Remedial Action Work Plan
Former Gorham Manufacturing Facility
Parcel B, Adelaide Avenue
Providence, Rhode Island

Prepared for

City of Providence
Department of Public Property
Providence, Rhode Island 02903

Prepared by

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1. INTRODUCTION AND SITE DESCRIPTION

On behalf of the City of Providence (the City), EA Engineering, Science, and Technology, Inc. has prepared this Remedial Action Work Plan (RAWP) for the Parcel B area of the former Gorham Manufacturing site in Providence, Rhode Island (the Site). This RAWP has been prepared to satisfy Section 9.0 of the Rhode Island Department of Environmental Management (RIDEM) Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (the Remediation Regulations dated August 1996, as amended February 2004).

The Site is currently undeveloped and lightly vegetated. A stockpile of concrete and brick rubble, removed from the subsurface during RIDEM-approved Limited Remedial Action Work Plan (LRAWP) activities in 2005, is located near the northern property boundary of Parcel B. To the east of the Site is the Parcel A area of the former Gorham Manufacturing facility, which is currently developed with a commercial retail facility and associated fueling station and parking area. To the west of the Site is the Parcel C portion of the former Gorham Manufacturing facility, which is also currently vacant. Mashapaug Pond is located approximately 120 ft to the north of the Site, and Adelaide Avenue and its associated residences are located to the south. The Providence Water Supply Board provides potable water for the residences along Adelaide Avenue and the adjacent retail complex. No public water supplies are located within 1 mi of the Site. A site locus map is included as Figure 1.

The adjacent Mashapaug Pond is classified by RIDEM as a Class C Surface Water Body, indicating that it is unsuitable for consumption of recreational use. Groundwater at the Site is classified as GB, indicating that it is not suitable for consumption without treatment. The direction of groundwater flow is presumed to be toward the north and Mashapaug Pond. Site investigations have encountered groundwater at approximately 25 ft below ground surface.

Topography over the Site is generally flat, with a slight slope toward the north and Mashapaug Pond. According to the U.S. Geological Survey topographic map (Figure 1), the Site is located at an elevation of approximately 70 ft above mean sea level. Bedrock at the site is characterized as a meta-sedimentary sequence of the Rhode Island Formation. The bedrock surface was not encountered during any environmental investigations conducted at the Site. Non-native fill material was encountered to approximately 15 ft below ground surface. Native soils observed during drilling activities were predominantly sand deposits.

2. SUMMARY OF SITE INVESTIGATION

Numerous previous environmental investigations and remedial actions have been conducted at the former Gorham Manufacturing site. These investigations include activities conducted both prior to and following subdivision of the Site into three separate parcels by various responsible or otherwise interested parties. The most recent site investigations for Parcel B were completed in 2005 by EA on behalf of the City.

The collective body of work that comprised the 2005 site investigation was documented in several site investigation summary reports and letters of correspondence to RIDEM, including the following:

- Site Investigation Report Addendum, Former Gorham Manufacturing – Parcel B, 333 Adelaide Avenue, Providence, Rhode Island, April 2005
- Response to RIDEM Site Investigation Report Comments, 19 May 2005
- Limited Remedial Action Work Plan and Supplemental Site Investigation Summary Report, Former Gorham Manufacturing Site, Parcel B, September 2005
- Response to Public Comments, Former Gorham Manufacturing Site, Parcel B, 24 January 2006
- Additional Response to Public Comments, Former Gorham Manufacturing Facility, Parcel B, 30 March 2006.

The conclusions of the 2005 site investigation were:

- Groundwater is not a media of concern at the Site.
- Polycyclic aromatic hydrocarbons in surficial soil at the site and volatile organic compounds (VOCs) in soil vapor are compounds of concern at the Site.
- The proposed remedial action for the Site includes: (1) construction of an engineered cap and instituting an Environmental Land Usage Restriction (ELUR) to eliminate the potential for direct exposure to contaminated soil by Site users; and (2) installation of an active, sub-slab venting system to remove potentially harmful soil vapors from beneath the future school building slab, thereby eliminating the potential for such vapors to enter into the future school building via subsurface infiltration.

RIDEM issued a Remedial Decision Letter, dated 7 April 2006, to the City that conceptually concurs with the proposed remedial alternative (engineered cap and sub-slab venting system) for the Site. In accordance Section 9.0 of the Remediation Regulations, the purpose of this RAWP is to document how the proposed remedial action will be implemented. The remainder of this document (Sections 3 through 15) is intended to fulfill the requirements set forth in Sections 9.02 through 9.19 of the Remediation Regulations.

3. PROPOSED DEVELOPMENT

The City will build a new public high school on a 4-acre portion of the former Gorham Manufacturing property referred to as Parcel B. The facility will include administration and classroom areas, a gymnasium, and a cafeteria. The majority of the Site will be paved or occupied by the building footprint.

A site plan obtained from the City's architectural contractor (Edward Rowse Architects, Providence, Rhode Island) illustrating the proposed high school layout is provided in Appendix A.

4. REMEDIAL OBJECTIVES

4.1 SOIL

The long-term remedial objective for soil is to prevent direct exposure to Site soils containing contaminant levels above the RIDEM Residential Direct Exposure Criteria. The construction of an engineered cap will isolate the soil and achieve this objective and, therefore, protect the health of future Site visitors.

The short-term remedial objective for soil is to minimize direct contact with Site soils during remedial and construction activities. A Safety, Health, and Emergency Response Plan (SHERP) and a Soil Management Plan (SMP) were prepared and implemented in 2005 during the Limited Remedial Action Work Plan (LRAWP) site preparation activities. The SHERP and SMP have been revised, as appropriate. The SMP has also been incorporated into the Draft ELUR for the site. Copies of the SHERP and Draft ELUR with the accompanying SMP are provided in Appendixes B and C, respectively.

4.2 GROUNDWATER

Groundwater beneath the Site, located at approximately 25 ft below ground surface, is classified as GB by RIDEM. The 2005 site investigation (Section 2) indicated that groundwater beneath the Site is in compliance with the RIDEM GB Groundwater Objectives. No contact with site groundwater is expected during construction activities, and groundwater will not be used for any purpose during or following construction activities. Therefore, no groundwater objectives are proposed at this time.

However, the abutting Parcel A located east of the Site (a.k.a. the Stop & Shop Parcel) is currently undergoing site assessment and remediation activities by another responsible party relative to groundwater contamination. The City will allow reasonable Site access to RIDEM or other responsible parties for future groundwater investigations, treatment, and/or monitoring as necessary.

4.3 SURFACE WATER AND SEDIMENT OBJECTIVES

There is no surface water or sediment located at the Site. No contact with nearby Mashapaug Pond or sediments will occur during construction and remediation activities, and restrictive fencing with deterrent vegetation will be installed along the northern Parcel B property boundary prior to implementation of the RAWP to further restrict access to nearby surface water and sediment. Therefore, no surface water or sediment objectives are proposed at this time. Section 5.4 provides additional information regarding the restrictive fencing to be installed.

4.4 AIR OBJECTIVES

The site investigation and LRAWP activities completed in 2005 indicated that there is a potential for VOCs and, to a lesser extent, methane gas to build up beneath the future building slab and migrate into the proposed high school structure.

The first long-term air objective for the Site is to prevent the users of the proposed high school from direct exposure to indoor air containing methane in excess of 1 percent of the lower explosive limit (LEL) or VOCs in excess of Proposed State of Connecticut Residential Target Air Concentrations (CT RTAC) (Appendix D). Installation, operation, and maintenance of an active sub-slab venting system and implementation of an air monitoring program that includes periodic sub-slab air sampling and laboratory analysis for VOCs and methane will achieve this objective.

The second long-term air objective for the Site is to prevent the discharge of contaminants from the sub-slab venting system to the atmosphere in concentrations that exceed criteria contained in the RIDEM Air Pollution Control Regulations (Regulation No. 9). Preliminary air emission estimates based upon soil gas survey data collected during the 2005 site investigation indicate that emissions from the proposed sub-slab venting system will not require treatment or a permit from RIDEM's Office of Air Resources. These estimates are presented in Section 6.2. Actual emission values calculated after the system is installed and operational, based upon laboratory analysis to be performed on the sub-slab venting system effluent, will verify the preliminary estimates and determine if treatment/ permitting requirements apply.

The short-term air objective for the Site is to prevent airborne nuisance dust migration from impacting nearby residents during construction and remediation activities. A comprehensive, RIDEM-approved dust monitoring and dust suppression program was implemented at the Site between 10 August and 6 September 2005 during LRAWP site preparation activities. The dust monitoring and dust suppression program included daily upwind/downwind air sampling, daily sampling of onsite worker breathing zones, regular application of water to work areas, installation/maintenance of windscreen fabric, and comparison of laboratory data with action levels established in accordance with the Occupational Safety and Health Administration (OSHA) and Rhode Island Department of Health. As documented in the LRAWP Summary Report, the monitoring data clearly demonstrated the effectiveness of the dust suppression program and the overly conservative nature of the monitoring program implemented at the Site. Specifically, one of the objectives of the LRAWP was to segregate various types of debris and asbestos from the soil beneath the building footprint. This objective was achieved, and all asbestos encountered during excavation and processing of soil beneath the building footprint to a depth of approximately 10 feet below grade was properly disposed off-site. Of the 73 asbestos air samples collected during the LRAWP, including samples collected from personal air monitoring devices worn by the qualified asbestos handler that was physically handling the asbestos and by the equipment operator performing excavation activities, only 2 samples revealed an asbestos concentration above the laboratory's minimum detection limit. In addition, the 2 sample results (0.008 f/cc and 0.013 f/cc) were far below the applicable OSHA Personal Exposure Limit (PEL) of 0.1 f/cc for personal air samples).

With respect to upwind and downwind monitoring, all upwind and downwind results from samples collected during the LRAWP activities were below all applicable OSHA requirements. Based upon these results and considering the goal of protecting nearby residences located south of the Site, fence line monitoring along the southern Site property boundary only is proposed. With respect to personal air monitoring devices, as previously discussed and as clearly demonstrated during the highly intrusive (i.e., high potential for dust generation) LRAWP activities, on-site workers need not be fitted with personal air monitors provided that the proposed dust suppression activities are implemented during intrusive site activities.

In summary, the short-term air objective will be achieved during implementation of the RAWP through the use of the same dust suppression program implemented during the LRAWP. A limited air monitoring program will be implemented to demonstrate the effectiveness of the dust suppression program. The proposed dust suppression and dust monitoring program is described below:

- During site construction, a tanker truck equipped with multiple spray nozzles and a hose attachment will regularly traverse the work area applying water throughout the course of site activities, as needed.

