. Ensure footwear is clean of site contaminants
- ☑ Level C work - refer to the Level C supplement attached.
- ☐ Other (specify):

Sanitation *(check all that apply)*

- ☐ Mobile operation with access to off-site restrooms and potable water
- ☐ Restroom facilities on site provided by client or other contractor
- ☑ Project to provide portable toilets (1 per 20 workers)
- ☐ Potable water available on site
- ☐ Project to provide potable water (assume 1 gal./person/day)
- ☐ Project requires running water (hot and cold, or tepid) with soap and paper towels

Safety Briefings (*check all that apply*)

- ☑ Safety briefing required daily
- ☐ Safety briefing required twice a day
- ☐ Safety briefings required at the following frequency: _____
- ☑ Subcontractors to participate in ARCADIS safety briefings
- ☑ ARCADIS to participate in client/contractor safety briefings
- ☐ Other (specify):

Safety Equipment and Supplies

***Safety equipment/supply requirements are addressed in the JSA for the task being performed**. If work is not performed under a JSA, the following safety equipment is required to be present on site in good condition (Check all that apply):*

- ☑ First aid kit
- ☐ Bloodborne pathogens kit
- ☐ Fire extinguisher
- ☐ Eyewash (ANSI compliant)
- ☐ Eyewash (bottle)
- ☐ Drinking water
- ☐ Other: _____
- ☐ Insect repellent
- ☐ Sunscreen
- ☐ Air horn
- ☐ Traffic cones
- ☐ 2-way radios
- ☐ Heat stress monitor

H&S Program (*check all that apply*)

☐ H&S metrics are provided on the account level, refer to account guidance
☐ TIP required at the following frequency on this project:
Select One: _____ mhrs _____ time(s) _____ Define: _____
☐ H&S Field Assessment required at the following frequency on this project:
Select One: _____ mhrs _____ time(s) _____ Define: _____
☐ Other (specify):

List tasks anticipated for TIP activity:

_____
_____
_____
_____

Signatures

I have read, understand and agree to abide by the requirements presented in this health and safety plan. I understand that I have the absolute right to stop work if I recognize an unsafe condition affecting my work until corrected.

Printed Name	Signature	Date

Add additional sheets if necessary

☐ Subcontractor Acknowledgement Form attached

You have an absolute right to STOP WORK if unsafe conditions exist!

Attachment 1
Level C Supplement for the
Standard HASP

Level C Supplement for the Standard HASP (Revision 2, 7/14/11)

Level C Scope of Work

Describe the task(s) requiring Level C upgrade:
Although it is not anticipated, soil vapor sampling activities at the bottom of the proposed excavation limits may expose workers to contaminants of concern above threshold levels.

*Verify the following (check box if condition **does not exist** for the task(s) listed above):*

☐ NO IDLH atmospheres
☐ NO oxygen deficient atmospheres
☐ NO permit required confined spaces
☐ NO unknown contaminant atmospheres

If any of the above conditions exist, contact your project H&S contact for assistance.

Roles and Responsibilities

Identify project team members and Level C responsibilities for each member for this work:

	Employee Name	Responsibilities
1	Nicholas (Klaus) Beyrle	Field Lead
2	Michael Nasca	Field Tech
3		
4		
5		
6		
7		
8		

Training
The following training is required beyond the training specified in the HASP:

☑ Respirator use and limitations
☑ Level C PPE specific to the project
☑ Site control specific to the project
☑ Decontamination specific to the project.
☑ Project air monitoring requirements under Level C
☑ Emergency Action Plan specific to this Level C project
☐ Other (specify): _____
☐ Other (specify): _____

Training will be provided on site prior to imitation of work and documented on:

☑ Tailgate Safety Briefing Form
☑ Field Logbook
☐ Other (specify): _____

Level C Supplement for the Standard HASP (Revision 2, 7/14/11)

Level C Scope of Work

Describe the task(s) requiring Level C upgrade:
Although it is not anticipated, soil vapor sampling activities at the bottom of the proposed excavation limits may expose workers to contaminants of concern above threshold levels.

*Verify the following (check box if condition **does not exist** for the task(s) listed above):*

☐ NO IDLH atmospheres
☐ NO oxygen deficient atmospheres
☐ NO permit required confined spaces
☐ NO unknown contaminant atmospheres

If any of the above conditions exist, contact your project H&S contact for assistance.

Roles and Responsibilities

Identify project team members and Level C responsibilities for each member for this work:

	Employee Name	Responsibilities
1	Jeff Dekoski	Field Lead
2	Michael Nasca	Field Tech
3		
4		
5		
6		
7		
8		

Training
The following training is required beyond the training specified in the HASP:

☑ Respirator use and limitations
☑ Level C PPE specific to the project
☑ Site control specific to the project
☑ Decontamination specific to the project.
☑ Project air monitoring requirements under Level C
☑ Emergency Action Plan specific to this Level C project
☐ Other (specify): _____
☐ Other (specify): _____

Training will be provided on site prior to imitation of work and documented on:

☑ Tailgate Safety Briefing Form
☑ Field Logbook
☐ Other (specify): _____

Respirator Selection and Fit Testing

The following respirator is required for this project:

	APF	Permitted Fit Test
☑ Dust mask	10	QLFT
☐ Half facepiece air purifying respirator (dual cartridge)	10	QLFT
☐ Full facepiece air purifying respirator	50	QLFT
☐ Loose fitting facepiece powered air purifying respirator	25	QLFT
☐ Half facepiece powered air purifying respirator	50	QLFT
☐ Full facepiece powered air purifying respirator	1000	QNFT

Required fit test for project: ☑ Qualitative (QLFT) ☐ Quantitative (QNFT)
☑ QLFT fit test protocol attached

Cartridge Selection

The following cartridges are required for this project:
Note: Consult the manufacturer's literature for specific constituents of interest to ensure correct cartridge is selected.

Chemical:
- ☐ Multigas
- ☐ Organic vapor
- ☐ Organic vapor/acid gas
- ☐ Ammonia/methylamine
- ☐ Mercury vapor/chlorine
- ☐ Other (specify): _____

Particulate/Dust/Mists:
- ☐ P-100
- ☐ N-95
- ☐ R-95
- ☐ Other (specify): _____

Combination:
- ☐ Organic vapor/P-100
- ☐ Organic vapor/acid gas/P-100
- ☐ Ammonia/methylamine/P-100
- ☐ Mercury vapor/chlorine/P-100
- ☐ Other (specify): _____

End of Service Life Indicators (ESLIs) (aka Respirator Cartridge Change Out)

Respirator cartridge ESLIs shall be factored when selecting the appropriate cartridge. Use of warning properties such as odor and taste are not permissible practices. The ESLI shall be identified and a cartridge change out schedule established prior to start of work. Information used to establish the change out schedule will be computed using manufacturer's supplied guidance or software (see below). At a minimum, chemical cartridges will be changed out daily. For particulate filters and cartridges, replace when breathing becomes difficult or daily whichever comes first.

☑ ESLI information is attached.

Comments:

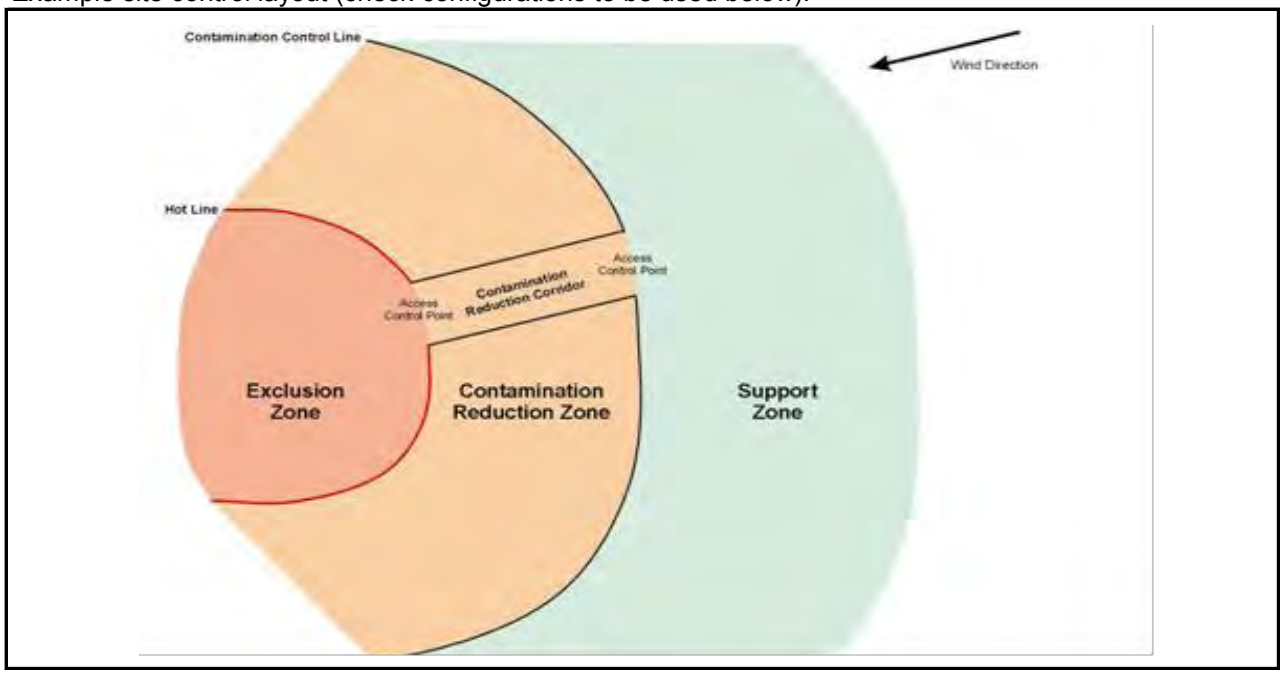
Respirator Care and Maintenance

☐ Cleaning protocol attached

All respirators will be stored in a clean and sanitary condition at all times. Each respirator used will be cleaned prior to be stored for the day. Each respirator will be inspected by the user prior to use. Any defective or worn part will be promptly replaced.

Site Control

Example site control layout (check configurations to be used below):



The size and configuration used for site control is dependent on many variables. Based on the hazards and tasks being performed, identify site control requirements for this project:

Configuration?

- ☐ Exclusion zone (EZ)
- ☐ Contamination reduction zone (CRZ)
- ☐ Contamination reduction corridor (CRC)
- ☐ Access control points (ACPs)
- ☐ Other: _____
- ☐ Other: _____

How delineated?

- ☐ Cones
- ☐ Channelizer cones
- ☐ Caution tape
- ☐ Safety fencing
- ☐ Other: _____
- ☐ Other: _____

☐ Site control is integrated into the STAR Plan or TCP for the project

Additional Level C PPE specific for each zone (excluding respirator):

EZ and ACP at EZ

- ☐ Coveralls: _____
- ☐ Boot covers: _____
- ☐ Outer gloves: _____
- ☐ Inner gloves: _____
- ☐ Taping _____
- ☐ Other: _____
- ☐ Other: _____

CRZ/CRC/ACP at Support Zone

- ☐ Coveralls: _____
- ☐ Boot covers: _____
- ☐ Outer gloves: _____
- ☐ Inner gloves: _____
- ☐ Taping _____
- ☐ Other: _____
- ☐ Other: _____