- Manual application of water to specific work areas, debris, soil piles, and any other areas in need of dust control not covered by the tanker truck's spray nozzles will also be implemented, as needed, throughout the site development and RAWP implementation activities. Water sprinklers may be used in place of or to supplement the water applied by the tanker truck if needed.

- Fabric wind screens currently installed along the perimeter fencing at the Site will be regularly inspected and maintained as needed.

- During the first week of intrusive construction activities, one daily time-weighted air sample will be collected and analyzed for nuisance dust via Phase Contrast Microscopy (PCM). The sample will be collected from a stationary sampling station equipped with a low volume sampling pump located along the Site's southern fence line closest to the residential neighborhood abutting the Site. The sampling pump will collect a time-weighted sample over the course of the workday during hours of on-site activities. The samples will be submitted to a laboratory with a requested turn around time of 24-48 hours from the time the samples are delivered for analysis. Action levels established in accordance with applicable Occupational Safety and Health Administration, EPA, and Rhode Island Department of Health guidelines and required responses for dust are included in Table 3 of the Site Safety, Health, and Emergency Response Plan (copy included in Appendix B).

- If all dust sampling data collected during the first week of intrusive construction activities are less than the applicable action levels, then the frequency of nuisance dust sampling will be reduced to once per month during site activities that have the highest potential to generate dust. If no intrusive site activities with the potential to generate dust are ongoing, then no dust sampling will be completed.

- Copies of all dust sampling data will be forwarded to RIDEM on a weekly basis for the first month of construction, and monthly during the remainder of the construction schedule.

5. PROPOSED REMEDY

The long-term remedy proposed for the Site involves the following elements:

- Engineered cap construction
- Instituting an ELUR for the property
- Installation, operation, monitoring, and maintenance of an active sub-slab venting system
- Installation, monitoring, and maintenance of a fence designed to prohibit access to the area of the Site referred to as the Park Parcel by users of Parcel B.

This long-term remedy for impacted soils and soil vapor is consistent with the Remediation Regulations and is appropriate and safe for the specific use (high school) proposed within the boundaries of the portion of the contaminated site for which it is designed (Parcel B). Furthermore, as an additional measure of safety and protection, the proposed remedy is also designed to provide an effective physical barrier (fencing with deterrent vegetation) to prevent access to abutting areas scheduled for remediation, or potentially in need of remediation as applicable site investigations and RAWPs are being developed and/or implemented. The short-term remedy for impacted soil involves the minimization of worker contact.

5.1 ENGINEERED CAP CONSTRUCTION

The objective for this project is to integrate access roadways, parking areas, building footprints, and the landscaped areas into the final cap design. The engineered cap components will consist of the following layers:

- Closure cap subgrade
- Geosynthetic fabric filter layer (for landscaped areas only)
- Protective cover soil
- Vegetative cover
- Site improvements.

These layers are more fully described below, in order of ascendance above the native site soils. Cross-section details of the proposed engineered cap are included on Design Drawing E.2 provided in Appendix E.

5.1.1 Closure Cap Subgrade

A closure cap subgrade will be prepared from the existing site grade that will create adequate stormwater drainage for the Site, and serve as a suitable base for the components of the closure cap system.

5.1.2 Geosynthetic Fabric Filter Layer

A geosynthetic fabric filter layer (ProPex 4510 or equivalent) will be placed above the closure cap subgrade and below a protective soil cover for all landscaped areas of the site to prevent human exposure to impacted soil. Geosynthetic fabric filter materials are currently the standard of practice in landfill cap systems and are recommended by most designers and the regulatory community. The fabric filter will be installed so that the seams overlap to prevent the underlying impacted soil from mixing with the clean soil. Technical specifications for the fabric filter are provided in Appendix E.

5.1.3 Protective Cover Soil Layer/Vegetative Cover

The protective cover soil layer of the closure cap system, also commonly termed the vegetative support soil layer, will consist of a minimum of 2 ft of certified clean fill material or equivalent in all areas of the site, and a minimum of 2 ft of clean soil in all areas known or suspected to be subject to the RIDEM Rules and Regulations for Composting Facilities and Solid Waste Management Facilities (Solid Waste Regulations), and under the jurisdiction of RIDEM's Solid Waste Program. This layer is designed to provide for root growth while buffering the underlying layers from damage due to the effects of frost penetration, root penetration, and loading of the finished surface of the landfill closure cap. The upper 6 in. of this soil layer will be specified as an organic topsoil having characteristics to promote adequate vegetation, stability, and erosion resistance in the landscaped areas of the Site.

The vegetative cover component will be specified to be a locally adapted perennial plant mix that is suitable for the Rhode Island area climate. The species will be capable of surviving in a low nutrient soil with little or no requirements for nutrient addition. Root penetration into the soil should be less than the minimum thickness of the soil cover layer so as not to affect the drainage media or geosynthetic material beneath. A regular inspection of the vegetative cover is necessary to ensure that adequate soil cover and stability are maintained on the Site.

Prior to delivery and placement, all clean fill material, including sub-grade material and loam, imported to the Site, will be sampled and analyzed for compliance with the RIDEM Method 1 Residential Direct Exposure Criteria in accordance with the following frequency: one sample for every 500 cubic yards will be analyzed for arsenic, and one quarter of the total number of compliance samples will also be analyzed for VOCs, Total Priority Pollutant metals, polycyclic aromatic hydrocarbons, and total petroleum hydrocarbons. Laboratory analytical results will be submitted to RIDEM via facsimile, and written approval will be received from RIDEM prior to use at the Site.

If the Residential Direct Exposure Criteria are exceeded, the fill material will be rejected as unsuitable. Laboratory results will be included in the Remedial Action Closure Report for the Site.

5.1.4 Site Improvements

The proposed Parcel B development will include extensive non-landscaped areas containing the proposed school structure, paved roadways, paved walkways, and paved parking areas. The engineered cap design proposed for asphalted areas will include a minimum of 6 in. of appropriate base coarse fill material covered with a minimum of 4 in. of bituminous asphalt. The engineered cap design proposed for concrete pavement areas will include a minimum of 4 in. of poured concrete over a minimum of 6 in. of appropriate base coarse material. An active sub-slab venting system, consisting of a network of suction fans, piping, and suction pits designed to create a negative pressure beneath the school, will be installed beneath the building structure. The components of the sub-slab venting system and the school's concrete slab foundation will cap the area beneath the school.

5.2 ENVIRONMENTAL LAND USAGE RESTRICTION

An ELUR, documenting the required maintenance and annual inspection of the remedy, will be recorded in the City's land evidence records for the property following construction activities and implementation of the remedial action. The ELUR will include an SMP with established procedures should any future work at the Site involve the disturbance or excavation of site surfaces and underlying soils. A Draft ELUR, which includes the SMP, is provided in Appendix C.

5.3 SUB-SLAB VENTING SYSTEM

The design of the active sub-slab venting system proposed for the Site is based upon the U.S. Environmental Protection Agency's (EPA's) guidance for radon gas evacuation systems as outlined in Radon Prevention in the Design and Construction of Schools and Other Large Buildings, EPA/625/R-92/016 (January 1993). Although radon is not a contaminant of concern, the application of the EPA radon prevention guidance document is appropriate for this Site based upon the fact that soil vapor contaminants of concern for the Site (VOCs and methane) are expected to potentially have similar transport characteristics when compared to radon. Specifically, VOCs, methane, and radon, if present in the subsurface, are all expected to have the potential to be drawn toward the future school building interior via pressure-driven transport or, to a lesser extent, diffusion-driven transport mechanisms. The sub-slab venting system is designed to create low-pressure zones beneath the school structure which will prevent VOCs and methane (if any) from entering the building through a series of suction fans, subsurface piping, sub-slab aggregate material, and other design features. Air exhausted from under the slab will be released to the atmosphere above the roof.

Air emission design calculations, based upon existing soil gas data for the Site, indicate that no permits and no treatment of the system effluent will be required. Design calculations and copies of laboratory data used to make this preliminary determination are provided in Section

6.2. Annual air samples of the system effluent will be collected after the system is operational to re-evaluate whether or not any permits or treatment are required.

Each of the major design components of the active sub-slab venting system is presented in the following subsections. The proposed suction pit locations, vertical piping locations, and other design specifications are presented on Design Drawings E.1 and E.2 (Appendix E).

5.3.1 Sub-Slab Aggregate Material

An approximate 6-in. layer of aggregate material meeting American Society for Testing and Materials Size No. 5 specifications or equivalent (approximately 0.5- to 1-in. diameter) will be evenly placed beneath the entire building slab. A vapor barrier will be placed on top of the aggregate material prior to pouring of the concrete slab to prevent wet concrete from entering the void spaces in the aggregate layer.

5.3.2 Vapor Suction Pits

A total of eight vapor suction pits are proposed for installation beneath the building slab to facilitate communication throughout the sub-slab aggregate layer. Each suction pit will be constructed in accordance with a design that has been successfully field-demonstrated by EPA for sub-slab venting systems in large buildings, including schools. Specifically, each suction pit will consist of a 4-ft × 4-ft × 8-in. deep void area within the aggregate layer in large, isolated areas beneath the slab.

5.3.3 Vent Piping

Each suction pit installed beneath the slab will be connected via horizontal 4-in. diameter polyvinyl chloride (PVC) vent pipe to one of three vertical risers extending through the floor slab and continuing up through the building roof. All piping joints will be solvent welded; and all floor slab penetrations, including utility penetrations, will be sealed with a polyurethane sealant or equivalent. The riser piping will pass through rooms that students will not have access to (e.g., mechanical or electrical rooms), and the vent pipe will terminate a minimum of 25 ft from any outdoor air intakes to prohibit entry into the building.

5.3.4 Suction Fans

Three in-line suction fans, each capable of providing approximately 500 ft^3 per minute (cfm) of air flow at 0 in. of water column static pressure will be installed to create negative pressure beneath the building and exhaust potential sub-slab vapors to the atmosphere. The fans will be installed in line with the roof top vent piping via rubber sewage pipe connectors to facilitate proper sealing, quiet operation, and fan maintenance/replacement activities (if needed). The fans will be installed on the roof to eliminate the potential adverse effects caused by piping leaks, if any, on the exhaust side of the fans. The sub-slab venting system will include electronic pressure sensors and a warning notification light to notify responsible personnel if a significant reduction in airflow has occurred (i.e., system operational problem). The system warning light will be located in an area frequented by responsible building personnel such as the heating, ventilation, and air conditioning room or administrative offices.

5.3.5 System Monitoring and Sampling Locations

Multiple system monitoring and/or sampling locations have been included in the design in order to determine whether the sub-slab venting system is effectively removing potentially harmful vapors from the sub-slab area, determine if air discharge permitting requirements are applicable, or verify compliance with existing regulations. The sub-slab, building interior, and rooftop monitoring locations are presented below.

5.3.5.1 Sub-Slab Monitoring/Sampling Locations

A total of eight monitoring/sampling ports will be installed around the perimeter of the school building. Each monitoring port will consist of approximately 10 ft of 1-in. diameter PVC piping extending from grade just outside of the school building to the aggregate layer beneath the building. Each monitoring point will be terminated below grade with a 2-ft length of PVC screen wrapped in fabric filter to facilitate vapor monitoring and/or sampling. An 8-in. bolt-down protective road-box will be installed over each 1-in. PVC monitoring location within a concrete pad and flush with the surrounding grade. Design information regarding the proposed location and construction of the monitoring points is provided on Design Drawings E.1 and E.2 (Appendix E).

5.3.5.2 Indoor Air Methane Monitoring

As required by the RIDEM Office of Waste Management, an indoor air monitoring system designed to continuously monitor the percentage of the methane lower explosive limit (LEL) inside the proposed school building will be installed. The indoor monitoring system will include eight methane sensors located throughout the first floor of the proposed school building in areas above the sub-slab suction pits. Design information regarding the proposed location of the methane sensors is provided on Design Drawings E.1 and E.2 (Appendix E). Each sensor will be electronically connected to a controller and a warning sensor located in an area frequented by responsible building personnel such as the heating, ventilation, and air conditioning room or administrative offices. The sensors will be set to trigger an alarm notification at the controller when the concentration of methane gas at any of the sensors is equal to or greater than 500 ppm or 1 percent of the methane LEL for a period of 5 consecutive minutes. In the absence of OSHA standards regarding permissible methane exposure limits, this sensor setting was selected based upon the threshold limit value (TLV) guidance established by the American Conference of Governmental Industrial Hygienists (ACGIH). The ACGIH TLV for methane (2 percent LEL or 1,000 ppm) is a guideline regarding the safe levels of exposure to methane from various hazards found in the workplace. A TLV reflects the level of exposure that a typical worker can experience without an unreasonable risk of disease or injury. A sensor setting of one-half the ACGIH TLV (1 percent LEL or 500 ppm) was selected to afford a significant measure of additional Site safety. Technical specifications for the proposed methane sensors and the controller are provided in Appendix E.

5.3.5.3 Rooftop Monitoring/Sampling Locations

Vacuum/pressure gauges, air velocity monitoring locations, and air sampling ports will be installed in the vicinity of the inline suction fans on the building rooftop to facilitate system monitoring and sampling procedures.

5.4 FENCE INSTALLATION, MONITORING, AND MAINTENANCE

5.4.1 Fence Installation

Prior to initiating Site development and RAWP implementation activities, a new 8-ft high chain link fence with deterrent vegetation planted along the proposed development side of the fencing will be installed along the northern property boundary of Parcel B in accordance with a Superior Court Order, dated 29 March 2006. In accordance with the Court Order, the fencing along the northern property boundary of Parcel B will include signage in English and Spanish that states, "Warning – Keep Out – Environmental Cleanup in Progress." A site map illustrating the proposed fencing and deterrent vegetation to be installed per the Court Order, including the portion to be installed north of Parcel B, is provided in Appendix F. Existing temporary fencing with fabric windscreen, currently installed around the Parcel B eastern, western, and southern property boundaries, will be utilized during construction for security and dust control purposes.

5.4.2 Fence Monitoring

The City will monitor the school grounds and fencing on a daily basis during Site use to prevent users of the school site from trespassing onto abutting parcels and to identify areas of vandalism or where the integrity of the fencing may have been compromised. All fencing areas in need of repair will be documented and submitted to school administrators.

5.4.3 Fence Maintenance

Fence repairs will be completed within 14 business days of identification.

5.5 LONG-TERM MONITORING, REPORTING, AND OPERATION AND MAINTENANCE

After the school is constructed and the RAWP is implemented, in accordance with the anticipated RIDEM Order of Approval for the Site remedy, the City will be responsible for long-term identification and correction of non-compliant Site conditions including, but not limited to, equipment failures or exceedances of established action levels. The City proposes the following procedures to minimize non-compliance with the anticipated RIDEM Order of Approval, and to protect human health and the environment:

- The City will prepare and submit to RIDEM quarterly status reports documenting all sub-slab monitoring and associated sampling data, equipment maintenance and repairs, and general compliance with the Order of Approval. All quarterly status reports will be submitted to RIDEM within 30 days of the end of the quarterly monitoring period.

- The City will verbally report all exceedances of established Action Levels to RIDEM within 24 hours, and will provide a written notification of the exceedance within 7 days with any plans to upgrade or adjust the sub-slab venting system to remedy the problem, including steps to be taken to address the non-compliance.

- The report or notice will include a description of the non-compliance, the known or suspected cause for the non-compliance, any response actions taken to address the non-compliance, a description of planned response actions, and a timetable for completion of said response actions.

- Equipment shut-downs or operational problems prohibiting equipment effectiveness will be reported to RIDEM immediately, with the exception of intentional equipment shutdowns for regular maintenance activity.

- Unless an alternate timeframe is requested from and approved by RIDEM, equipment repairs or replacements, or other actions taken in response to any non-compliance with the Order of Approval, will be completed within 14 days of discovery of the non-compliant condition. Documentation describing the repairs or other action taken to correct the non-compliant condition will be submitted to RIDEM in the next quarterly status report.

- Deficiencies in the engineered cap, including but not limited to sinking or cracks to pavement, will be reported immediately upon discovery and be repaired within 14 days except if prohibited by weather or other unforeseen circumstances. Should weather conditions or other unforeseen circumstances prohibit such repairs within 14 days, the City will make reasonable efforts to complete the repairs as soon as possible and prohibit access to the areas in need of repair. Documentation describing the deficiencies and demonstrating that the repairs meet the requirements of the remedy will be submitted to RIDEM in the next quarterly report.

- In the event that the indoor methane alarm system recognizes an Action Level exceedance (refer to Section 6 for discussion of Action Levels):

    - Identify which of the sensors detected the elevated methane condition.

    - Notify the City's environmental consultant of the alarm incident and provide the specific information obtained through controller and sensor communication in accordance with manufacturer's instructions. Determine whether troubleshooting, maintenance, or repair of the sub-slab venting system is needed.

    - Notify the City's methane alarm system supplier, if a problem with the alarm system (e.g., sensor failure) is suspected.

    - Notify RIDEM immediately of the City's receipt of knowledge of all legitimate (i.e., not false alarms) alarm incidents. Provide RIDEM with a summary of alarm conditions if known, the steps taken to protect human health (i.e., building evacuation, notification of fire department, etc.), and the steps taken or scheduled to be taken to investigate and correct the condition(s) that caused the alarm. Submit a written notification that includes the above information to RIDEM within 72 hours of the alarm incident at the following address:

Mr. Joseph T. Martella II
RI Department of Environmental Management - Office of Waste Management
235 Promenade Street
Providence, RI 02908-5767

- o Based upon the information gathered above and all available information, re-evaluate site safety conditions and determine if notification to the local fire department is warranted based upon the following decision matrix.

If Indoor Methane Sensor Concentration is ...	**Then The City should ...**
Less than 1% LEL	No response required.
Greater than 1% LEL but less than 2% LEL	Continue to monitor sensors, contact environmental consultant, continuously evaluate site safety, develop and implement steps to correct the problem, notify RIDEM.
Greater than 2% LEL but less than 10% LEL	Continue to monitor sensors, contact environmental consultant, continuously evaluate site safety, develop and implement steps to correct the problem, notify RIDEM, evacuate building occupants if greater than 2% persists for 8 or more continuous hours.
Greater than or equal to 10% LEL	Immediately evacuate building and notify local fire department via "911". Once building occupancy is allowed to resume, continue to monitor sensor concentrations, contact environmental consultant for guidance, continuously evaluate site safety, develop and implement steps to correct the problem, notify RIDEM.

- Periodic compliance monitoring of the sub-slab venting system will be performed weekly during the first 3 months of system operation, followed by monthly for the remainder of the first year of operation. After the first year of system operation, the frequency of compliance monitoring may be decreased, but only in accordance with written approval from RIDEM and after the City successfully demonstrates compliant operation. At a minimum, the monitoring events will consist of the following:

- Monitoring VOCs and methane %LEL in the sub-slab monitoring points and in the roof-top effluent monitoring locations.
- Verification of proper indoor methane sensor and controller operation.
- Monitoring of negative pressure beneath the building within the sub-slab monitoring points.
- Sampling of sub-slab soil gas, sub-slab venting system effluent, and indoor air as proposed in Section 6.

The City representative's signature on Page 30 (Section 15) of this RAWP demonstrates the City's commitment to fully fund all costs associated with the operation, monitoring, and maintenance of the proposed remedial action for a minimum of 20 years from the date the facility is occupied.

6. POINTS OF COMPLIANCE

6.1 SOIL

During construction activities, the site will be periodically inspected to ensure that the remedial design specifications are adhered to. The impacted soil at the site will be considered to be in compliance once it has been completely capped as proposed in this RAWP. An ELUR, discussed in Sections 5.2 and 12 of this RAWP, will be placed on the Site following construction activities.

Soil compliance at this Site will also be evaluated through laboratory analysis of the clean fill material brought to the Site for engineered cap construction in accordance with the protocol previously outlined in Section 5.1.3.

6.2 VENTING SYSTEM EFFLUENT

Preliminary air emission estimates based upon the maximum soil gas concentrations collected during the most recent soil vapor survey completed on 5 October 2005, and the proposed total effluent air flow rate of 1,500 cfm (500 cfm each for 3 suction fans), are summarized below. Copies of the laboratory analytical reports that include the Site-specific data upon which these estimates are based are provided in Appendix G. As shown in the table below, these emission estimates are far below the hourly, daily, and annual permit applicability thresholds of 10 lb/hour and 100 lb/day for an air contaminant, 10 tons/year (individual Hazardous Air Pollutants [HAPs], and 25 tons/year (combined HAPs) specified in Section 9.3.1 of RIDEM's Air Pollution Control Regulation No. 9, and are also in compliance with the HAP minimum quantities specified in Appendix A of RIDEM's Air Pollution Control Regulation No. 9.