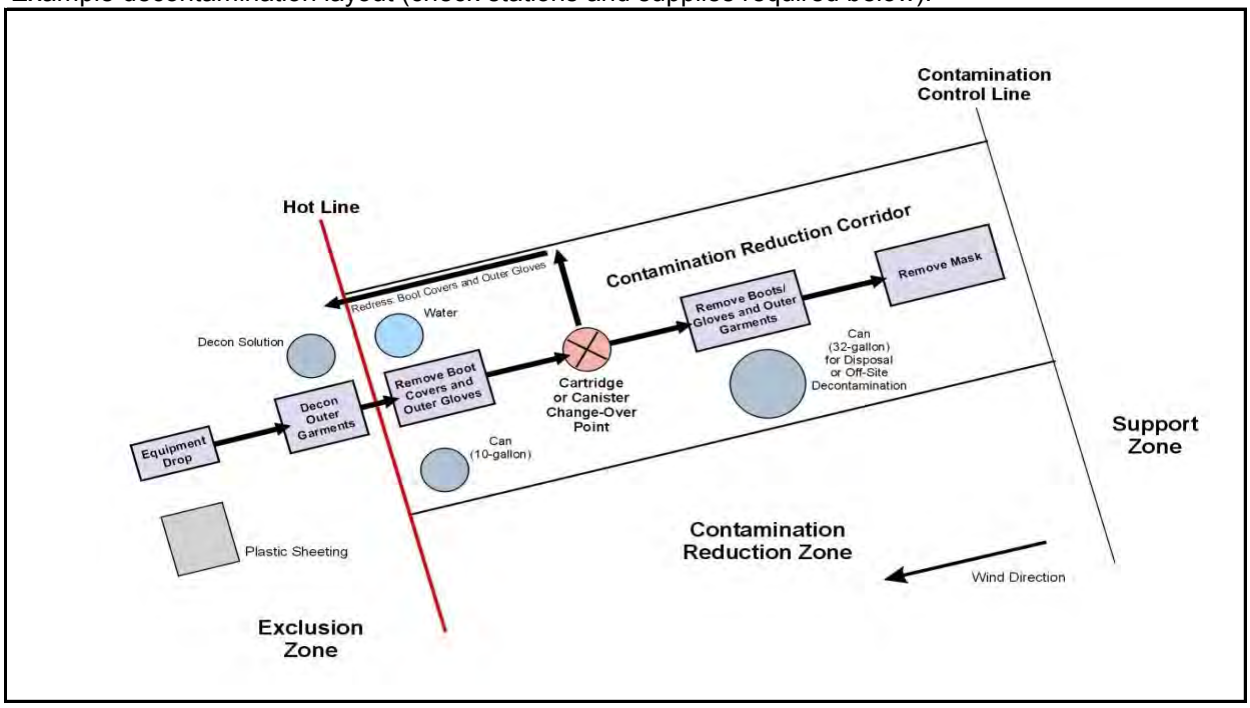
Support Zone

- ☐ See applicable JLA
- ☐ See HASP
- ☐ Other: _____

Comments:

Decontamination

Example decontamination layout (check stations and supplies required below):



The number of stations required for decontamination is dependent on many variables. Based on the hazards and tasks being performed, identify decontamination stations and supplies required for this project:

Station:	Zone:	Supplies:	Number:
☐ Equipment drop	EZ	☐ Plastic containers	_____
		☐ Plastic liners/bags	_____
		☐ Plastic sheeting (rolls)	
☐ Outer garment decon	EZ	☐ Containers (20-30 gallon)	_____
		☐ Decon solutions (gallons)	_____
		☐ Rinse water (gallons)	_____
		☐ Long handled scrub brushes	
☐ Boot cover/outer glove removal	CRZ	☐ Containers (20-30 gallon)	_____
		☐ Plastic liners/bags	_____
		☐ Bench or stools	
☐ Cartridge change out	CRZ	☐ Spare cartridges (sets)	_____
		☐ Tape	_____
		☐ Boot covers (pair)	_____
		☐ Gloves (pair)	
☐ Boot/glove/outer garment removal	CRZ	☐ Containers (20-30 gallon)	_____
		☐ Plastic liners/bags	_____
		☐ Bench or stools	
☐ Mask Removal	CRZ	☐ Plastic sheeting (rolls)	_____
		☐ Buckets	_____
		☐ Soap	_____
		☐ Water (gallons)	_____
		☐ Paper towels (rolls/boxes)	

Exhibit 1-1
Level C Supplement -
QLFT Protocol

Level C Supplement - Qualitative Fit Testing Protocol

The following procedure may be used to perform a qualitative fit test using an accepted testing media (isoamyl acetate, saccharin solution aerosol, irritant smoke, etc.).

- The employee will be informed of and will be allowed to pick the most acceptable respirator from several models and sizes so the respirator will be acceptable to and correctly fits the employee. The employee may hold face pieces up to the face to eliminate respirators that obviously would not fit.
- The employee will be re-instructed in the proper placement and positioning of the respirator on the head and face. Proper tensioning of the straps will be reviewed as well as methods to determine proper and acceptable fit. A mirror should be provided to assist with this review.
- The selected respirator shall be worn for 5 minutes to determine the comfort of the respirator. An assessment of comfort will include the following which will be discussed with the employee:
    1. Position of the mask on the nose;
    2. Room for eye protection, as appropriate;
    3. Room to talk; and
    4. Position of mask on the face and cheeks.
- Adequacy of the respirator selected will be evaluated using the following criteria:
    1. Proper placement of chin;
    2. Adequate strap tension;
    3. Fit across bridge of the nose;
    4. Size of respirator appropriate to span distance from nose to chin;
    5. Tendency of respirator to slip; and
    6. Employee evaluation of proper fit and position.
- The employee shall perform a seal check consisting of a positive and negative pressure check as follows:
    1. *Positive Pressure Check.* Close off exhalation valve and gently exhale into the facepiece. The test is satisfactory if slight positive pressure can be produced without any evidence of leakage from the mask and face seal.
    2. *Negative Pressure Check.* Close off the inlet opening of the canister or cartridge(s) by covering with palm of the hand(s) or by replacing filter seal(s). Inhale gently so that the mask collapses slightly and hold breath for 10 seconds. The test is

considered satisfactory when the facepiece remains in its collapsed position and no inward leakage of air is detected.

- A review of the employees face will be conducted to evaluate any condition which could interfere with the test including, but not limited to, razor stubble, sideburns, mustache, beard, and any apparel which conflicts with the proper use of the respirator.
- An evaluation will be performed to assure that the employee is not having difficulty breathing. If the employee indicates breathing is labored or difficult in any way, the test shall immediately cease and the employee referred to a physician to re-evaluate if the employee is suitable to wear a respirator.
- A review of the fit test exercise regimen shall be performed with the employee prior to the test.
- Perform test exercises as follows:
    1. *Normal breathing.* In a normal standing position, without talking, the employee shall breathe normally.
    2. *Deep breathing.* In a normal standing position, the employee shall breathe slowly and deeply, taking caution not to hyperventilate.
    3. *Turning head side to side.* Standing in place, the employee shall turn his/her head slowly from side to side between the extreme positions of each side. The head shall be held at each extreme side position momentarily so the employee can inhale.
    4. *Moving head up and down.* Standing in place, the employee shall slowly move his/her head up and down. The employee shall be instructed to inhale in the up position.
    5. *Talking.* The employee shall talk out loud slowly and loud enough to be heard by the individual conducting the test. The employee shall read the Rainbow Passage: *"When sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is according to legend, a boiling pot of gold at each end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."*

6. *Bending over.* The test subject shall bend over at the waist as if he/she were to touch his/her toes. Qualitative fit tests using a shroud or other device to contain the testing media may substitute jogging in place for bending over at the waist.
7. *Normal breathing.* The employee shall repeat exercise number 1.

- Each test shall be performed for one minute. The employee shall be questioned regarding the comfort of the respirator. If the respirator becomes unacceptable due to discomfort, adequacy of seals, or for any other reason identified during the fit test process, then the respirator will be replaced with another suitable and acceptable respirator and the fit test procedure repeated.

Exhibit 1-2
H&S Standard -
Respiratory Protection

1. POLICY

It is ARCADIS US policy to be proactive in the identification, assessment and control of health and safety hazards and associated risks. ARCADIS will assess potential respiratory exposure hazards resulting from or encountered by our staff during job activities in accordance with the ARCADIS Industrial Hygiene Standard ARC HSIH009. To the extent feasible, appropriate engineering and/or administrative controls will be used to reduce or eliminate exposure to airborne compounds. If those controls are not able to reduce exposure adequately, employees who are exposed or potentially exposed to a respiratory hazard at or above the applicable occupational exposure guideline are required to wear appropriate respiratory protection. ARCADIS' policy requires that our staff be adequately trained, medically cleared, and appropriately fit-tested before using respiratory protection.

2. PURPOSE AND SCOPE

2.1 This standard sets forth the requirements for the selection, use and care of respiratory protective equipment (respirators) by ARCADIS staff.

2.2 This standard applies to all employees who use or could potentially use respiratory protection. It also applies to all work where airborne hazards present the potential where respiratory protection may be required.

3. DEFINITIONS

All definitions are documented in Exhibit 1.

4. RESPONSIBILITIES

4.1 **Corporate H&S** - On an annual basis, review and update, as necessary, this standard and associated attachments and assess the effectiveness of the program. In addition, Corporate H&S serves as the overall Respiratory Protection Program Administrator in accordance with OSHA 29 CFR 1910.134 (Exhibit 5).

4.2 **Operations Managers and Supervisors** - support the requirements of this standard and provide the resources necessary to implement this standard including equipment, time for training, medical exams, and fit-testing, and other appropriate and necessary resources.

4.3 **Project and Task Managers** – ensure the completion of exposure assessments on applicable projects to determine the need for respiratory protection. In addition, ensure that appropriate budgets are established on projects to provide the necessary respiratory protection based on the exposure assessments. Also, understand the requirements of the client with regards to respiratory protection.

4.4 **Health and Safety Staff and Project Site Safety Officers or Supervisors** – conduct or assist with the completion of exposure assessments and respirator training and fit-testing as necessary. These staff will also assist in the proper selection of respiratory protection and ensure the proper use and care of respiratory protection by ARCADIS staff. In addition, these staff will assist in the assessment of this respiratory protection program and procedure.

4.5 **Designated Medical Provider – WorkCare** – coordinates annual medical surveillance exams to determine the employee's ability to use a respirator and provides documentation to the employee and ARCADIS in regard the employee's ability to wear a respirator. WorkCare may also coordinate fit testing and, in these situations, provide documentation as to the outcome of the fit test. WorkCare is responsible for maintaining all medical records, including the required medical questionnaire.

4.6 **Location H&S Coordinators or Fit Testing Designees** – responsible for conducting qualitative fit-testing for employees in their locations unless the location elects to use WorkCare for such activities. The H&S Coordinator or Fit Testing Designee will conduct the fit tests in accordance with this standard. They will check that the employee is medically cleared to participate in the fit-testing activity and ensure that the fit-test record is sent to Corporate H&S either via hard copy or electronically as determined by the Corporate H&S Administrator. In addition, the H&S Coordinator or Fit Testing Designee is responsible for purchasing a complete Qualitative Fit Testing kit to have on hand at the office location for performing the fit testing. The specific kit and source will be designated by Corporate H&S

4.6 **Employees** - Wear respirators as required by project conditions and as outlined in the site-specific Health and Safety Plan (HASP) or approved project guidance. Use and maintain respirators per the manufacturer's recommendations and this standard. Perform pre-use negative and positive pressure fit checks of respirators. Participate in the required medical evaluation, training, and fit test prior to assignment and inform the site supervisor if medical, training, or fit test certifications have expired. Provide the site supervisor with a copy of medical and training certifications, and fit test results, upon request. Will not participate in the fit-testing procedure or wear a respirator of any kind for any reason nor put themselves in any situation where a respirator may be necessary if the medical clearance has expired or a fit-test has not been conducted within the last 12 months.

5. PROCEDURE

5.1 Respirator Selection

Respirators will be selected as follows:

- All respirators must have NIOSH approval.
- Only respirators selected, supplied, and/or approved by ARCADIS may be used.
- The maximum use concentration (**MUC**) shall be evaluated for proper respirator selection. The MUC can be calculated by multiplying the APF rating for the respirator selected by the PEL or TLV for the contaminant of interest. If the airborne concentrations of the contaminant exceed the MUC for the respirator, then another respirator, meeting the MUC requirements, shall be selected.
- The following "Rule of Thumb" may also be used in conjunction with the information below:

- If the chemical has a boiling point greater than 70° C and the concentration is less than 200 parts per million (ppm), a service life of 8 hours at a normal work rate can be expected.
- Service life is inversely proportional to work rate.
- Reducing the concentration by 10 will increase service life by a factor of 5.
- Humidity above 85 percent will reduce service life by 50 percent.

5.1.1 Air purifying respirators

A. ARCADIS recommends that air purifying respirators of the full-face, dual cartridge design be used when an APR is required and appropriate. However, a half-face respirator may be used following appropriate hazard and risk assessment to ensure the protection factor is adequate for the exposure.

B. Respirator cartridge selection must be based on the anticipated hazards as identified in the site-specific health and safety plan (HASP). The following points must be considered when selecting air purifying cartridges*: [Air-purifying respirators do not supply oxygen and may not be used in oxygen-deficient atmospheres or in ones that are immediately dangerous to life or health (IDLH)]*.

- The anticipated air contaminant(s) concentration and the potential for air contaminant(s) to be present in concentrations which present an immediate danger to life and health (IDLH) and/or an oxygen deficient atmosphere.
- The nature of the air contaminant (s) (e.g. gas, vapor, particulate).
- The odor characteristics and odor threshold of the contaminant.
- Irritant properties of the air contaminant(s).
- The Occupational Safety and Health Administration (OSHA), Permissible Exposure Limit (PEL), the American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Value (TLV), and/or the National Institute for Occupational Safety and Health (NIOSH), Recommended Exposure Limit (REL).
- Work activities and the anticipated duration of respirator usage.

C. The filters are split up into three classes: N, R, and P:

- N series filters: **N**ot resistant to oil - can be used in environments where oil particles are not present in the atmosphere.
- R series filters: **R**esistant to oil – can be used in atmospheres where oil particles are present.

- P series filters: oil **P**roof – can be used in atmospheres where oil particles are present for more than 8 hours.

  In addition to the N, R, and P series above, filter efficiency shall also be considered for appropriate selection. There are three filter efficiency categories: 95 percent, 99 percent, and 99.7 percent. The higher the filter efficiency, the lower the filter leakage

D. Respirator cartridge End of Service Life shall be factored when selecting the appropriate cartridge. Use of warning properties such as odor and taste are not permissible practices. Some cartridges are equipped with End of Service Life Indicators (ESLIs). If the cartridges selected have ESLIs, cartridges will be changed based upon that indicator. If cartridges are not equipped with ESLIs, then the ESL shall be determined and a cartridge change out schedule established in the task hazard analysis stage of the project.

At a minimum, organic vapor filters should be changed at the end of each day's use or sooner, if the respirator manufacturer change-out schedule software program dictates otherwise.

Using respirator manufacturer-supplied information (this may be in the form of computer software), a change out schedule will be established based on conditions and/or concentration data obtained from the job site. The Director of Health and Safety or designate will specify if the cartridge change out schedule for a particular activity differs from that presented above.

Cartridges will be changed out as required by the established schedule or as job site conditions dictate. The change out will be performed only when the user has left the work area and has followed decontamination procedures.

Several OSHA chemical-specific standards specifically address cartridge change out schedules. Examples include the following:

Chemical	OSHA Standard	Change Out Schedule
Acrylonitrile	1910.1045 (h)(2)(ii)	end of service life indicator (ESLI) or end of shift (whichever occurs first)
Benzene	1910.1028 (g)(2)(ii)	ESLI or beginning of shift (whichever occurs first)
Butadiene	1910.1051 (h)(2)(ii)	Every 1, 2, or 4 hours dependent upon concentration according to Table 1 of standard and at beginning of every shift

Chemical	OSHA Standard	Change Out Schedule
Formaldehyde	1910.1048 (g)(2)(ii)	For cartridges every three hours or end of shift (whichever is sooner); for canisters, every 2 or 4 hours according to the schedule in (g)(3)(iv)
Vinyl chloride	1910.1017 (g)(3)(ii)	ESLI or end of shift in which they are first used (whichever occurs first)
Methylene chloride	1910.1052 (g)(2)(ii)	Canisters may only be used for emergency escape and must be replaced after use.

5.1.2 Atmosphere-supplying respirators/ Supplied Air Respirators (SARs)

A. This section applies to compressed air/oxygen and liquid air/oxygen used for supplied-air and SCBA respirators. Atmosphere-supplying respirators are designed to provide breathable air from a clean air source other than the surrounding contaminated work atmosphere.

B. They include airline-type supplied-air systems supplying air from cascaded breathing air cylinders or compressors, systems, self-contained breathing apparatus (SCBA) and complete air-supplied suits.

C. Breathing air couplings must *not be compatible* with outlets for nonrespirable worksite air or other gas systems. Compressed and liquid oxygen will meet the U.S. Pharmacopoeia requirements. Compressed breathing air will meet at least the requirements for Grade D breathing air described in ANSI G-7.1-1989 to include:

- Oxygen content (v/v) of 19.5-23.5%;
- Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;
- Carbon monoxide (CO) content of 10 ppm or less;
- Carbon dioxide content of 1,000 ppm or less; and
- Lack of noticeable odor.

D. Cylinders of purchased breathing air must have a *certificate* of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air.

Cylinder air must be tested (Oxygen content (v/v) of 19.5-23.5%) by a calibrated oxygen sensor prior to being placed into service.

E. Cylinders used to supply breathing air must also be hydrostatically tested by a qualified organization. Steel tanks must be tested at least every five year and composite tanks at least every three years. The tested tanks will be marked with the date of the last test. Breathing air containers must be marked in accordance with the NIOSH Respirator Certification Standard, 42 CFR Part 84.

F. Employees using SARs must attend additional respirator training covering the use, care, and limitations of this equipment.

G. Airlines used in compressor or cascaded cylinder systems shall be used only for breathing air and no other gas or liquid. Maximum length of the lines is 300 feet. Airlines will be inspected before each use and at a minimum, daily and checked for damage, contamination, etc.

H. Where airline systems are utilized, all users will be equipped with a suitable escape respirator system.

I. Compressors used to supply breathing air to respirators must be constructed and/or situated to provide the following:

- Prevent contaminated air from entering the system.
- Have in-line air-purifying filters to further ensure breathing air quality. Filters must be maintained and replaced periodically following the manufacturer's instructions.
- Display a tag with the most recent filter change date with the signature of the individual authorized to perform the filter maintenance.
- Have a carbon monoxide alarm to monitor carbon monoxide (CO) levels. Levels of CO in breathing air must be maintained below 10 ppm.

5.2 Fit Testing

Fit testing will be completed on all employees that may wear or do wear respirators as follows:

- Fit testing will be conducted as required in OSHA 29 CFR 1910.134 Appendix A which is mandatory and as described in Exhibit 2.
- Employees must have received an initial and annual medical examination in accordance with the ARCADIS Medical Surveillance Standard prior to fit testing. Evidence of medical clearance to wear respiratory protection or physician authorization must be provided for review to the individual conducting the fit test.
- The fit-tester will complete a fit-test form and provide a copy to the employee upon completion of the fit-test using the form shown in Exhibit 3 or similar form.

- Fit testing will be conducted prior to actual respirator use and at least annually thereafter.
- Additional fit testing will be conducted in the event that an employee's physical condition changes resulting in the potential for an inadequate "fit." i.e. Significant weight gain/loss, reconstructive facial surgery, etc.
- Fit testing must be performed by trained and qualified individuals in accordance with the OSHA respiratory protection standard and manufacturer's specifications. Fit testing may be conducted by the ARCADIS medical exam provider or by an approved provider whether an internal or external source. (as long as the medical examination and qualification is received first). ARCADIS Corporate H&S will approve those fit-test providers.
- Only those respirators that have been properly fitted may be worn. Alternative respirator makes, models, and sizes will require additional fit testing.
- If after passing a fit test, an employee notifies a supervisor or the respirator program administrator that the fit is not acceptable, an additional fit test will be conducted.
- Fit testing will be, at a minimum, qualitative (QLFT). Quanitative Fit Testing (QNFT) will be conducted as required by the client or based on the exposure assessments completed before the initiation of a project and the protection factors required to adequately control exposure. When QNFT is conducted, it will be done so using a Porta-Count or similar device. QLFT is also acceptable as long as the respirator is used at protection factors as designated by OSHA.
- If QLFT is used, any of the approved challenge agents approved by OSHA and NIOSH shall be utilized including isoamyl acetate (banana oil), irritant smoke (stannous chloride), sacharrine, or Bitrex.
- The person doing the fit-test will ensure the respirator user is competent to conduct and understand the following:

  A. Donning and doffing of the respirator

  B. Negative and positive fit checks

  C. Parts and pieces of the respirator

  D. Maintenance and care

  E. Inspections

5.3 Respirator Usage

5.3.1 General Requirements

A. Staff doing active field work will be provided their own full-face air purifying respirator.

B. Only medically cleared, trained, and fit tested, employees may use respirators.

C. Employees must use only those respirators in which they have been fit tested.

D. Employees must wear and use all respirators in accordance with training, this standard, and the manufacturer's instructions.

E. Respirators must be assigned to a single individual for their exclusive use.

F. Respirators must not be worn if there is any condition that prohibits a good face to face piece seal (i.e., facial hair, glasses, loss of weight, lack of teeth). If an employee requires corrective lenses, ARCADIS will provide glass inserts for the respirator.

G. Respirator users will conduct a respirator user seal check each time they put on a respirator.

H. Respirator users must exit the work area immediately upon the following:

- Odor breakthrough.
- Increased breathing resistance.
- Physical symptoms, such as headache, dizziness, nausea, blurred vision or any other conditions that indicate respirator failure.

I. Respirator users must leave the work area to change filter cartridges or air bottles.

J. Surveillance will be conducted during respirator use to monitor the work area, employee exposure, or any other condition that may affect respirator effectiveness.

K. The buddy system must be used during all activities requiring the use of a respirator.

L. Respirator cartridges must be changed when they are damaged, defective, dirty, odor breakthrough, or increased breathing resistance occurs, or when indicated by the end of life service indicator (ELSI), or in accordance with a project-specific change-out schedule that must be documented in the site-specific health and safety plan (See section 5.1.1 D).

5.3.2 IDLH atmospheres

A. Work in an IDLH atmosphere shall be approved by the Environmental Division H&S Director or designate

B. In IDLH atmosphere situations, at least one person will be located outside the IDLH atmosphere. In addition visual, voice, or signal line communication will be maintained between the person in and the person outside the IDLH atmosphere. The person located outside the IDLH atmosphere will be trained to provide effective emergency rescue, and will be equipped with pressure demand, other positive SCBA or supplied-air respirator with auxiliary SCBA and:

- Appropriate retrieval equipment if it will not increase the overall risk; or
- Equivalent means for rescue where retrieval equipment is not required as noted above.

C. The appropriate supervisor will be notified before the person located outside the IDLH atmosphere enters the IDLH atmosphere to provide emergency rescue. Once notified, the supervisor will provide assistance appropriate to the situation.

5.4 Program Evaluation

A. Evaluations of work areas (site inspections) will be conducted by supervisory and Health and Safety personnel to determine the effectiveness of the program.

B. During site inspections and the annual HAZWOPER 8-hour refresher-training program, employees will be consulted to assess program effectiveness and identify problem areas.

C. Corporate Health and Safety, will review information compiled during site inspections and employee discussions and make adjustments to the program to correct identified deficiencies.

5.5 Voluntary Respirator Use

A. Respirators will be provided at the request of an employee, if the use of the respirator will not create a hazard.

B. Prior to voluntary respirator use, employees must undergo a medical examination to ensure they are physically able to use the respirator.

C. Prior to voluntary respirator use, employees must be trained in the use, care, and limitations of the respirator.

D. Prior to voluntary respirator use, employees must be fit tested as outlined in section 5.2.

E. A copy of 29 CFR 1910.134 Appendix D "Information for Employees Using Respirators When Not Required Under the Standard" will be provided to any employee who wears a respirator when its use is not required.

5.6 Maintenance, Care, and Storage of Respirators

5.6.1 Inspection

A. All respirators will be inspected according to the schedule outlined below. The checklist shown in Exhibit 6 should be followed to ensure a complete and thorough inspection:

- Respirators used routinely will be inspected before each use and during cleaning;
- SCBAs will be inspected before each use, during cleaning and monthly; inspection will include making sure that the regulator and warning devices function properly;
- Respirators that are maintained for emergency use will be inspected monthly and in accordance with the manufacturer's recommendations; and
- Emergency escape-only respirators will be inspected before being taken to the work site.

B. Documentation of respirator inspections will include checks on the following:

- Respirator function.
- Tightness of connections and condition of parts (e.g., face piece, head straps, valves, connecting tube and filters, canisters or cartridges).
- Pliability and any deterioration of any elastic or elastic-type parts.
- Condition of the regulator.
- Proper functioning of warning devices.
- If air and oxygen cylinder are fully charged. Cylinders will be recharged when the pressure falls to 90% of the manufacturer's recommended pressure level.

C. Respirators that fail inspection must be removed from service and tagged "DO NOT USE."

5.6.2 Cleaning

- As often as necessary to maintain a sanitary condition if used exclusively by one employee.