Volatile Organic Compound	Maximum Concentration October 2005 ($\mu g/m^3$)	Maximum Hourly Emission (1b/hour)	Maximum Daily Emission (lb/day)	Maximum Yearly Emission (lb/year)	Hazardous Air Pollutant Minimum Quantity (lb/year)
Acetone	39	0.0002	0.005	1.92	20,000
Benzene	1.6	0.000009	0.0002	0.08	10
Benzyl Chloride	11	0.00006	0.001	0.54	2
Bromodichloromethane	3.4	0.00002	0.0005	0.17	3
Bromomethane	2.0	0.00001	0.0003	0.10	70
1,3-Butadiene	1.1	0.000006	0.0001	0.05	None
2-Butanone (MEK)	6.8	0.00004	0.0009	0.33	4,000

NOTE: Estimates based upon VOC soil gas data collected on 5 October 2005; a copy of the laboratory analytical report is provided in Appendix G.

If VOCs are reported as "not detected," then the laboratory Method Detection Level is used in emission estimates to provide a worst-case potential emission estimate. Emissions calculated as shown below:

Maximum Hourly Emission (lb/hour) = VOC Concentration ($\mu g/m^3$) × (1500 ft^3/min) × (0.02832 m^3/ft^3) × (60 min/hour) × (0.001 mg/μg) × (0.001 g/mg) × (0.0022 lb/g)

Maximum Daily Emission (lb/day) = Maximum Hourly Emission (lb/hour) × (24 hour/day)

Volatile Organic Compound	Maximum Concentration October 2005 (μg/m³)	Maximum Hourly Emission (1b/hour)	Maximum Daily Emission (lb/day)	Maximum Yearly Emission (lb/year)	Hazardous Air Pollutant Minimum Quantity (lb/year)
Maximum Yearly Emission (lb/year) = Maximum Hourly Emission (lb/day) × (365 days/year)					
Carbon Disulfide	8.4	0.00005	0.001	0.41	2,000
Carbon Tetrachloride	3.1	0.00002	0.0004	0.15	8
Chlorobenzene	2.3	0.00001	0.0003	0.11	20,000
Chlorodibromomethane	4.3	0.00002	0.0006	0.21	40
Chloroethane	1.4	0.000008	0.0002	0.07	10,000
Chloroform	2.5	0.00001	0.0003	0.12	20
Chloromethane	1.1	0.000006	0.0001	0.05	400
Cyclohexane	1.7	0.000006	0.0002	0.08	20,000
1,2-Dibromoethane	3.9	0.00002	0.0005	0.19	None
1,2-Dichlorobenzene	3.1	0.00002	0.0004	0.15	900
1,3-Dichlorobenzene	3.1	0.00002	0.0004	0.15	None
1,4-Dichlorobenzene	6.4	0.00004	0.0009	0.31	10
Dichlorodifluoromethane	2.6	0.00001	0.0004	0.13	None
1,1-Dichloroethane	2.1	0.00001	0.0003	0.10	70
1,2-Dichloroethane	2.1	0.00001	0.0003	0.10	4
1,1-Dichloroethylene	2.0	0.00001	0.0003	0.10	600
cis-1,2-Dichloroethylene	2.0	0.00001	0.0003	0.10	1,000
trans-1,2-Dichloroethylene	2.0	0.00001	0.0003	0.10	200
1,2-Dichloropropane	2.4	0.00001	0.0003	0.12	10
cis-1,3-Dichloropropene	2.3	0.00001	0.0003	0.11	None
trans-1,3-Dichloropropene	2.3	0.00001	0.0003	0.11	None
1,2-Dichlorotetrafluoroethane (114)	3.5	0.00002	0.0005	0.17	None
Ethanol	57	0.0003	0.008	2.80	None
Ethyl acetate	1.8	0.00001	0.0002	0.09	None
Ethylbenzene	7.4	0.00004	0.0010	0.36	3,000
4-Ethyl toluene	2.5	0.00001	0.0003	0.12	None
n-Heptane	2.0	0.00001	0.0003	0.10	None
Hexachlorobutadiene	22	0.0001	0.003	1.08	2
Hexane	2.1	0.00001	0.0003	0.10	20,000
2-Hexanone	3.4	0.00002	0.0005	0.17	None
Isopropanol	3.6	0.00002	0.0005	0.18	1,000
Methyl tertiary-butyl ether	3.4	0.00002	0.0005	0.17	3,000
Methylene Chloride	7.8	0.00004	0.001	0.38	200
4-Methyl-2-Pentanone	2.0	0.00001	0.0003	0.10	None
Propene	2.6	0.00001	0.0004	0.13	None
Styrene	2.2	0.00001	0.0003	0.11	3,000
1,1,2,2-Tetrachloroethane	3.5	0.00002	0.0005	0.17	9,000
Tetrachloroethylene	3.4	0.00002	0.0005	0.17	20
Tetrahydrofuran	1.5	0.000008	0.0002	0.07	None
Toluene	5.0	0.00003	0.0007	0.25	1,000
1,2,4-Trichlorobenzene	38	0.0002	0.005	1.87	90
1,1,1-Trichloroethane	2.8	0.00002	0.0004	0.14	None
1,1,2-Trichloroethane	2.8	0.00002	0.0004	0.14	30
Trichloroethylene	2.7	0.00002	0.0004	0.13	50
Trichlorofluoromethane	4.9	0.00003	0.0007	0.24	3,000

Volatile Organic Compound	Maximum Concentration October 2005 (µg/m³)	Maximum Hourly Emission (1b/hour)	Maximum Daily Emission (lb/day)	Maximum Yearly Emission (lb/year)	Hazardous Air Pollutant Minimum Quantity (lb/year)
1,1,2-Trichloro-1,2,2-Trifluoroethane	3.9	0.00002	0.0005	0.19	None
1,2,4-Trimethylbenzene	4.3	0.00002	0.0006	0.21	None
1,3,5-Trimethylbenzene	2.5	0.00001	0.0003	0.12	None
Vinyl acetate	1.8	0.00001	0.0002	0.09	600
Vinyl Chloride	1.3	0.000007	0.0002	0.06	20
m/p-Xylene	30	0.0002	0.004	1.48	1,000
o-Xylene	9.6	0.00005	0.001	0.47	1,000
Total VOCs	368	0.002	0.05	18	None

Following startup of the sub-slab venting system and annually thereafter, three venting system effluent air samples (one from the discharge of each suction fan) will be collected and submitted for laboratory analysis of methane and VOCs (via Method TO-15). The effluent data will be used to calculate actual emission values and re-evaluate if treatment or permitting requirements apply.

6.3 SUB-SLAB SOIL GAS AND PRESSURE

Prior to building occupancy, three sub-slab air samples will be collected from monitoring points around the perimeter of the building and submitted for laboratory analysis of methane and VOCs (via Method TO-15) to establish baseline concentrations. For comparative purposes, the sub-slab VOC data will be compared to the Proposed CT RTAC (Appendix D), and sub-slab methane concentrations will be compared to the indoor air methane Action Level of 1 percent LEL or 500 ppm. Due to: a) the fact that the sub-slab venting system is designed to create an area of negative pressure and effectively draw VOCs toward the sub-slab area from both inside the building and from the subsurface, and b) the likely presence of VOCs inside the new school resulting from various sources not related to subsurface site contamination, including but not limited to, building materials (e.g., carpeting), cleaning products, dry cleaned clothing, or cosmetics, establishing VOC Action Levels for sub-slab soil gas is not warranted or scientifically valid to determine system effectiveness or to protect building occupants. More appropriately and in accordance with EPA guidance, sub-slab pressure should be used to determine the effectiveness of the sub-slab venting system at the Site. EPA recommends that a minimum sub-slab pressure of –0.002 in. water column is required for an effective venting system [Radon Prevention in the Design and Construction of Schools and Other Large Buildings, EPA/625/R-92/016 (January 1993)]. Therefore, a sub-slab Action Level of –0.002 in. water column is proposed. To demonstrate sub-slab venting system effectiveness, sub-slab pressure monitoring will be performed at each of the eight sub-slab monitoring locations during all site monitoring visits (refer to Section 5.5).

During the first year of school occupancy, quarterly sub-slab VOC and methane sampling will be performed to re-evaluate potential indoor air health risks from potential VOC and methane intrusion from Site soils. If the first year of sub-slab VOC and methane sampling reveal no detection of VOCs in sub-slab vapor greater than CT RTACs and no methane greater than 1 percent LEL, then subsequent sampling will occur annually. If the first year of VOC and methane sampling reveals VOCs in sub-slab vapor in concentrations greater than CT RTACs or methane greater than 1 percent LEL, then subsequent sampling will continue to be quarterly.

6.4 INDOOR AIR

The indoor methane monitoring system will continuously monitor the methane percent LEL within the school building, and will electronically notify school officials (Section 5.3.5.2) if an exceedance of the 1 percent LEL Action Level occurs. A detailed response protocol to an exceedance of the indoor methane Action Level is included in Section 5.5.

In addition, should site monitoring reveal the lack of negative pressure equal to or greater than the Action Level within any of the sub-slab monitoring locations, then indoor air sampling for VOCs in the areas of the building above where inadequate negative pressures were detected will be completed within 24 hours. The sample(s) will be submitted to a certified laboratory for VOC analysis (via TO-15) with a 24-hour turnaround request time. For comparative purposes, the indoor VOC data will be compared to the Proposed CT RTAC (Appendix D). Indoor air Action Levels for VOCs will be the CT RTAC concentrations. No indoor air sampling is warranted or proposed unless the sub-slab negative pressures are found to be insufficient (see Section 6.3). Please refer to Section 5.5 for the response protocol (RIDEM notification, etc.), in the event that an Action Level is exceeded.

6.5 OTHER MEDIA

There are no remedial objectives for groundwater, surface water, or any other types of media (e.g., sediment). Therefore, points of compliance are not applicable with respect to these other types of media.

7. PROPOSED SCHEDULE FOR REMEDIAL ACTION WORK PLAN IMPLEMENTATION

Implementation of this RAWP is directly related to building construction schedules and receipt of an Order of Approval from RIDEM regarding this RAWP. Assuming that building construction commences shortly after the City's receipt of an Order of Approval, and assuming that the Order of Approval is received in May 2006, a tentative RAWP implementation schedule is presented below. Should the actual date of receipt of the Order of Approval be dramatically later than assumed above, this schedule will be revised and submitted to RIDEM accordingly.

Initiation of school construction/RAWP implementation	22 May 2006
Completion of school construction/RAWP implementation	31 December 2006
Sub-slab venting system startup	3 January 2007
Filing of ELUR	31 January 2007
Remedial Action Summary Report	28 February 2007
Submittal of first quarterly status report	On or before 30 April 2007
Subsequent quarterly status reports	Within 30 days of the end of the quarterly reporting period
Reporting and maintenance of non-compliant site conditions	Section 5.5

8. CONTRACTORS AND CONSULTANTS

The general contractor for the school construction and implementation of the construction-related RAWP activities is:

H.V. Collins Company
99 Gano Street
Providence, Rhode Island
Mr. Brian McCourt
(401) 421-4080.

Oversight related to RAWP implementation will be provided by:

EA Engineering, Science, and Technology, Inc.
2350 Post Road
Warwick, Rhode Island
Mr. Peter Grivers, P.E.
(401) 736-3440, Extension 216.

The names and telephone numbers of other subcontractors involved with the RAWP will be forwarded to RIDEM upon selection.

9. DESIGN STANDARDS AND TECHNICAL SPECIFICATIONS

Cross-sections of the proposed engineered cap, design drawings of the sub-slab venting system, technical specifications, and supporting documentation for various RAWP components have been discussed in previous sections of this RAWP and/or are included in various appendices.

10. SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN

A SHERP has been prepared for the Site to provide construction personnel with protection standards and mandatory safety practices, procedures, and contingencies to be followed while performing field activities at the Site. A copy of the SHERP is provided in Appendix B. The SHERP defines actions to be taken with respect to personal safety during work activities associated with the development project. Work activities will include material excavation and grading, trenching, and utility installation. One copy of the SHERP will be maintained onsite for use during the scheduled construction activities and made available for site use/employee review. Persons who enter the construction site are required to read and understand the SHERP and sign the SHERP Review Record. The SHERP addresses the following regulations and guidance documents:

- OSHA Standards for General Industry, 29 CFR 1910
- OSHA Standards for Construction Industry, 29 CFR 1926
- National Institute of Occupational Safety and Health, OSHA, EPA, and U.S. Coast Guard *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities,* October 1985.

11. SECURITY PROCEDURES

Entrance to the Site is secured by fences and gates that will be locked during off-work hours. During construction activities, access to the Site will be limited to the City's contractors or other designated representatives. The fencing and gates will be maintained throughout the construction project.

12. INSTITUTIONAL CONTROLS

As previously discussed in Section 5.2, an ELUR documenting the required maintenance and annual inspection of the remedy will be recorded in the City's land evidence records for the property following construction activities and implementation of the remedial action. The ELUR will include an SMP with established procedures should any future work at the Site involve the disturbance or excavation of site surfaces and underlying soils. A Draft ELUR, which includes the SMP proposed for use during implementation of this RAWP, is provided in Appendix C.

13. COMPLIANCE DETERMINATION

Compliance with the RAWP objectives will be demonstrated through completion of the following:

- Construction of the engineered cap
- Recording of the ELUR in the City land evidence records
- Construction the sub-slab venting system
- Completion of venting system start-up sampling activities
- Installation of indoor methane alarm system and start-up of methane system monitoring.

Documentation illustrating compliance with the RAWP objectives, including inspection logs, laboratory reports, and photographs, will be provided to RIDEM in the Remedial Action Closure Report. A copy of the recorded ELUR will also be provided.

Long-term compliance of the remedy will be determined by successful and timely completion of the maintenance and monitoring procedures proposed in Section 5.5. To document the Site's compliance status with respect to the proposed remedy and the ELUR, an Annual Inspection Report, prepared by a qualified environmental consulting firm, will be submitted to RIDEM. As requested by RIDEM, the Annual Inspection Report for the Site will include a discussion relative to the regulatory compliance status of abutting parcels that comprise the entire former Gorham property.

14. REMEDIAL ACTION APPROVAL FEE

A check made payable to the General Treasurer of the State of Rhode Island for the RIDEM-required Remedial Action Approval Fee has been provided to RIDEM under separate cover concurrent with this submittal.

15. CERTIFICATIONS

The undersigned certify that this RAWP is a complete and accurate representation of the contaminated site and contains all known facts to the best of their knowledge.

4-25-06

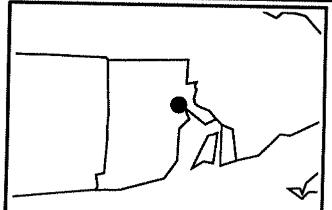
Peter M. Grivers, P.E., Project Manager — Date
EA Engineering, Science, and Technology, Inc.

4-25-06

Timothy C. Regan, P.E., Senior Engineer — Date
EA Engineering, Science, and Technology, Inc.

4-25-06

Alan Sepe — Date
Director, Providence Department of Public Property



0 1,375 2,750 5,500 Feet

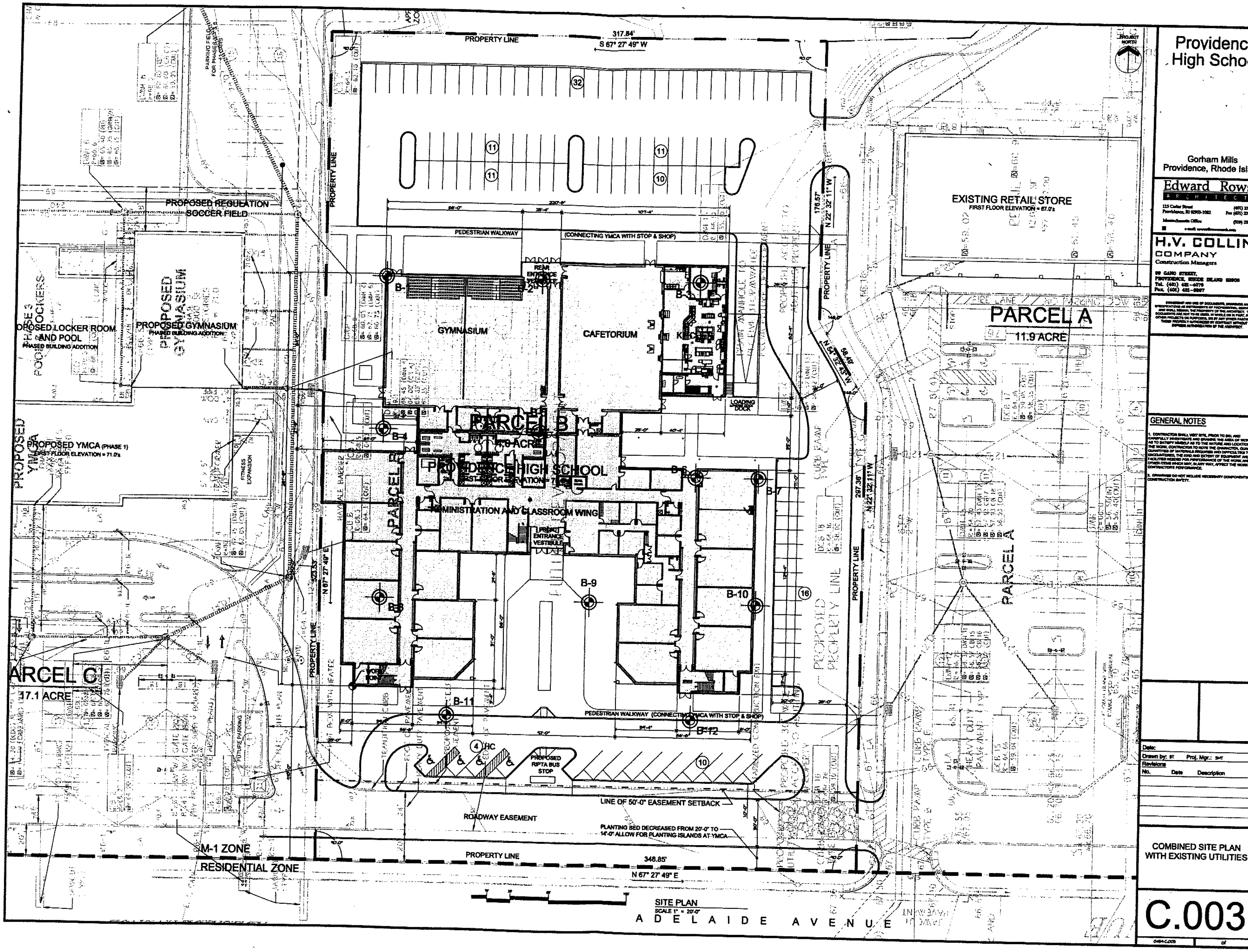
N

EA	FORMER GORHAM MANUFACTURING SITE, PARCEL B 333 ADELAIDE AVENUE PROVIDENCE, RHODE ISLAND	FIGURE 1 SITE LOCATION MAP

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
TR	DC	DC	JP	AS SHOWN	FEBRUARY 2005	6196501	I:\RI\FIG1 333 ADELAIDE_PROV.MXD

Appendix A

Site Plan


Providence High School
Gorham Mills
Providence, Rhode Island
Edward Rowse Architects
H.V. COLLINS COMPANY
Construction Managers
GENERAL NOTES
EXISTING RETAIL STORE
FIRST FLOOR ELEVATION = 67.0'±
PARCEL A
11.9 ACRE
PARCEL B
PROVIDENCE HIGH SCHOOL
ADMINISTRATION AND CLASSROOM WING
GYMNASIUM
CAFETORIUM
KITCHEN
LOADING DOCK
FRONT ENTRANCE VESTIBULE
PEDESTRIAN WALKWAY (CONNECTING YMCA WITH STOP & SHOP)
PROPERTY LINE
PROPOSED PROPERTY LINE
317.84'
S 67° 27' 49" W
348.85'
N 67° 27' 49" E
N 22° 32' 11" W
PROPOSED REGULATION SOCCER FIELD
PROPOSED GYMNASIUM
PHASED BUILDING ADDITION
PROPOSED LOCKER ROOM AND POOL
PHASED BUILDING ADDITION
PROPOSED YMCA (PHASE 1)
FIRST FLOOR ELEVATION = 71.0'±
FITNESS EXPANSION
PARCEL C
17.1 ACRE
PROPOSED RIPTA BUS STOP
ROADWAY EASEMENT
LINE OF 50'-0" EASEMENT SETBACK
PLANTING BED DECREASED FROM 20'-0" TO 14'-0" ALLOW FOR PLANTING ISLANDS AT YMCA
M-1 ZONE
RESIDENTIAL ZONE
SITE PLAN
SCALE 1" = 20'-0"
ADELAIDE AVENUE
COMBINED SITE PLAN WITH EXISTING UTILITIES
C.003