- Each time before it is worn if used by more than one employee.
- After each use if maintained for emergency use.
- After each use if used for fit testing.

The procedure for cleaning respirators is presented in Exhibit 4.

5.6.3 Maintenance

Respirators requiring maintenance due to worn or malfunctioning parts will be repaired as follows:

- Repairs shall be conducted only by individuals appropriately trained to perform necessary repairs;
- Replacement parts shall be approved by the manufacturer of the respirator; be NIOSH approved for use with the respirator; and designed and manufactured for the specific respirator being repaired.
- Repairs are to be made in accordance with manufacturer recommendations and specifications.
- Reducing and admission valves, regulators, and alarms shall only be adjusted or repaired by an authorized technician trained by the manufacturer or by the manufacturer.

5.6.4 Storage

- All respirators shall be stored in the following manner which protects them from damage, contamination, dust, sunlight, temperature extremes, excessive moisture, damaging chemicals and shall be stored in a manner which prevents deformation of the face piece and exhalation valve.
- Emergency respirators shall be stored in readily accessible condition to the work area, stored in containers or covers clearly marked as containing emergency respirators, and stored in accordance with manufacturer recommendations. Since most emergency respirators are issued to ARCADIS by the client at job sites, any client protocol for proper storage and use shall be followed.

5.7 Work Area Surveillance

- Air monitoring will be performed continuously during any work that involves use of respiratory protection. The type of monitoring to be performed will be identified during the task hazard analysis phase of the work and will be specified in the site-specific health and safety plan for the project in accordance with policy ARC HSFS010, “Health and Safety Plans”.
- Workers wearing respirators will be monitored during work to ensure employees are not enduring undue stress or difficulty of any type while wearing the respirator

and to ensure the respirator is adequate protection for the hazard. Surveillance will also be conducted to identify any changes in the work method of environmental conditions which may alter the effectiveness of respirator use.

5.8 Medical Evaluation

- Because using a respirator may place a physiological burden on an employee that may vary depending upon the type of respirator and workplace conditions, the written Respiratory Protection Program includes what medical evaluation process we have implemented at ARCADIS. All employees who use a respirator as defined under this standard will participate in the company's medical monitoring program ARC HSGE010. Medical evaluations may cease if the employee is no longer required to use a respirator per the Medical Surveillance standard.

- A physician or other licensed health care professional will perform the evaluation using a medical questionnaire as defined in CFR 1910.134, Appendix C or an equivalent medical examination. A follow-up medical examination may be given depending upon the answers to the questionnaire and/or medical examination.

5.8.1 Timeframe of Medical Evaluations

Medical evaluations will take place according to the following schedule:

- Prior to fit testing and use at the work site;

- When an employee reports medical signs/symptoms that may be related to his/her ability to use a respirator;

- When a physician, supervisor or the respirator Program Administrator suggests/requests an evaluation;

- When information such as observations made during fit testing or program evaluation indicate a need; or

- When a change occurs in workplace conditions that may result in a substantial increase in the physiological burden placed on an employee (e.g., physical work effort, protective clothing, temperature, etc.).

5.8.2 Written Medical Opinion

The physician or other licensed health care professional will determine and provide a written opinion as to the employee's ability to use a respirator. This opinion will contain:

- Whether or not the employee is medically able to use the respirator;

- Any limitations on respirator use;

- The need for follow-up medical evaluations; and

- A statement that the employee was provided with a copy of the written recommendation.

6. TRAINING

Training will be provided prior to respirator use; annually; when changes in the workplace or respirator make the training obsolete; when inadequacies are found in the employee's knowledge or use of PPE; or any other situation in which retraining appears necessary.

6.1 General Requirements

A. All employees who use respirators must be trained in their use, care, and limitations. Employees will also be trained to understand why respirators are necessary and the importance of a proper fit, the signs and symptoms of over exposure, the requirements of this standard and the general requirements of the OSHA Respiratory Protection Standard.

B. Respirator training will be conducted prior to actual respirator use and at least annually thereafter. Annual training will be conducted as part of the HAZWOPER 8-hour refresher-training program.

C. All training provided must be reviewed and approved by Corporate Health & Safety and will be managed through the corporate training database.

D. Documentation of training certification received by attendance at any training course including externally provided training courses will be kept by the employee with copies provided to the corporate training group.

6.2 Training Content Requirements

Training will ensure that employees can demonstrate, at a minimum, knowledge of the following:

- Why the respirator is necessary and its limitations and capabilities;
- How improper fit, usage, or maintenance can compromise the protective effect of the respirator, and how to recognize the signs and symptoms that may limit or prevent the effective use of respirators;
- How to use the respirator effectively in emergency situations, including when it malfunctions;
- How to inspect, put on and remove, use, and check the seals of the respirator;
- Proper procedures for maintenance and storage of the respirator; and
- The general requirements of this standard.

6.3 Other Training Considerations

- Training does not need to be repeated for a new employee if he/she can provide documentation of training within the 12 months prior.
- Although annual HAZWOPER training may be utilized to help meet compliance with the training portion of this standard, training will be specific to the type of respirator used and the conditions at the job/work site.

6.4 Training for ARCADIS Fit Testers

- ARCADIS Fit Testers will complete either live meeting training or course posted on Archimedes. In addition, following completion of the training, fit testers will complete an on-line quiz to test their knowledge and competency before they conduct fit-testing of employees. A score of 90% will be required to pass the quiz.

7. REFERENCES

- 29 CFR 1910.134 “Respiratory Protection”
- National Institute for Occupational Safety & Health (NIOSH) Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84, NIOSH 96-101, 1996.
- NIOSH Guide to Industrial Respiratory Protection, NIOSH 87-116, 1987.
- ARCADIS Health and Safety Standard ARC HSGE010 – Medical Surveillance

8. RECORDS

- Training records will be kept by the individual employee with copies of such certificates kept by the ARCADIS corporate training group. Information related to the course such as training dates and vendors, will be kept by the corporate training group.
- Air monitoring results must be maintained with project files.
- Results of medical surveillance examinations will be maintained by the designated medical provider in compliance with 29 CFR 1910.1020.
- Fit test records will be maintained by the employee who is fit tested per CFR 1910.134 (m)(2)(11) and, where utilized, the designated medical provider. In addition, records for those employees fit-tested by an ARCADIS fit tester will be sent to the ARCADIS corporate office either in hard copy or electronically by the fit tester.
- Copies of fit test records are to be kept centrally at the corporate office or they will be scanned and sent to ARCADIS' designated medical provider to be kept with the employee's medical records.

9. APPROVALS AND HISTORY OF CHANGE

Approved By: 

History of Change

Revision Date	Revision Number	Reason for change
19 January 2009	01	Original document
1 September 2009	02	Updated requirements for fit-testing and made other changes to clarify requirements. Added fit-testing responsibilities for H&S Coordinators or their designee, added the fit test agents that are allowed for use for qualitative fit testing, and added training requirements for ARCADIS fit-testers. Updated the fit test form.
1 February 2010	03	Enhanced the section on Change out Schedule for respirator cartridges to better meet the intent of the US Occupational Health and Safety Administration respiratory protection standard.
24 February 2010	04	Modified section 5.1.1 A to allow the use of half face air purifying respirators

Exhibit 1 – Definitions

Air-purifying respirator means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Assigned protection factor (APF) means the workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program as specified by this section.

Atmosphere-supplying respirator means a respirator that supplies the respirator user with suitable breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

Canister or cartridge means a container with a filter, sorbent, catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

Demand respirator means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

Emergency situation means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

Employee exposure means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection. Note: all exposure assessments are made and reported regardless of the assigned protection factor of the respiratory protective device used

End-of-service-life indicator (ESLI) means a system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

Escape-only respirator means a respirator intended to be used only for emergency exit.

Filter or air purifying element means a component used in respirators to remove solid or liquid aerosols from the inspired air.

Filtering facepiece (dust mask) means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Fit factor means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Fit test means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. See also Qualitative fit test (QLFT) and Quantitative fit test (QNFT).

Helmet means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

High efficiency particulate air (HEPA) filter means a filter that is at least 99.97% efficient in

removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

Hood means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

Immediately dangerous to life or health (IDLH) means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Loose-fitting facepiece means a respiratory inlet covering that is designed to form a partial seal with the face.

Maximum use concentration (MUC) means the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of the hazardous substance. The MUC can be determined mathematically by multiplying the assigned protection factor specified for a respirator by the required OSHA permissible exposure limit, short-term exposure limit, or ceiling limit. When no OSHA exposure limit is available for a hazardous substance, an employer must determine an MUC on the basis of relevant available information and informed professional judgment.

Negative pressure respirator (tight fitting) means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Oxygen deficient atmosphere means an atmosphere with oxygen content below 19.5% by volume.

Physician or other licensed health care professional (PLHCP) means an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by paragraph (e) of this section.

Positive pressure respirator means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered air-purifying respirator (PAPR) means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Pressure demand respirator means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

Qualitative fit test (QLFT) means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

Quantitative fit test (QNFT) means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Respiratory inlet covering means that portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

Self-contained breathing apparatus (SCBA) means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

Service life means the period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

Supplied-air respirator (SAR) or airline respirator means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

Tight-fitting facepiece means a respiratory inlet covering that forms a complete seal with the face.

User seal check means an action conducted by the respirator user to determine if the respirator is properly seated to the face. This is conducted through the performance of a negative and positive pressure check each time the respirator is donned.

Exhibit 2 – Fit Testing Procedure

A. This is a summary of the fit-testing procedure. The person conducting the fit-test should thoroughly review OSHA 29 CFR 1910.134 Appendix A for the method of fit-testing that is to be performed.

B. The employee will be instructed in the proper placement and positioning of the respirator on the head and face. Proper tensioning of the straps will be reviewed as well as methods to determine proper and acceptable fit. A mirror should be provided to assist with this review.

C. The selected respirator shall be worn for 5 minutes to determine the comfort of the respirator. An assessment of comfort will include the following which will be discussed with the employee:

- Position of the mask on the nose
- Room for eye protection, as appropriate
- Room to talk
- Position of mask on the face and cheeks

D. Adequacy of the respirator selected will be evaluated using the following criteria:

- Proper placement of chin
- Adequate strap tension
- Fit across bridge of the nose
- Size of respirator appropriate to span distance from nose to chin
- Tendency of respirator to slip
- Employee evaluation of proper fit and position

E. The employee shall perform a seal check consisting of a positive and negative pressure check as follows:

- *Positive Pressure Check.* Close off exhalation valve and gently exhale into the facepiece. The test is satisfactory if slight positive pressure can be produced without any evidence of leakage from the mask and face seal.
- *Negative Pressure Check.* Close off the inlet opening of the canister or cartridge(s) by covering with palm of the hand(s) or by replacing filter seal(s). Inhale gently so that the mask collapses slightly and hold breath for 10 seconds. The test is considered satisfactory when the facepiece remains in its collapsed position and no inward leakage of air is detected.

F. Perform test exercises as follows:

- *Normal breathing.* In a normal standing position, without talking, the employee shall breathe normally.
- *Deep breathing.* In a normal standing position, the employee shall breathe slowly and deeply, taking caution not to hyperventilate.
- *Turning head side to side.* Standing in place, the employee shall turn his/her head slowly from side to side between the extreme positions of each side. The head shall be held at each extreme side position momentarily so the employee can inhale.
- *Moving head up and down.* Standing in place, the employee shall slowly move his/her head up and down. The employee shall be instructed to inhale in the up position.
- *Talking.* The employee shall talk out loud slowly and loud enough to be heard by the individual conducting the test. The employee shall read the Rainbow Passage:

  "When sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is according to legend, a boiling pot of gold at each end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."
- *Bending over.* The test subject shall bend over at the waist as if he/she were to touch his/her toes. Qualitative fit tests using a shroud or other device to contain the testing media may substitute jogging in place for bending over at the waist.
- *Normal breathing.* The employee shall repeat exercise number 1.

G. Each test shall be performed for one minute. The employee shall be questioned regarding the comfort of the respirator. If the respirator becomes unacceptable due to discomfort, adequacy of seals, or for any other reason identified during the fit test process, then the respirator will be replaced with another suitable and acceptable respirator and the fit test procedure repeated.

H. TThe fit-tester will record the information on the fit test form, have the employee sign the form, sign the form themself and submit it either hard copy or electronically to Corporate H&S. A copy should also be given to the employee.