Appendix B

Safety, Health, and Emergency Response Plan

Safety, Health, and Emergency Response Plan for Former Gorham Manufacturing – Parcel B 333 Adelaide Avenue Providence, Rhode Island

Prepared for

Mr. Alan R. Sepe
Director of Public Property
Department of Public Property
City Hall
Providence, Rhode Island 02903

Prepared by

EA Engineering, Science, and Technology, Inc.
2350 Post Road
Warwick, Rhode Island 02886
(401) 736-3440

July 2005
Version: FINAL
EA Project No.: 61965.01

Safety, Health, and Emergency Response Plan for Former Gorham Manufacturing – Parcel B 333 Adelaide Avenue Providence, Rhode Island

Prepared for

Mr. Alan R. Sepe
Director of Public Property
Department of Public Property
City Hall
Providence, Rhode Island 02903

Prepared by

EA Engineering, Science, and Technology, Inc.
2350 Post Road
Warwick, Rhode Island 02886
(401) 736-3440

[signature] 8/3/05

Peter M. Grivers, P.E., LSP
Project Manager
Date

[signature] 8/3/05

Kris Hoiem, CIH
Program Safety and Health Officer
Date

July 2005
Version: FINAL

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1. INTRODUCTION

1.1 PURPOSE

EA Engineering, Science, and Technology, Inc. (EA) has prepared this Safety, Health, and Emergency Response Plan (SHERP) for the purpose of providing personnel with protection standards and mandatory safety practices, procedures, and contingencies to be followed while performing field activities at the Parcel B area of the former Gorham Manufacturing site in Providence, Rhode Island. This SHERP, as developed, defines actions to be taken with respect to personal safety during site preparation activities as described in the Limited Remedial Action Work Plan (LRAWP) and construction and testing activities as described in the Remedial Action Work Plan. Work activities include surficial debris removal, earth moving operations, regrading, and site preparation. One copy of this SHERP will be maintained onsite for use during the scheduled field effort and made available for site use/employee review. All persons who enter the site are required to read and understand this SHERP and sign the SHERP Review Record (Attachment A). This SHERP addresses the following regulations and guidance documents:

- Occupational Safety and Health Administration (OSHA) Standards for General Industry, 29 CFR 1910
- OSHA Standards for Construction Industry, 29 CFR 1926
- National Institute of Occupational Safety and Health, OSHA, U.S. Environmental Protection Agency, and U.S. Coast Guard *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities,* October 1985.

1.2 BACKGROUND

1.2.1 Site History

The site is currently undeveloped and lightly vegetated. There is some surficial disposal of white goods in the northwestern corner of the site. No hazardous materials are handled or generated at the site. To the east of the site is the Parcel A area of the former Gorham Manufacturing facility, which is currently developed with a commercial retail facility and associated fueling station and parking area. To the west of the site is the Parcel C portion of the former Gorham Manufacturing facility, which is also currently vacant. Mashapaug Pond is located to the north of the site (approximately 120 ft to the north), and Adelaide Avenue and its associated residences are located to the south. The Providence Water Supply Board provides potable water for the residences along Adelaide Avenue and the adjacent retail complex. No public water supplies are located within 1 mi of the site. A site locus map is included as Figure 1.

Several previous environmental investigations have been conducted at the former Gorham Manufacturing site, including remedial actions. These investigations include activities conducted both prior to and following the subdivision of the site into three separate parcels. No offsite migration of contaminants is associated with Parcel B. Therefore, some of these investigations have included Parcel B, although none have been conducted on Parcel B specifically prior to EA's January 2005 Limited Design Investigation.

The adjacent Mashapaug Pond is classified by Rhode Island Department of Environmental Management as a Class B Surface Water Body. This designation indicates that the pond is primarily used for fish and wildlife habitat and primary and secondary recreational activities, and is suitable for industrial, navigational, and irrigation processes. Groundwater at the site is classified as GB, indicating that it is not suitable for consumption without treatment. The direction of groundwater flow is presumed to be towards the north and Mashapaug Pond. Site investigations have encountered groundwater at approximately 25 ft below ground surface.

Topography over the site is generally flat, with a slight slope towards the north and Mashapaug Pond. According to the U.S. Geological Survey Topographic Map (Figure 1), the site is located at an elevation of approximately 70 ft below mean sea level, with an elevation of approximately 45 ft above mean sea level along the shoreline of the pond. Bedrock at the site is characterized as a meta-sedimentary sequence of the Rhode Island Formation. The bedrock surface was not encountered during any environmental investigations conducted at the site. Non-native fill material was encountered to approximately 15 ft below ground surface. Native soils observed during drilling activities were predominantly sand deposits.

The former Gorham Manufacturing facility was once the country's largest producer of silverware, and was also renowned for its statues, memorials, and architectural bronze work. The facility at the site reportedly began operations in 1890. Site activities included milling, forging, heat treating, plating, lacquering, polishing, and degreasing. Gorham Manufacturing operated at the site until 1967, at which time the facility was purchased by Textron. Operations ceased at the facility in 1986, and the facility was demolished in 2001. The current retail operations on Parcel A, to the east of Parcel B, began in 2002. Parcels B and C are currently owned by the City of Providence.

1.2.2 Scope of Work

The scope of work activities described in the Remedial Action Work Plan consists of construction activities associated with the installation of an engineered cap. The scope of this SHERP includes, but is not limited to, safety and health hazards anticipated for field activities during construction, including:

- Shallow trench excavation
- Test pitting
- Soil, debris, and gas sampling

- Earth moving
- Engineered cap installation
- Site regrading.

The scope of this SHERP also includes all post-remedy soil disturbance activities and is intended to be used in conjunction with the Soil Management Plan and Environmental Land Usage Restriction for this site.

1.2.3 Potential Chemicals of Concern

The chemicals of primary concern at Parcel B of the former Gorham Manufacturing site are total petroleum hydrocarbons (TPH), semivolatile organic compounds (SVOC), and asbestos containing materials (ACM) in soil, and chlorinated volatile organic compounds (CVOC) in groundwater. TPH is found primarily in deep subsurface soil samples. The highest concentrations were discovered in the northern portion of the site. SVOC were detected in surface soil samples collected in March 2001. Contaminants exceeding Residential Direct Exposure Criteria include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and chrysene. CVOC, specifically trichloroethene, are detected in both soil vapor and groundwater. Trichloroethene exceeds the applicable standards (here, the Connecticut Department of Environmental Protection Targeted Indoor Air Concentrations) in three of five soil vapor sampling points collected in February 2005 and in one of the groundwater samples collected in January 2005.

1.3 SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN ORGANIZATION

This SHERP presents the overall approach to safety during execution of the project activities conducted at the Parcel B of the former Gorham Manufacturing site. This section presents an introduction and outlines the report organization. Section 2 summarizes the project management team. Section 3 outlines the hazard communications and environmental monitoring during field operations. Section 4 presents the required employee training. Section 5 details personal protective equipment (PPE). Section 6 summarizes emergency response reactions to site contingencies. Section 7 outlines site controls and work zones. Attachment A contains a copy of the SHERP Review Record. Attachment B provides the Site Entry and Exit Log. Attachment C provides an Accident/Loss and Incident Report form.

2. PROJECT MANAGEMENT

2.1 KEY PERSONNEL

The following table, and attached Table 2, contain information on key project personnel:

Position	Name	Work Phone	Home Phone
Project Manager	Timothy Regan	(401) 736-3440	(401) 241-5461
Regional Safety and Health Officer	Kris Hoiem	(410) 771-4950	(410) 357-5485
Field Manager	Peter Grivers	(401) 736-3440	(401) 270-2591
Site Safety and Health Officer/ Emergency Coordinator	Jill Ann Parrett	(401) 736-3440	(401) 465-7138

2.2 RESPONSIBILITIES

Clear lines of authority will be established for enforcing compliance with the safety, health, and contingency procedures consistent with industry policies and procedures.

Designated EA personnel are responsible for implementation of the SHERP during field activities. This includes field supervision; implementing and directing emergency operations; coordinating with onsite and offsite emergency responders; enforcing safe work practices and decontamination procedures (if needed); ensuring proper use of PPE; communicating site safety program modifications and requirements to site personnel; proper reporting of injuries, illnesses, and incidents to the appropriate internal and external organizations; and containing and controlling the loss of potentially hazardous materials to soil, air, and surface/ground water during all phases of construction operations.

In the event of an onsite injury, occupational illness, near-miss, or environmental contamination incident, the following organizations/individuals will be notified as appropriate:

- Field Manager
- Site Safety and Health Officer/Emergency Coordinator
- Project Manager
- Program Safety and Health Officer
- EA Rhode Island Branch Manager
- Regional Safety and Health Officer.

2.2.1 Project Manager

The ***Project Manager*** has overall responsibility for site activities and will be the primary contact during work activities. Specific responsibilities of the Project Manager include: approving the SHERP and its amendments, providing overall supervisory control for health and safety protocols in effect for the project, assuring adequate resources are available for health and safety, and coordinating all site occupational health and safety issues with the Program Safety and Health Officer.

2.2.2 Regional Safety and Health Officer (or Designee)

The ***Regional Safety and Health Officer*** has overall project responsibility for the development of this SHERP and will provide technical safety and health guidance, as needed.

2.2.3 Site Safety and Health Officer/Emergency Coordinator

The ***Site Safety and Health Officer/Emergency Coordinator*** is responsible for coordination of onsite contingency operations, as well as the Site Safety and Health Program. The Site Safety and Health Officer/Emergency Coordinator will be onsite throughout the project and will be responsible for daily compliance with site safety and health requirements. Specific responsibilities of the Site Safety and Health Officer include daily site inspections, stopping work when an imminent health and safety risk exists, implementing the usage of forms presented as attachments to this SHERP, providing an initial health and safety briefing to all site workers, supervising the use of proper PPE, and investigating and preparing incident reports as necessary.

During an emergency, the Field Manager and Site Safety and Health Officer/Emergency Coordinator will be responsible for initiating and coordinating emergency responses/contingency operations.

The Program Safety and Health Officer, Field Manager, and Site Safety and Health Officer/ Emergency Coordinator will have the authority to make on-the-spot corrections concerning safety, health, and environmental pollution infractions.

2.2.4 Field Manager

The ***Field Manager's*** responsibilities include, but are not limited to, providing technical support to the Site Safety and Health Officer/Emergency Coordinator, evaluating onsite environmental monitoring results and reporting to the Project Manager and Program Safety and Health Officer, initiating evacuation of the work site when needed, communicating with offsite emergency responders, and coordinating activities of onsite and offsite emergency responders.

2.2.5 Employee Responsibilities

EA and subcontractor employees are responsible for reading, understanding, and meeting the safety and health requirements contained in this SHERP. A Review Record sign-off sheet is provided in Attachment A. Employees are required to implement these procedures when conducting daily operations. This will also include receiving appropriate training and medical monitoring and utilization of safety and health equipment (to include PPE) to safely conduct site operations. This will also include maintaining appropriate grooming standards (removal or proper trimming of beards, mustaches, and sideburns) to ensure the proper fit of respiratory protection. Employees will review each task prior to commencement to consider the potential safety and health hazards, and the measures to be taken in the event of an emergency. Employees should know where material safety data sheets, first aid supplies, and emergency equipment are maintained. The Field Manager and Site Safety and Health Officer/Emergency Coordinator should be notified of potential safety and health hazards, near-miss conditions, or incidents present on the job site or unusual effects believed to be related to hazardous chemical exposures. Failure to follow established safety and health procedures could result in immediate dismissal from the site.

2.2.6 Subcontractors

Responsibilities of EA and subcontractor personnel include: following the SHERP and applicable safety and health rules, regulations, and procedures; using required controls, procedures, and safety devices, including PPE; notifying his/her supervisor of identified or suspected emergencies, safety, or health hazards; and complying with training and medical requirements.

3. ENVIRONMENTAL MONITORING DURING FIELD OPERATIONS

3.1 CHEMICAL HAZARDS

3.1.1 Area of Concern Chemical Hazards

Information regarding chemicals of concern was gathered through the EA Site Investigation conducted in January-March 2005, as well as reviews of past activities conducted at Parcel B of the former Gorham Manufacturing site. Concerns identified suggest that the chemical of primary concern is TCE in vapor. Auxiliary contaminants of concern include PAHs, ACM, and TPH.

Table 1 provides a list of potential site chemical hazards and symptoms of overexposure.

3.1.2 Chemicals for Equipment Calibrations and Operations

The following chemicals are typically supplied by the primary investigation team:

- Isopropyl alcohol
- Isobutylene calibration gas
- Methane calibration gas.

These chemicals will be used for environmental monitoring equipment calibration and operation. The quantities to be used will not exceed 0.5-liter (L) quantities, and will be used under controlled environments. Chemicals used during the field activities will be properly contained and labeled. Occupational exposures will be negligible.

3.2 PHYSICAL HAZARDS

Physical hazards can potentially be present during field activities. These physical hazards may include, but not be limited to:

- Fire/explosion hazards
- Heat/cold stress
- Equipment hazards
- Slips, trips, and falls
- Noise hazards
- Electrical hazards
- Utilities
- Weather hazards.

Parcel B of the former Gorham Manufacturing site will be visually inspected for the presence of general safety hazards (e.g., trip/slip hazards, unstable surfaces or steep grades, and sharp objects) prior to beginning work. If hazards are present, these hazards will be recorded and precautionary measures taken to prevent injury.

3.2.1 Fire/Explosion Hazards

The potential for fire and/or explosion emergencies is always present. Workers must continuously monitor the work area for combustible or explosive gases. Employees should always be alert for unexpected events, such as ignition of chemicals or sudden release of materials under pressure, and be prepared to act in these emergencies.

Field vehicles will be equipped with a fire extinguisher. Employees must be trained in the proper use of fire suppression equipment. However, large fires that cannot be controlled with a fire extinguisher should be handled by professionals. The proper authorities should be notified in these instances.

3.2.2 Heat Stress and Heat-Related Illness

Effects of heat stress and illness are possible during the performance of field activities at Parcel B of the former Gorham Manufacturing site. Injury from excess exposure to high temperatures may occur to persons working outdoors. This is a major concern when personnel are working in PPE clothing. The body's principal means of cooling is through the evaporation of sweat. When personnel are working in PPE, sweat is trapped inside the clothing and cannot evaporate, thus raising the body's core temperature and resulting in a heat-related illness.

The symptoms of heat-related illness include painful muscle spasms, dizziness, slurred speech, confusion, fainting, and cool, clammy skin. Site personnel should be familiar with these symptoms of heat-related illness and be prepared to administer first aid or to contact the appropriate emergency personnel.

3.2.3 Effects of Cold Exposure

Effects of cold exposure are possible during the performance of field activities at Parcel B of the former Gorham Manufacturing site. Injury from cold exposure may occur in persons working outdoors during a period when temperatures average below freezing. The extremities, such as fingers, toes, and ears, are the most susceptible to frostbite.

Symptoms of cold stress include shivering, pain in the extremities, numbness, drowsiness, white or grayish skin, confusion, or fainting. To prevent cold stress, personnel should wear layers of loose-fitting clothing and head covering. Protection of the hands, feet, and head is particularly important because these are the areas most likely to be injured first by the cold. Bare skin contact with cold surfaces must be avoided.

3.2.4 Heavy Equipment Hazards

The use of heavy equipment (e.g., excavators, graders, generators, etc.) may pose safety hazards to site workers. Heavy equipment work must be conducted only by trained, experienced personnel. Proper protective gear (hard-hats and steel-toed boots) will be worn onsite. If possible, personnel must remain outside the turning radius of large, moving equipment, with particular attention given to remaining within the line of sight of the operator and maintaining eye contact with the operator. Personnel will not approach the machines until they have stopped moving and have gotten the attention of the operator. Excavated materials will be kept at least 2 ft away from the excavation. There will be no entering a trench more than 4 ft deep. At a minimum, personnel must maintain visual contact with the equipment operator. No guards, safety appliances, or other devices may be removed or made ineffective unless repairs or maintenance are required, and then, only after power has been shut off, tagged, and locked out. Safety devices must be replaced once repair or maintenance is complete. Exhaust from equipment must be directed so that it does not endanger workers or obstruct the view of the operator. When not operational, equipment must be set and locked so that it cannot be activated, released, dropped, etc. No personnel will work beneath loads handled by lifting or digging equipment.

3.2.5 Noise Hazards

Work around large equipment often creates excessive noise. Noise can cause workers to be startled, annoyed, or distracted; can cause physical damage to the ear, pain, and temporary and/or permanent hearing loss; and can interfere with communication. If workers are subjected to noise exceeding an 8-hour time-weighted average sound level of 85 dBA (decibels on the A-weighted scale), hearing protection will be selected with an appropriate noise reduction rating to comply with 29 CFR 1910.95 and to reduce noise levels to or below the permissible values. During the field activities where workers are using heavy equipment, such as drill rigs and excavators, hearing protection should be used.

3.2.6 Electrical Hazards

Overhead power lines, electrical wiring, electrical equipment (electrical generators), and buried cables pose risks to workers of electric shock, burns, muscle twitches, heart fibrillation, and other physical injuries, as well as fire and explosion hazards. Workers will take appropriate protective measures when working near live electrical parts, including inspection of the work area, identification of potential spark sources, maintenance of a safe distance, proper illumination of the work areas, provision of barriers to prevent inadvertent contact, and use of nonconductive equipment. If overhead lines cannot be de-energized prior to the start of work, a 10-ft distance must be maintained between overhead energized power lines with a voltage of 50 kV and elevated equipment parts. This distance will be increased 4 in. for every 10 kV greater than 50 kV. For example, workers should maintain a distance of 11.7 ft from energized power lines with a voltage of 100 kV.

3.3.7 Utilities

Underground utilities pose hazards to workers involved in excavation and other invasive operations. These hazards include electrical hazards, explosion, and asphyxiation, as well as costly and annoying hazards associated with damaging communication, sewer, and water lines. Prior to commencement of invasive operations, Rhode Island Dig Safe will be contacted to inspect and flag the area of investigation. Dig Safe's telephone number in Rhode Island is (888) 344-7233. Dig Safe requires 3 days notice prior to intrusive activities on the site.

Personnel should be aware that although an area may be cleared, it does not mean that unanticipated hazards will not appear. Workers should always be alert for unanticipated events such as snapping cables, drilling into unmarked underground utilities, and drilling into a heavily contaminated zone. Such occurrences should prompt involved individuals to halt work immediately and take appropriate corrective measures to gain control of the situation. A careful walkover inspection of the project area should be performed where trenching and excavations will take place, being particularly careful to look for surface indicators of additional and unmarked utilities.

3.2.8 Weather Hazards

Weather conditions should always be taken into consideration. Heavy rains or snowfall, electrical storms, high winds, and extreme temperatures, for example, may create extremely dangerous situations for employees. Equipment performance may also be impaired because of inclement weather. Whenever unfavorable conditions arise, the Site Safety and Health Officer/Emergency Coordinator will evaluate both the safety hazards and ability of the employees to effectively perform given tasks under such conditions. Activities may be halted at their discretion.

Wind direction should be accounted for when positioning equipment at sampling locations. If exposure to organic vapors or dust emissions is anticipated, workers should locate upwind of sampling point. Wind direction often changes abruptly and without warning, so personnel should always be prepared to reposition, if necessary.

3.2.9 Biological Hazards

During site activities, attention will be paid to biological hazards such as ticks, mosquitoes, and other biting insects. Personnel will have commercial bug spray onsite to use if necessary.

Attention will also be paid to the presence of irritant plants such as poison ivy, oak, and sumac. If exposed, personnel should flush the area with soap and water.

3.3 SAFE WORK PRACTICES

3.3.1 Site-Specific Work Practices

Safe work practices that must be followed by site workers, include:

- Eat, drink, and smoke only in those areas designated by the Site Safety and Health Officer/Emergency Coordinator. These activities will not take place within any work zone.

- In the event the potential for chemical contamination exists onsite, employees will wash and conduct appropriate decontamination activities.

- Defective PPE must be repaired or replaced immediately.

- Each employee required to take prescription drugs will notify the Field Manager and/or Site Safety and Health Officer/Emergency Coordinator prior to the start of work. Controlled or unauthorized drugs will **not** be permitted onsite at any time.