Exhibit 3 - Respirator Program Fit Test Form and Employee Checklist

Employee Name: _____
Last First

Employee Number: _____

Date: _____

Office: _____

Division: _____

Business practice: _____

Checklist Item	OK
Respirator Training	☐
Medical Review/Exam **(mandatory)** *Date completed:*	☐
Medical Clearance Records on File	☐

Fit Test Method: ___ Qualitative; Test Agent Used: _____

Model: _____ Type: _____Size: _____

___ Quantitative; Model: _____ Size: _____

Response:	**Passed**	**Failed**	**Fit Factor (QN)**
Normal Breathing	☐	☐	_____
Deep Breathing	☐	☐	_____
Turning Head Side to Side	☐	☐	_____
Moving Heads Up and Down	☐	☐	_____
Talking	☐	☐	_____
Grimace	☐	☐	_____
Bending Over	☐	☐	_____
Normal Breathing	☐	☐	_____
Pass or Fail (Qualitative Fit Test)	☐	☐	_____
Overall Fit Test Factor: (from Portacount)	☐	☐	_____

Employee: Printed name_____
Signature_____

Test Administrator: Printed name_____
Signature_____
Company_____

Respirator Type [1]	**Assigned Protection Factor**
Single use or quarter mask	5
Air purifying half mask with cartridge and/or any type of particulate filter	10
Air purifying full facepiece with cartridge and/or high efficiency filter	50
Supplied air equipped with full facepiece and operated in pressure demand or other positive pressure mode	2000
Self contained breathing apparatus with tight fitting facepiece and operated in pressure demand mode	10,000

[1]For respirators not listed in this table, contact corporate health and safety for assistance in determining APFs.

Exhibit 4 – Respirator Cleaning Procedure

- Remove cartridges/canisters/filters. Disassemble facepiece by removing speaking diaphragm, demand and pressure-demand valve assemblies, hoses, or any components recommended by the manufacturer.
- Wash components with warm (<110° F) water with a mild detergent or with a cleaner approved by the manufacturer. A soft, non-wire bristle brush may be used to facilitate dirt removal.
- Rinse with warm (<110° F) clean water, preferably running water.
- If the cleaner used does not contain a disinfecting agent, respirator components should be immersed in one of the following for two minutes:
    a. Hypochlorite solution (50 ppm chlorine) made by adding approximately 1 milliliter of laundry bleach to 1 liter of water at 110° F; or
    b. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine [6-8 grams ammonium and/or potassium iodide/100 cubic centimeters (cc) of 45 percent alcohol] to one liter of water at 110° F; or
    c. Other commercially available cleansers of equivalent disinfectant quality, when used as directed by the manufacturer, and are approved for use by the respirator manufacturer.
- Thoroughly rinse the respirator components in clean, warm, (<110° F) running water.
- Components should be hand dried with a soft lint free cloth or allowed to air dry.
- Reassemble the facepiece and restore cartridges/canisters/filters as necessary.
- Test the respirator for proper working condition.

Exhibit 5 - OSHA Standards with Respiratory Protection Requirements

Compound	29 CFR
Asbestos	1910.1001
4-Nitrobiphenol	1910.1003
Alpha-Naphthylamine	1910.1004
Methyl-Chloromethyl Ether	1910.1006
3,3-Dichlorobenzidine (+ salts)	1910.1007
Bis-Chloromethyl Ether	1910.1008
Beta-Naphthylamine	1910.1009
Benzidine	1910.1010
4-Aminodiphenyl	1910.1011
Ethyleneimine	1910.1012
Beta-Propiolactone	1910.1013
2-Acetylaminofluorene	1910.1014
4-Dimethylaminoazobenzene	1910.1015
N-Nitrosodimethylamine	1910.1016
Vinyl Chloride	1910.1017
Inorganic Arsenic	1910.1018
Lead	1910.1025
Benzene	1910.1028
Coke Oven Emissions	1910.1029
Cotton Dust	1910.1043
1,2,Dibromo-3-Chloropropane	1910.1044
Acrylonitrile	1910.1045
Ethylene Oxide	1910.1047
Formaldehyde	1910.1048

Exhibit 6 – Respirator Inspection Checklist

The following is a guideline to be used when inspecting a respirator before wearing:

Head Strap

_____ attached properly to the respirator
_____ pliable, not stretched out or too stiff
_____ the rubber is not cracked or warped in anyway

Face Shield

_____ no visible cracks
_____ securely attached to the respirator
_____ not badly scratched, visibility is good
_____ there are no gouges or divots
_____ if there are screws, make sure they are securely in place

Nose Piece

_____ is securely in place
_____ contains all inhalation valves

Actual Face Seal

_____ pliable, not stiff
_____ does not contain any cracks or warped areas
_____ does not appear worn or discolored

Inhalation and Exhalation Valves

_____ are they in place
_____ they are not sealed shut
_____ pliable, not brittle

Cartridge Connectors

_____ plastic is not cracked
_____ if bayonet style, all three prongs are in place
_____ of screw-in style, it is not stripped
_____ O-ring is in place and not brittle

Speaker Diaphragm

_____ the diaphragm is not missing
_____ plastic cover is in place
_____ screw is in place and not loose

Attachment 2
H&S Standard -
Excavation and Trenching

1. POLICY

It is ARCADIS US policy to be proactive in the identification, assessment and control of health and safety hazards and associated risks. To those means, any work involving trenching and excavation that is under the control or direction of ARCADIS or an ARCADIS subcontractor will be accomplished following, at a minimum, this procedure.

It is ARCADIS' policy that ARCADIS staff will not enter excavations and trenches unless it is absolutely necessary. If there are no suitable alternatives and it becomes necessary to enter excavations or trenches, this procedure, at a minimum will be strictly followed.

It is also the policy of ARCADIS to ensure an OSHA-defined Excavation Competent Person is on-site for all excavation work under ARCADIS contractual control. The competent person will be provided by the entity on site responsible for performing the excavation work unless otherwise required by the client. Thus, if an ARCADIS subcontractor is conducting the excavation work, that subcontractor will provide the competent person. If ARCADIS is self-performing the excavation services, then ARCADIS will provide a competent person whether a specialized subcontractor or authorized employee.

2. PURPOSE AND SCOPE

2.1 Purpose

To effectively control or eliminate the hazards presented by working near or entry into excavations or trenches, this procedure sets forth the accepted practice for and establishes the requirements for workplace safety near excavations and trenches and employee and subcontractor entry into such.

2.2 Scope

This procedure along with associated checklists and the Utility Location procedure (ARC HSFS019) apply to all employees of ARCADIS-US. Only trained and authorized personnel are permitted to work near or enter excavations and trenches, perform rescue services, or act as the excavation competent person.

3. DEFINITIONS

Exhibit 1 includes relevant definitions to this procedure including that for competent person qualifications.

4. RESPONSIBILITIES

4.1 Corporate H&S with Division and Practice Experts

On an annual basis, review and update, as necessary, this procedure. In addition, review cancelled checklists periodically to ensure conformance to this procedure. Provide the excavation competent person and qualified person training and retraining, or recommend qualified training provider. Provide technical assistance regarding excavation and trench protocol, atmospheric testing equipment, PPE, hazard assessment and research

information on unusual hazards. Audit project-specific excavation sites for compliance with this procedure.

4.2 Principal in Charge (PIC), Project Manager (PM), and Task Manager (TM)

PIC, PM and TMs are responsible to:

- Verify that all excavation and trench protocols are properly identified and addressed within the project work plan, project health & safety plan, and/or other project-related documents.
- Verify that their divisional or project team employees have received the proper training provided by Corporate Health & Safety or qualified training source prior to conducting excavation/trenching entry activities.
- Verify that any ARCADIS employee acting as the Excavation Competent person has been authorized and trained to do so as noted in Exhibit 1
- Verify that the proper entry equipment, including personal protective equipment (PPE), atmospheric testing equipment and safety equipment, is available for use by their divisional employees.
- Verify that copies of the completed checklists are available for Corporate Health and Safety review and retained with the project files

4.3 Health and Safety Plan Writers and Reviewers

Utilize this procedure as guidance to ensure the appropriate identification, assessment and control of excavation and trenching hazards for documentation in project HASPs

4.4 Entry/Work Supervisors (also see Training and Duties of Entry Supervisor)

- Work in direct coordination with and under the direction of the project excavation competent person
- Interface with the client representative to identify hazards associated with the client's excavation and trenching and/or work permit programs.
- Review existing soil sampling (if any) data or other pertinent hazard characterization information recorded by the client.
- Investigate the client's excavation/trenching protocol, to verify that any identified hazards and previous experience with earthwork at the site is properly communicated.
- Coordinate entry operations with the client's employees when both client and ARCADIS employees will be working in or near an excavation/trench.
- Coordinate necessary rescue assistance with either the client's in-house rescue team and/or the offsite rescue assistance specified by the client. The offsite rescue

assistance specified by the client must have applicable rescue experience and be within a reasonable response distance.

- Verify that the client takes the necessary precautions in notifying their employees that our employees will be installing an excavation or trench.
- Review the lockout/tagout and isolation measures implemented by the client as necessary based on proximity of utilities or other energy sources in the area of the excavation/trench
- Immediately report any unusual or unforeseen excavation or trenching hazards to Corporate Health and Safety prior to authorizing entry
- Verify that all tests and precautionary measures identified on the Daily/Periodic Inspection Checklist located in Exhibit 1 and the ARCADIS Utility Location Policy and Procedure ARC HSFS019 has been performed prior to authorizing subsurface work or entry into an excavation or trench
- Offer all entrants an opportunity to review the applicable control measures and testing results and an opportunity to request a reevaluation as necessary
- Issue, authorize, and have the Utility Clearance and Daily/Periodic Inspection forms readily available for review
- Verify that copies of the completed clearance forms and checklists are properly disseminated to Corporate Health and Safety and retained with the project files, as specified in Section 8.0 – Records.

4.5 Entrants

- Qualified Employee Entrants must have training and instruction in their duties and responsibilities regarding the following:
- Recognize the hazards which may be faced during entry, as well as the signs and symptoms of exposure to the hazard(s).
- Maintain visual contact and/or verbal communications with the attendant at all times.
- Use the PPE, air monitoring and testing equipment that has been provided or have access to the information.
- Maintain an awareness of all required hazard controls and consult with the Competent Person as necessary
- Obey evacuation orders given by the Attendant, automatic alarm activation, or when self-perceived.

4.6 Competent Person

- The Competent Person will be responsible for the anticipation, identification and control of excavation and trenching hazards, as well as the signs and symptoms of

exposure to the hazard(s), and the Authority to implement all corrective actions including Stopping Work.

- Meet all of the requirements specified for the Qualified Employee Entrants plus adequate training and experience for their duties and responsibilities.
- Implement the ARCADIS Utility Clearance Policy and Procedure and complete the Daily/Periodic Excavation Inspection Checklist
- Verify adequate training and experience of all Entrants prior to entry
- Verify that the safety procedures identified in this Standard, the site specific HASP, and applicable regulatory requirements are utilized when required to protect employees during excavation activities.

ARCADIS employees must meet the following requirements to be considered a Competent Person:

- Attend an Excavation Competent Person training course approved by Corporate Health and Safety or have equivalent training to that provided in the course; and
- Approval by Corporate Health and Safety through demonstration of practical field experience and/or knowledge of the subject matter.
    - If on an Environmental project where HAZWOPER training is required by ARCADIS, completed a 40 Hour HAZWOPER and HAZWOPER Supervisor training course and be current on their annual 8 Hour refresher.
    - If a hazardous atmosphere is present, or there is limited entry or exit and the excavation or trench must be entered as a confined space, the person must also be Confined Space trained and authorized as per the ARCADIS Confined Space procedure ARC HSFS003.

4.7 Attendants

- An attendant must be stationed outside the excavation and be available to monitor operations above and below ground. The attendant may have no other duties besides those listed in this section.
- All attendants must have training and instruction in their duties and responsibilities regarding excavation/trenching entry. The following are assigned duties.
- Maintain an accurate count of all entrants in the excavation
- Monitor activities both inside and outside the excavation/trench to verify the continued safety of entrants
- Maintain visual contact or verbal communication with all entrants

- Order evacuation of the excavation/trench if an uncontrolled hazard develops, either within or outside the space, or upon observing a behavioral effect of hazard exposure among entrants
- Keep unauthorized persons away from the excavation area
- Participate in non-entry rescue as appropriate
- Summon rescue and other emergency services
- Attendants must maintain current certification in basic first aid and cardiopulmonary resuscitation (CPR).

4.8 All ARCADIS Employees

Use the TRACK process described below regularly and frequently. In addition, employees read and understand all documented hazard identification and risk assessments conducted using the HARC process and documented in HASPs, JSAs, and other written plans that are associated with their work. ARCADIS employees will:

- Recognize the hazards of trenches and excavations
- Understand and follow the methods for working near trenches and excavations
- Notify the PIC, PM, TM or entry/work supervisor if they have not received appropriate training
- Participate in entry operations only if trained and authorized to do so
- Never enter an excavation/trench without completion of the required Utility Location Procedure, Daily/Periodic Inspection Checklist and have an authorized attendant
- Never attempt entry rescue within a excavation unless trained in entry rescue with appropriate equipment available
- If unexpected conditions arise during entry, immediately notify other entrants, evacuate the space and inform the designated Competent Person

5. PROCEDURE

5.1 General Safety Requirements for all Excavations

- All surface obstructions must be moved or supported so as to protect employees and equipment.
- Prior to excavation, all underground installations (water, electric, telephone, gas, etc.) must be located and documented in accordance with ARCADIS Utility Clearance Policy and Procedure ARC HSFS019.

- When excavating in areas near underground installations, proper precautions must be taken to determine the exact location of the installations and to adequately protect and support them. While an excavation is open, underground installations shall be protected, supported or removed as necessary to protect employees.

- Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person.

- Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

- Ladders used for access and egress from the excavation must extend at least 36” (3 feet) above the landing surface.

- If personnel are working in a location exposed to vehicular traffic they must be provided with and be required to wear reflective safety vests. Adequate, signs, barriers or other equivalent traffic controls must be used to protect employees.

- Personnel are not permitted to be beneath elevated loads handled by equipment or be in excavations when heavy equipment is digging in or near the excavation.

- Mobile equipment located near open excavations must be adequately protected from falling or rolling into excavations by the use of barricades or warning devices.

- All excavations over 4 feet in depth must be tested for hazardous atmospheres whenever personnel are required to enter and a potential exists for the existence of hazardous contaminants or oxygen deficiency. Excavations less than 4 feet in depth must be evaluated by the competent person and at the competent person's discretion be tested for hazardous atmospheres whenever personnel are required to enter and a potential exists for the existence of hazardous contaminants or oxygen deficiency.

- Means of rescue including a lifeline and body harness must be used by personnel entering excavations with a potential for air hazards. A standby person must be stationed outside the excavation to tend the lifeline(s).

- Water must not be allowed to accumulate in open excavations where employees are working. When necessary, means such as diverting natural drainage around the excavation or actively pumping water must be used to prevent or control water accumulation.

- All structures adjacent to an open excavation must be supported, or a registered professional engineer (PE) must determine that the structure will not be affected by the excavation activities.

- Excavated materials (spoil) must be placed no closer than 2 feet from the edge of an open excavation, and otherwise retained to prevent loose material from falling into the excavation.

- Protection such as guardrails, barricades or covers must be in place to protect personnel from possible falls into open excavations, pits, wells and shafts.

- Work tasks will be designed to limit the number of personnel required to enter any excavation. All tasks that can be completed remotely from outside the excavation (such as soil sampling) will be conducted in such a manner.

- Personnel will not be allowed to enter any excavation unless adequate protective systems and procedures are utilized to prevent accidents and injury.

- All excavations over four feet in depth shall be provided with a stairway, ladder, ramp, or other safe means of egress so as to require no more than 25 feet of lateral travel. As deemed necessary by the competent person, excavations less than 4 feet in depth will be provided with a stairway, ladder, ramp, or other safe means of egress so as to require no more than 25 feet of lateral travel.

5.2 Excavations Requiring Protective Systems

This section defines excavations that require protective systems.

- All excavations into which employees will enter, regardless of depth, where the potential for cave-in exists.

- Any excavation over 4 feet in depth into which employees will enter that is not entirely in stable rock as defined in this procedure.

- Any excavation near a structure, (e.g. foundations, piers, footers, walls, sidewalks, tanks, roadways, etc.), as required by the registered professional engineer reviewing the stability of the excavation and the structure.

- All excavations over 20 feet in depth must be designed by a registered professional engineer regardless of whether personnel will enter it or not.

- All excavations with adjacent structures which are located a distance less than 6 times the depth of the excavation away shall be reviewed by a registered professional engineer to determine if the stability of the structure will be affected by the excavation.

- Support systems for an adjacent structure must be designed by a registered professional engineer.

5.3 Selection and Use of Protective Systems

5.3.1 Shoring or Shielding

- If shoring or shielding is selected as the protective system for an excavation, soil classification in accordance with 1926 Subpart P Appendix A (see Section 9 of this procedure) is required.

- One of the following options must be utilized for all excavations which will be shored or shielded.

    - Timber shoring as specified in 1926 Subpart P Appendix C must be utilized

    - Hydraulic shoring, trench jacks, air shores, or shields as required in 1926.652 (c)(2) must be utilized following the system manufacturer's data

    - A system which follows other tabulated data (approved by a registered professional engineer) must be utilized

    - The excavation must be designed by a registered professional engineer

5.3.2 Sloping

- If sloping is selected as the protective system for an excavation, the excavation sides must be sloped at a maximum of 34 degrees (1.5 Horizontal: 1 Vertical), unless the procedure listed above is followed.

- Soil classification in accordance with Section 10 of this procedure) is required for all excavations with sides which will be sloped greater than 34^{o} (1.5 Horizontal: 1 Vertical). If it will be sloped greater than 34^{o}, the one of the following options must be utilized:

    - Option 1 - assume Type C and slope 1.5/1 - probably the most common and preferred method for us

    - Option 2 - classify soil according to the standard and use Type A/B sloping requirements

    - Option 3 – use other tabulated data with PE approval

    - Option 4 – PE approval of sloping/benching design

5.4 Atmospheric Testing for Entry

Any excavation over 4 feet in depth with a potential for hazardous contaminants or oxygen deficiency must be tested for hazardous atmospheres prior to and during activities involving entry. After atmospheric testing, if the area is found to be oxygen deficient or a hazardous atmosphere exists or could exist a confined space permit must be obtained if the area will be entered.

The site designated "competent person" will document initial and periodic air monitoring results for all activities requiring entry into the excavation. All atmospheric testing of excavations must be conducted in the following sequence and meet the following air quality criteria.

- Oxygen content must be 19.5 to 23.5%
- Combustible gas or vapor must not exceed 10% of its lower explosive limit (LEL)
- Toxic air contaminant levels must not exceed 50% of the PEL or TLV for the specific contaminant whichever is lower
- Carbon monoxide must not exceed 10 ppm for a 5 minute average or ceiling value of 25 ppm
- Hydrogen sulfide must not exceed 0.5 ppm

5.5 Location of Underground/Overhead Utilities

- The competent person and the project manager shall both verify that local underground facilities location/protection agencies are notified within the required time frame prior to the initiation of excavation activities and meet all requirements in the ARCADIS Utility Location Policy and Procedure ARC HSFS019.
- Prior to initiation of excavation or trenching operations the competent person shall verify that all utilities have been located.

5.6 Daily/Periodic Inspections

- Prior to initiation of daily excavation or trenching operations the competent person shall complete a daily inspection of the excavation.
- During excavation or trenching operations the competent person shall complete a periodic inspection after any event (e.g., thunderstorm, vibration, excessive drying) that may affect excavation stability.
- The competent person shall complete the daily/periodic inspection checklist (A copy of the checklist is attached to this Policy as Exhibit A– Subcontractors must complete an equivalent inspection form) is completed for each inspection of excavation and trenching activities.

5.7 Soil Classification for Selection of Protective Systems

5.7.1 Soil Classification

This section describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. This

section contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

This section applies when a sloping, benching or shoring system is utilized as a method of protection for employees from cave-ins.

5.7.2 Soil Classification Definitions

5.7.2.1 Types/Classes of Soil

Type/Class A Soils are cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144kPa) or greater. Examples of cohesive soils are: Clay, silty clay, sandy clay, clay loam and in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if the following apply.

- The soil is fissured
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects
- The soil has been previously disturbed
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4 Horizontal:1 Vertical) or greater
- The material is subject to other factors that would require it to be classified as a less stable material

5.7.2.1.1 Type Class B Soils

- Cohesive soils with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa)
- Granular cohesionless soils including angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam
- Previously disturbed soils except those which would otherwise be classed as Type C soil
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration
- Dry rock that is not stable
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4 Horizontal:1 Vertical), but only if the material would otherwise be classified as Type B

5.7.2.1.2 Type/Class C Soils

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less
- Granular soils including gravel, sand, and loamy sand
- Submerged soil or soil from which water is freely seeping
- Submerged rock that is not stable
- Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4 Horizontal:1 Vertical) or steeper

5.7.2.2 Methods for Classifying Soils

Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in this section. The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis conducted by a competent person using tests described below, or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

The visual and manual analyses, such as those noted as being acceptable in this section, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits. Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

Observe the following:

- Samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine grained material is cohesive material. Soil composed primarily of coarse grained sand or gravel is granular material.
- Soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.
- The side of the open excavation and the surface area adjacent to the excavation. Crack like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

- The area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

- The open side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

- The area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

- The area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

5.7.2.3 Classifications

A. Plasticity. Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8 inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of 1/8 inch thread can be held on one end without tearing, the soil is cohesive.

B. Dry strength. If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

C. Thumb penetration. The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

D. Other strength tests. Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand operated shearvane.

E. Drying test. The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

1. If the sample develops cracks as it dries, significant fissures are indicated.

2. Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as an unfissured cohesive material and the unconfined compressive strength should be determined by using the thumb penetration or other test.

5.7.2.4 If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

5.7.2.5 Layered system

A layered system shall be classified in accordance with its weakest layer. Each layer may be classified individually where a more stable layer lies under a less stable layer.

5.7.2.6 Reclassifying Soils

A layered system shall be classified in accordance with its weakest layer. Each layer may be classified individually where a more stable layer lies under a less stable layer.

In most instances the ARCADIS designated Excavation/Trenching Competent person will assume Type C soil, unless they have conclusive data to validate Type A or B.

5.7.2.7 Excavation Construction Based on Soil Type

The Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V). Short-term exposure means a period of time less than or equal to 24 hours that an excavation is open. Soil and rock deposits must be classified in accordance with Appendix A to Subpart P of Part 1926. The maximum allowable slope for a soil or rock deposit must be determined from the table provided below. The actual slope

must not be steeper than the maximum allowable slope. The actual slope must be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope must be cut back to an actual slope which is at least horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope. When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person must determine the degree to which the actual slope must be reduced below the maximum allowable slope, and must assure that such reduction is achieved. Surcharge loads from adjacent structures must be evaluated in accordance with 1926.651(I). Configurations of sloping and benching systems must be in accordance with 29 CFR 1926 Subpart P, Appendix B.

EXCAVATION SLOPE TABLE 2 29 CFR 1926 SUBPART P APPENDIX B MAXIMUM ALLOWABLE SLOPES	
Soil or Rock Type	**Maximum Allowable Slopes (H:V)[1] for Excavations Less Than 20 Feet Deep[2]**
Stable Rock	Vertical (90 degrees)
Type A[3]	¾:1 (53 degrees)
Type B	1:1 (45 degrees)
Type C	1:½ (34 degrees)

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. Sloping or benching for excavations greater than 20 feet deep must be designed by a registered professional engineer.
3. A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth must be 3/4H:1V (53 degrees).

6. TRAINING

6.1 Project - Specific Training

All staff working on a site where trenching and excavation activities are being conducted by ARCADIS or its subcontractors will be provided with site orientation on excavation projects, and shall include a discussion of the following:

- Site excavation hazards and procedures
- Requirements for conducting activities remotely whenever possible
- Client requirements and procedures for excavation activities
- This Procedure

Daily Safety Meetings on projects involving excavation activities shall include a discussion of:

- Site excavation hazards and procedures
- Requirements for conducting activities remotely whenever possible
- Client requirements and procedures for excavation activities
- This Excavation and Trenching Procedure, as appropriate

6.2 Additional Training

Besides site orientation training, additional training will be provided as follows based on the employee's activities:

- All employees who work in the area of potential excavation/trenching sites will receive awareness level training as provided and/or approved by ARCADIS Corporate H&S in order to recognize and to understand the hazards.
- Entrants, Attendants, and Entrant Supervisors will receive additional training as approved by Corporate H&S. This training will be classroom in nature and cover the details of trenching and excavation hazards and controls
- Qualified Competent Persons will be provided training as follows:

  In order to be assigned duties as a competent person with respect to excavation and trenching, in addition to the criteria noted in section 4.6, personnel must attend an Excavation Competent Person training course approved by Corporate Health and Safety or have equivalent training to that provided in the course. The course shall include, but is not limited to the following:

  - Introduction to trenches and excavations
    - Definition of trenches and excavations
    - General requirements of OSHA 29 CFR 1926 Subpart P
  - Responsibilities and requirements of a competent person
    - Necessary authority
    - When other/outside resources may be necessary
  - Hazard Identification and Assessment
    - Cave-In Hazards including nearby structures
    - Underground utilities
    - Confined Space
    - Hazardous atmospheres

- Water accumulation
- Vehicular traffic and falling loads

- Hazard controls
  - Soil analysis and testing (visual and manual
  - Protective systems
    - Shoring
    - Sloping
    - Shielding
    - Benching
  - Personal protective equipment
  - Utility location
  - Atmospheric testing
  - Water drainage and pumping
  - Site housekeeping and management
    - Spoils
    - Traffic control
    - Overhead hazard protection
  - Communications
    - Verbal
    - Signaling
  - Access and egress
- Emergency Procedures
  - Warning signs of cave-in
  - Evacuation procedures
  - Rescue
- Inspections
  - Checklists

- Potential deficiencies

All training provided must be reviewed and approved by Corporate Health & Safety and will be managed through the Training Team.

Documentation of training certification received by attendance at any training course including externally provided training courses will be kept by the employee with copies provided to the Training Team.

7. REFERENCES

ARCADIS Health and Safety Procedure ARC HSFS010– Health and Safety Planning

ARCADIS Health and Safety Procedure ARC HSFS004 – Control of Hazardous Energy (Lockout/Tagout)

ARCADIS Utility Clearance Policy and Procedure ARC HSF019

ARCADIS Confined Space Policy and Procedure ARC HSF003

OSHA 29 CFR Part 1926 Subpart P - Excavations

8. RECORDS

8.1 Training records will be kept by the individual employee with copies of such certificates kept by the Training Team. Training dates and times will be kept by the Training Team.

8.2 Completed clearance forms and checklists will be kept in the project files with copies available for Corporate H&S review.

8.3 Copies of all HASPs that document excavation trenching procedures will be kept in the project files.

9. APPROVALS AND HISTORY OF CHANGE

Approved By: Michael Thomas, CIH, CPEA

History of Change

Revision Date	Revision Number	Reason for change
12 May 2008	01	Original document

Revision Date	Revision Number	Reason for change
13 June 2008	02	Modified Section 5.1 – 4th bullet related to structural ramps. Modified Section 5.2 to designate a 6x factor for structural integrity of structures near the excavation. Revised Exhibit 1 to modify the definition of a Competent person
9 January 2009	03	Cleaned up definitions, deleted training requirements from Section 5.0 and moved them to Section 6.0, modified purpose statement
31 March 2011	04	Updated Competent Person training and qualification requirements in section 4.6, section 6.2 and definition in Exhibit 1.

Exhibit 1 – Definitions

Attendant is a trained qualified individual stationed outside the excavation whose duty is to monitor authorized entrants inside the excavation or trench and have a means of communication with the designated rescue services.

Benching/Benching system means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury or otherwise injure and immobilize a person.

Competent person means one who, through education, training, and/or experience, is capable of identifying existing and predictable hazards or working conditions which are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt corrective measures to eliminate them.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface formed by earth removal into which a person can bodily enter. **Entry** constitutes the act by which an employee proceeds into an excavation or trench. Consideration of hazards, especially cave-ins and fall protection must still be considered and accounted for when equipment or personnel are near an excavation or trench, even if personnel will not be entering.

Entrants are employee's who are trained and authorized to enter a trench or excavation. Entrants must have attended a Qualified Excavation Training course offered or approved by Corporate Health and Safety.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous Atmosphere is an atmosphere which exposes employees to a risk of death, incapacitation, injury, or acute illness from one or more of the following:

- An atmospheric concentration of any substance in excess of 50% of its established permissible exposure limit (PEL); or its assigned threshold limit value (TLV) or other value listed on the Material Safety Data Sheet (MSDS) for the chemical constituent, whichever is lower.
- A flammable gas, vapor, or mist in excess of 10% of its lower explosive limit (LEL).
- An airborne combustible dust at a concentration that obscures vision at a distance of 5 feet or less.
- An atmospheric oxygen concentration below 19.5% (oxygen-deficient atmosphere) or above 23.5% (oxygen-enriched atmosphere).
- An atmosphere which is immediately dangerous to life and health.

Immediately Danger to Life and Health (IDLH) means any condition which poses an immediate threat to loss of life; may result in irreversible or immediate-severe health effects; may result in eye damage, irritation, or other conditions which could impair escape from the space.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems and other systems that provide protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce. To oversee an excavation/trench activity the PE must have experience with and expertise in excavation, soil and stability considerations.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shield can be either pre-manufactured or job-built in accordance with 1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields".

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Trench means a narrow excavation (in relation to its length) made below the surface of the ground to which a person can bodily enter. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 meters). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 meters) or less (measured at the bottom of the excavation), the excavation is considered to be a trench.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sides, and is plastic when

moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this procedure, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the characteristics of the deposits and the environmental conditions of exposure.

Submerged soil means soil which is underwater or is free seeping.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

Exhibit 2 – Daily / Periodic Excavation Inspection Checklist

ARCADIS		**Daily / Periodic Excavation Inspection Checklist**
Project Name:		**Date / Time:**
Project Number:		**Location:**
Prepared By:		**Project Manager:**

This checklist must be completed for all excavations. It documents that daily and post-event / periodic inspections are conducted.

Soil Classified As: Stable Rock Type A Type B Type C

Soil Classified On: By:

Type of Protective System in Use: Sloping Shoring Other _____

Description:

Inspection Item	YES	NO	Comments
Has the ARCADIS Utility Clearance Procedure been completed?			
Are underground installations protected from damage?			
Are adequate means of entry / exit available in the excavation – at least every 25 feet?			
If exposed to traffic, are personnel wearing reflective vests and adequate barriers/traffic controls installed?			
Do barriers exist to prevent equipment from rolling into the excavation?			
Was air monitoring conducted prior to and during excavation entry?			
Was the stability of adjacent structures reviewed by a registered P.E.?			
Are spoil piles at least 2 feet from the excavation edge?			
Is fall protection in use near excavations deeper than 6 feet?			
Are work tasks completed remotely if feasible?			
Is a protective system in place and in good repair?			
Is emergency rescue (lifeline / body harness) equipment used due to potential atmospheric hazard?			
Is excavation exposed to vibration?			
Are employees protected from falling / elevated material?			
Is soil classification adequate for current environmental / weather conditions?			
Do portable ladders extend at least 4 feet above the excavation?			
Are portable ladders or ramps secured in place?			
Have all personnel attended safety meeting on excavation hazards?			
Are support systems for adjacent structures in place?			
Is the excavation free from standing water?			
Is water control and diversion of surface runoff adequate?			
Are employees wearing required protective equipment?			
ARCADIS Excavation Competent Person:			**Date/Time:**

Attachment 3
H&S Standard -
Utility Clearance

EXECUTIVE SUMMARY

Damaging an underground or above ground utility can result in serious injury and loss of life, disrupt essential services, and create significant liability to ARCADIS, clients and subcontractors. Therefore, it is ARCADIS' policy that the presence of all existing utilities will be investigated and cleared (to the extent feasible) by locating, marking, and, where appropriate, visually verifying before the start of any field operation. The following requirements are mandatory under this policy:

- A minimum of three (3) reliable lines of evidence are required for an acceptable utility clearance.
- Additional lines of evidence are required if the primary lines of evidence cannot adequately identify subsurface, submarine or above ground utilities with reasonable certainty.
- The lines of evidence used will be reasonable and appropriate for the conditions expected to be encountered and the type of utilities expected to be encountered (e.g., gas line versus an irrigation line).
- Utility clearance information will be documented on the ARCADIS Utility and Structures Checklist or equivalent client provided checklist or permit presenting equivalent information.
- Employees overseeing utility clearance activities will:
    - Be familiar with the contents of this standard;
    - Have one year field experience in the identification of utilities; and
    - Have training and six months experience in the proper operation and results interpretation of any clearance equipment used by ARCADIS employees, including without limitation, magnetometers and ground penetrating radar.
- All utility strikes must be reported to Corporate Health and Safety and Legal within 24 hours using the Utility Line and Incident Involving a Third Party Incidents Investigation Form. Do not enter the incident into 4-Sight until approved to do so by Corporate Legal.

Report Utility Incident Now

1. POLICY

It is the practice of ARCADIS and its affiliated companies to implement appropriate, reasonable and practical standards within acceptable and customary industry practices to promote the health and safety of its employees, and avoid and mitigate exposure of risk in the performance of their work. In furtherance of this policy, ARCADIS promotes and encourages compliance by all employees with this policy and standards relating to work in the vicinity of subsurface, submarine or aboveground utilities.

2. PURPOSE AND SCOPE

2.1 Purpose

This standard directs general safety standards and best practices associated with the identification and management of subsurface, submarine and aboveground utilities on project sites.

2.2 Scope

This standard assigns responsibilities and expectations for proper utility clearance by both ARCADIS employees and ARCADIS subcontractors at project sites.

3. DEFINITIONS

Refer to ARC HSFS-019 Supplement 1 for definitions of terms used in this standard.

4. RESPONSIBILITIES

4.1 Project Manager Responsibilities

For every project site having the potential to come into contact with utilities, Project Managers must ensure that:

- The requirements of this standard are followed.
- Local regulations governing utility clearance are followed.
- Efforts are made to work with the client, project site representatives and subcontractors to identify the nature of any utilities, and to determine what control processes need to be implemented by ARCADIS and the subcontractors to prevent damage to these utilities and to properly manage the effects in the event there is utility damage.
- Utility clearance activities are only delegated to a Task Manager or other individual meeting the requirements of section 4.2 below, as appropriate. However, even if the Project Manager delegates certain responsibilities, the Project Manager maintains primary responsibility for a complete utility clearance.

4.2 Field Personnel Responsibilities

ARCADIS field personnel conducting work on a project site having the potential to come into contact with utilities have the responsibility to:

- Read, understand, and follow this standard and complete the appropriate checklists during the on-site utility locate process.
- Complete a minimum of 1 year of utility clearance related experience before accepting responsibility for any utility clearance tasks.
- Complete training and have 6 months of experience in operating and interpreting the results of remote sensing technologies, including without limitation, magnetometers and ground penetrating radar, before operating such technologies.
- Use their Stop Work Authority to eliminate any reasonable concern if utilities cannot be reasonably located.
- Ensure that ARCADIS subcontractors conduct their own reasonable independent utility clearance efforts as required by ARCADIS' standard subcontract, and are aware of any ARCADIS clearance standards used onsite.
- Be on site during any active intrusive activities involving contractor under contract to ARCADIS.

4.3 ARCADIS Subcontractor Responsibilities

According to ARCADIS' standard subcontract, subcontractors have agreed to take responsibility for any damages resulting from a utility impact cause by their work. Therefore, ARCADIS subcontractors are expected to take reasonable time and diligence to conduct their own independent utility clearance using reasonable standards and processes. Subcontractors have the responsibility to stop their work if utility concerns are identified and will report those concerns to the ARCADIS employee overseeing their work activities. ARCADIs staff should reinforce these responsibilities with subcontractors during job safety briefings.

5. STANDARD

5.1 General

Protocols to be followed during utility clearance activities are outlined in:

- Best Practices for Project Managers (or Their Delegates) Concerning Utility Clearance (ARC HSFS-019 Supplement 2).
- Best Practices for Field Personnel Concerning Utility Clearance (ARC HSFS-019 Supplement 3).

5.2 Lines of Evidence

A minimum of 3 lines of evidence are required for an appropriate utility clearance as defined in this standard. Generally, the following lines of evidence may be utilized to meet this requirement:

- Contact the State One Call or equivalent service (Nationwide "811" is acceptable) if working within the right-of-way or public areas served by such services. For work on private property or in areas not served by such services, utilize a reputable private utility locating company to locate and mark the utilities. Utilization of a private utility locator is encouraged for all projects with subsurface or submarine utility issues.

- Use detailed scaled site utility plans, preferably in the form of an "as-built" or "record" drawing, to identify and/or confirm utility locations.

- Conduct a detailed visual site inspection to identify and/or confirm utility locations. For underground utilities, conduct an inspection for structures that tend to indicate the presence and general location of such utilities, including, but not limited to manholes, vaults, valve covers, valve markers, telephone pedestals, transform housings, fire hydrants, spigots, sprinkler heads, air relief valves, backflow preventers, meters, downspouts going into the subsurface, power poles with wring going into the subsurface and line markers. Saw cut lines and concrete /asphalt repairs often yield valuable information regarding utility locations. Always discuss the presence of utilities with the site owner, operator or occupant to identify any potential utilities that might not be readily identified by non intrusive clearing methods or may be:

    - At depths > 5 ft below ground surface; or

    - At very shallow depths (< 2ft below ground surface) such as electrical conduits/wiring, irrigation lines, etc.

View the Utilities and Structures Checklist

If one of the above lines of evidence cannot be utilized, or if using the above lines of evidence does not adequately identify utilities with reasonable certainty, one or more additional lines of evidence must be utilized. Commonly used lines of evidence are listed on the Utility and Structures Checklist.

A discussion of use and limitations associated with common utility clearance methods is provided in ARC HSFS-019 Supplement 4.

The lines of evidence will be recorded on the Utility and Structures Checklist or equivalent client provided checklist or permit presenting equivalent information.

5.3 Color Codes Used for Utility Markings

The following colors are used for marking utilities. Some government agencies or large industrial facilities may use additional colors not provided below. ARCADIS policy is to assume any paint marking or pin flag color not provided below is a subsurface utility marking until proven otherwise.

COLOR	Utility Line
WHITE	Proposed Excavation
PINK	Temporary Survey Markings
RED	Electrical Power Lines, Cables, Conduit and Lighting Cables
YELLOW	Gas, Oil, Steam, Petroleum or Gaseous Materials
ORANGE	Communication, Alarm or Signal Lines, Cables or Conduit
BLUE	Potable Water
PURPLE	Reclaimed Water, Irrigation and Slurry Lines
GREEN	Sewer and Drain Lines

APWA and ANSI standard Z-53.1

5.4 Working in Close Vicinity of Subsurface Utilities

No work will be conducted within 30 inches of a subsurface utility marking, or as prescribed by the utility owner, unless the utility is exposed through hand clearing. Make sure to factor the diameter of the utility when determining the 30 inch buffer zone as this may increase the distance from the actual marking (if the markings do not indicate diameter of utility).

Manual clearing methods such as shoveling, using pick axes, digging bars and other hand tools should be used with caution. Excessive down force, prying or use in poor/obstructed visibility conditions is prohibited as these tools can damage utilities.

For borings and excavations, if the utility is known to be at depths where hand clearing is not reasonable or creates additional safety concerns, no work will be performed within 30 inches vertically or horizontally of the utility unless manual clearing is performed under the oversight of an Excavation Competent Person as defined in the ARCADIS Excavation and Trenching H&S standard (ARC HSCS005).

For horizontal borings, to avoid potential of utility strike, damage from vibration, damage by pressure of the advancing boring, do not plan the drill boring location within 30 inches vertically of utilities. This requirement applies even if the operating contractor has technology that places the location to within a few inches. Make sure to factor the diameter of the utility when determining the 30 inch buffer zone.

Additional cautions are required when coring/cutting through or removing concrete or asphalt. Utilities may be encased within these materials or in the gravel sub grade under these materials and may be damaged during the utility clearance process. Always work slowly, methodically and frequently stop work to evaluate conditions during these work activities.

Additional cautions for horizontal borings include gravity utilities such as sewers and storm drains as the depth of these utilities will change (sometimes

significantly) as they run across the project site. Always obtain the utility depth at the location where the boring will actually cross the line.

5.5 Acceptable Clearance for Working in Vicinity of Overhead Power Lines

No work will be performed by ARCADIS or a subcontractor where any equipment is within the limits specified below, unless the power line has been properly covered or de-energized by the owner or operator of the power line:

Power Line Voltage Phase to phase (kV)	Minimum Safe Clearance (feet)
50 or below	10
Above 50 to 200	15
Above 200 to 350	20
Above 350 to 500	25
Above 500 to 750	35
Above 750 to 1,000	45

ANSI standard B30.5-1994, 5-3.4.5

5.6 Reporting Utility Incidents

ARCADIS field personnel involved with any subsurface, submarine, and above-ground utility strikes should immediately stop work and contact the Project Manager to discuss the incident. The utility strike must be reported to Corporate Health and Safety and Legal Departments within 24 hours. Use the Utility Line and Incidents Involving a Third Party Incident Investigation Form as part of the notification process.

Selected utility strike incidents may also utilize a conference call with operations management to review findings and lessons learned. The Divisional Health and Safety Manager will make the determination concerning the need to have the call, and will arrange the call, if deemed necessary.

5.7 Relationship of this standard to the Project Specific HASP

With the exception of the Utility and Structures Checklist, this standard, including most supplements, are not designed to be printed off and attached to project HASPs. During project health and safety planning, this standard will be reviewed and applicable clearance technologies and methods will be documented on the Utility and Structures Checklist.

Additionally, emergency action standards specific to utility strikes should be addressed. ARC HSFS-019 Supplement 5 provides general guidelines for emergency response to utility strikes. Applicable information may be attached to the Utility and Structures Checklist to facilitate communication of response expectations.

5.8 Required Contract Terms and Conditions

ARCADIS' standard client and subcontractor contracts contain required terms and conditions defining responsibility for utility clearance and the allocation of risk associated with an impacted utility. These terms and conditions have prescribed language concerning subsurface work that is presented in ARCADIS client contracts and ARCADIS subcontractor contracts. If such provisions cannot be agreed upon, the reasons are documented and other risk-management actions should be identified, such as limits of liability, additional physical investigations, additional lines of evidence or utility location, assignment of risk to subcontractors, etc. In addition, any changes to these terms and conditions require approval by Legal Services.

6. TRAINING

Employees responsible for coordinating or conducting utility clearance activities will be familiar with the requirements of this standard.

7. REFERENCES

- Utility and Structures Checklist
- Utility Strike and Incidents Involving Third Parties Investigation Form
- HSFS-019 Supplement 1, Utility Definitions
- HSFS-019 Supplement 2, Best Practices for Project Managers (or Their Delegates) Concerning Utility Clearance
- HSFS-019 Supplement 3, Best Practices for Field Personnel Concerning Utility Clearance
- HSFS-019 Supplement 4, Use and Limitations Associated with Common Utility Clearance Methods
- HSFS-019 Supplement 5, Emergency Action Plan guidelines for Utility Strikes
- ARC HSCS005 Excavation and Trenching
- Required client contract language concerning subsurface work
- Required subcontractor language concerning subsurface work

8. RECORDS

8.1 Utility Clearance Records

All records (maps, checklists and documentation of communications) used to determine the location of utilities should be retained and kept in the project file.

9. APPROVALS AND HISTORY OF CHANGE

Approved By: Tony Tremblay, Environment Division Health and Safety Manager

History of Change

Revision Date	Revision Number	Reason for change
13 December 2006	01	Original document
26 March 2007	02	Put in new company format
15 May 2007	03	Added nation-wide 811 number
6 September 2007	04	Changing over to new template format
22 February 2008	05	Changing over to new template format
13 January 2009	06	Define lines of evidence
4 October 2010	07	Reformatting and addition of utility clearance information

Exhibit 3-1
Utilities and Structures
Checklist

Utilities and Structures Checklist

Project: Former Teutonia Hall
Project Number: 05633002.0000
Date:
Work locations applicable to this clearance checklist:

Pre-Field Work

One Call or "811" notified 48-72 hours in advance of work? ☐ Yes ☐ No
Utility companies notified during the One Call process ☐ See attached ticket

List any other utilities requiring notification: ☐ None

Client provided utility maps or "as built" drawings showing utilities? ☐ Yes ☐ No

Field Work

Markings present: ☐ Paint ☐ Pin flags/stakes ☐ Other ☐ None

Subsurface Utility Lines of Evidence Used (3 Minimum):

- ☐ One Call/"811"
- ☐ Client Provided Maps/Drawings
- ☐ Client Clearance
- ☐ Interviews: Name(s)/Affiliation(s)

Did persons interviewed indicate depths of any utilities in the subsurface?

- ☐ Yes, depths provided:
- ☐ Did not know or refused to answer

Comments:

- ☑ Site Inspection
- ☐ GPR
- ☐ Air-Knife
- ☐ Hydro-Knife
- ☐ Public Records/Maps
- ☐ Radiofrequency
- ☐ Metal Detector
- ☐ Handauger
- ☐ Potholing
- ☐ Probing
- ☐ Private Locator: Name and Company:
- ☐ Marine Locator: Name and Company:
- ☐ Other:

Tips for Successful Utility Location:
1. No excessive turning or downward force of handaugers/shovels, etc.
2. No hammering- no pickaxes-no digging bars-no hurrying or shortcutting
3. Select alternate/backup locations for clearance
4. Utilities may run directly under asphalt/concrete or be > 5 ft depth
5. Be on site when utilizing private utility locators

T R A C K

Site Inspection

During inspections look for the following ("YES" requires follow up investigation):

		Utility color codes		
a)	Natural gas line present (evidence of a gas meter)?	Yellow	☐ Yes	☐ No
b)	Evidence of subsurface electric lines :	Red		
	i) Conduits to ground from electric meter?		☐ Yes	☐ No
	ii) Overhead electric lines absent		☐ Yes	☐ No
	iii) Light poles, electric devices with no overhead lines?		☐ Yes	☐ No
c)	Evidence of water lines:	Blue		
	i) Water meter on site?		☐ Yes	☐ No
	ii) Fire hydrants in vicinity of work?		☐ Yes	☐ No
	iii) Irrigation systems?		☐ Yes	☐ No
d)	Evidence of sewers or storm drains:	Green		
	i) Restrooms or kitchen on site?		☐ Yes	☐ No
	ii) Gutter down spouts going into ground		☐ Yes	☐ No
	iii) Grates in ground in work area		☐ Yes	☐ No
e)	Evidence of telecommunication lines:	Orange		
	i) Fiber optic warning signs in areas?		☐ Yes	☐ No
	ii) Lines from cable boxes running into ground?		☐ Yes	☐ No
	iii) Conduits from power poles running into ground?		☐ Yes	☐ No
	iv) Aboveground boxes or housings in work area?		☐ Yes	☐ No
f)	Underground storage tanks:			
	i) Tank pit present?		☐ Yes	☐ No
	ii) Product lines running to dispensers/buildings?		☐ Yes	☐ No
	iii) Vent present away from tank pit?		☐ Yes	☐ No
g)	Proposed excavation markings in work area?	White	☐ Yes	☐ No
h)	Other:			
	i) Evidence of linear asphalt or concrete repair		☐ Yes	☐ No
	ii) Evidence of linear ground subsidence or change in vegetation?		☐ Yes	☐ No
	iii) Manholes or valve covers in work area?		☐ Yes	☐ No
	iv) Warning signs ("Call Before you Dig", etc) on or adjacent to site?		☐ Yes	☐ No
	v) Utility color markings not illustrated in this checklist?		☐ Yes	☐ No
i)	Aboveground lines in or near the work area:			
	i) < 50 kV within 10 ft of work area?		☐ Yes	☐ No
	ii) >50 - 200 kV within 15 ft of work area?		☐ Yes	☐ No
	iii) >200-350 kV within 20 ft of work area?		☐ Yes	☐ No
	iv) >350-500 kV within 25 ft of work area?		☐ Yes	☐ No
	v) >500-750 kV within 35 ft or work area?		☐ Yes	☐ No
	vi) >750-1000 kV within 45 ft of work area?		☐ Yes	☐ No

Comments:

Do not initiate intrusive work if utilities are suspected to be present in area and are not located, markings are over 14 days old, or if clearance methods provide incomplete or conflicting information. Do not perform intrusive work within 30 inches of a utility marking without hand clearing.

Name and signature of person completing the checklist:

Name: _____

Signature: _____

Date: _____