3.4 ENVIRONMENTAL MONITORING

For intrusive work (e.g., trench excavation) conducted onsite, environmental monitoring for toxic and flammable/combustible gases will be performed continuously during onsite construction activities using a combustible gas indicator and a photo ionization detector (PID). Instruments will only be used by employees who have been trained in the proper operation, use limitations, and calibration of the monitoring equipment. Monitoring will be conducted at intervals not greater than once every 30 minutes using either the PID or the combustible gas indicator. Instrument calibration and measurements taken will be logged in the field notebook.

Environmental monitoring will include sufficient monitoring of air quality in work zones during intrusive field operations to assess levels of employee exposure and to verify that the level of PPE being worn by personnel is adequate. Monitoring will be conducted to ensure that contaminants are not migrating offsite to minimize the exposure to nearby populations and/or workers. Table 3 summarizes the monitoring requirements for the project.

If visible dust is emitted in the breathing zone, dust suppression will be implemented. If dust can not be suppressed, environmental sampling for dust will be implemented and action levels established.

3.4.1 Calibration and Maintenance

Direct-reading instruments will be calibrated on a daily basis and prior to use with a known concentration of calibration gas (isobutylene for use with the PID and methane for the combustible gas indicator) following the instrument manufacturer's guidance. Instructions in the manufacturer's operations manual regarding storage, cleaning, and maintenance of the instruments will be followed. Calibration will be properly recorded in the field logbook to show the date, calibration material type and concentration, and the actual reading obtained. Equipment failing to meet the manufacturer's standards for accuracy and repeatability will be considered suspect and replaced with an alternate, properly functioning piece of equipment.

4. EMPLOYEE TRAINING

4.1 SITE WORKERS

Personnel who will be performing construction-related non-hazardous waste operations are not required to have been trained according to U.S. Department of Labor OSHA Standard, 29 CFR 1926.65 *Hazardous Waste Operations and Emergency Response.* These workers will have appropriate safety and health training based upon their specific job tasks and activities.

The Site Safety and Health Officer/Emergency Coordinator and personnel conducting the field sampling and monitoring for site gases and vapors during intrusive operations (e.g., Geoprobe) will be trained as required to meet the U.S. Department of Labor OSHA Standard, 29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response* to qualify as hazardous waste site workers and supervisor. Training will include:

- A minimum of 40 hours of initial offsite instruction
- A minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor
- An 8-hour "refresher" training period annually
- Additional training that addresses unique or special hazards/operational requirements.

Onsite supervisors who are directly responsible for or who supervise employees will receive at least 8 additional hours of hazardous waste operations training for supervisors. Copies of training certificates and dates of attendance will be provided to the Site Safety and Health Officer/Emergency Coordinator prior to the commencement of field activities, and will be available through the Site Safety and Health Officer/Emergency Coordinator upon request.

4.1.1 Subcontractor Training

The Project Manager will obtain a written list of subcontractor personnel to be onsite for intrusive site activities only. The subcontractor will provide written certification from subcontractor management that these workers meet the training requirements for their assigned tasks to conduct intrusive activities such as excavation.

4.1.2 Pre-Entry Orientation Session

Prior to entering the site, personnel will attend a pre-entry orientation session presented by the Site Safety and Health Officer/Emergency Coordinator. Personnel will verify attendance of this meeting by signing the SHERP Review Record provided in Attachment A. Visitors entering designated work areas will be subject to applicable safety and health regulations during field operations at the site. The Field Manager and/or Site Safety and Health Officer/Emergency Coordinator is responsible for briefing the personnel onsite of potential hazards that may be encountered on the site, the presence and location of the site SHERP, and emergency response procedures. Visitors will be under the direct supervision of the Field Manager and/or Site Safety and Health Officer/Emergency Coordinator or his/her representative.

At a minimum, the pre-entry orientation session will discuss the contents of this SHERP, PPE, potential hazards, health effects of hazards associated with onsite activities, and the potential hazards presented by unearthing unidentified hazardous materials. Personnel will be instructed in the emergency procedures to include onsite communications and implementation of the site-specific contingency plans.

4.2 MEDICAL SURVEILLANCE

Non-hazardous waste site workers will be medically examined to meet OSHA requirements specific to their job. Hazardous waste site workers must have satisfactorily completed a comprehensive medical examination by a licensed physician within 12 months (or 24 months pending physician's approval) prior to the start of site operations. Subcontractors will provide this information in writing to the Project Manager for their workers prior to mobilization onsite. Copies of this information will be kept onsite by the Site Safety and Health Officer/Emergency Coordinator. Medical surveillance protocol and examination results will be reviewed by a licensed physician who is certified in Occupational Medicine by the American Board of Preventative Medicine. Medical surveillance protocols will comply with 29 CFR 1910.120. The content of medical examinations will be determined by the attending physician and will be based upon the guidelines in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*. Medical examinations and consultations will be provided for employees covered by this program on the following schedule:

- Prior to field work assignment
- At least annually (or every other year with the approval of the occupational physician) for employees covered by the program
- At termination of employment or reassignment to an area where the employee would not be covered if the employee has not been examined within the past 6 months

- As soon as possible upon the development of signs or symptoms that may indicate an overexposure to hazardous substances or other health hazards, or that an unprotected person has been exposed in an emergency situation

- More frequently if the physician deems such examination necessary to maintain employee health.

An accurate record of the medical surveillance will be maintained for each EA employee for a period of no less than 30 years after the termination of employment. Records will be managed and maintained per recordkeeping provisions of EA's *Safety and Health Program Manual* (SHP-001). Records must include at least the following information about the employee:

- Name and social security number
- Physician's written opinions, recommendations, limitations, and test results
- Employee medical complaints related to hazardous waste operations
- Information provided to the physician by the employee concerning possible exposures, accidents, etc.

4.3 HAZARD COMMUNICATION PROGRAM

4.3.1 Hazard Communication

The Site Safety and Health Officer/Emergency Coordinator will conduct regularly scheduled safety meetings with site workers to discuss the planned activities, since these activities and workers may change over the duration of the project. The objective of instituting a Hazard Communication Program is to ensure that hazards associated with the site and with chemicals brought onsite by EA or subcontractors are evaluated, and that information concerning these hazards is transmitted to site employees. Site personnel include EA and subcontractor employees, manufacturer's representatives, or local agency employees, and other workers who observe or perform services onsite. Employee awareness of chemical identities, health and physical hazards, properties, and characteristics is essential to safely handle chemicals and to minimize potential hazards. The Hazard Communication Program must follow OSHA requirements listed in 29 CFR 1926.59.

4.3.2 Hazard Communication Labeling

The Site Safety and Health Officer/Emergency Coordinator will ensure that containers are properly labeled and that workers know the contents of containers. Container labels will contain, at a minimum, information on name of product on container, chemical(s) in product, manufacturer's name and address, protective equipment required for the safe handling of the product, and first-aid procedures in case of overexposure to product contents.

4.3.3 Material Safety Data Sheets

The Site Safety and Health Officer/Emergency Coordinator will maintain a current alphabetical file of complete material safety data sheets (MSDSs) for each hazardous substance stored or used at the work site. The file must be easily accessible to employees. Subcontractors and visitors to the workplace will be informed of the existence and location of this file. Workers and visitors will be instructed on how to read and understand the information shown on the MSDSs. Subcontractors must inform the Site Safety and Health Officer/Emergency Coordinator about hazardous substances which they bring onsite and provide MSDSs.

4.3.4 Hazard Communication Training

Site workers and visitors will be informed of the Hazard Communication Program, their legal rights under the program, the location of the chemical inventory, and the location of the MSDS file. Prior to site work or potential exposure to hazardous substances, the Site Safety and Health Officer/Emergency Coordinator will describe hazardous substances routinely used and provide information about:

- Nature of potential chemical hazards
- Appropriate work practices
- Appropriate control programs
- Appropriate protective measures
- Methods to detect presence or release of hazardous substances
- Emergency procedures.

5. PERSONAL PROTECTIVE EQUIPMENT

5.1 PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

Based upon currently available information, the site will require Level D protection for anticipated conditions and intrusive activities. In the event that potential chemical hazards are identified, the level of protection may be upgraded appropriately to the potential hazard conditions. Only those personnel identified and qualified for hazardous waste work as defined in 29 CFR 1926.65 will be allowed to upgrade beyond Level D or provide support of hazardous material/substance contingency operations. Only the Site Safety and Health Officer/Emergency Coordinator, in conjunction with the Program Safety and Health Officer, will be allowed to approve PPE upgrade beyond Level D and site re-entry for the purpose of hazardous conditions assessment.

The following is a list of the Level D PPE components for the minimum level of protection authorized for use during this project.

- Coveralls or appropriate work clothes
- Steel-toe, steel-shank safety boots/shoes
- Hard hats (with overhead activities such as drilling, excavation, and other heavy equipment operation)
- Chemical resistant gloves (nitrile) as appropriate to prevent contact with contaminated media during excavation activities
- Leather work gloves (as needed)
- Safety glasses with side shields and face shield (as needed) or impact-resistant chemical goggles; safety glasses, goggles, and face shields will meet American National Standards Institute requirements for impact resistance and safety
- Hearing protection (as needed).

The following is a list of the Modified Level D PPE components for the minimum level of protection authorized for use during this project.

- Tyvek
- Steel-toe, steel-shank safety boots/shoes
- Boot covers for steel-toe boots
- Hard hats (with overhead activities such as drilling, excavation, and other heavy equipment operation)
- Chemical resistant gloves (nitrile) as appropriate to prevent contact with contaminated media during excavation activities
- Leather work gloves (as needed)
- Safety glasses with side shields and face shield (as needed) or impact-resistant chemical goggles; safety glasses, goggles, and face shields will meet American National Standards Institute requirements for impact resistance and safety
- Hearing protection (as needed).

The following is a list of the Level C PPE components for the maximum levels of protection authorized for use during this project:

- Full facepiece, air purifying respirator equipped with combination organic vapor high efficiency particulate cartridges
- Poly-coated Tyvek coveralls
- Steel-toe, steel-shank safety boots/shoes
- Chemical-resistant boot covers
- Hard hat
- Hearing protectors
- Chemical resistant gloves (neoprene or nitrile) as appropriate to prevent contact with contaminated media during excavation activities.

6. EMERGENCY RESPONSE AND REACTION TO SITE CONTINGENCIES

6.1 EMERGENCY RECOGNITION

Prior to work startup, personnel must be familiar with emergency condition identification, notification, and response procedures. The emergency telephone numbers for local emergency response and reporting organizations and directions to the nearest hospital are provided in Table 2. The Field Manager, along with the Site Safety and Health Officer/Emergency Coordinator, will rehearse/review emergency procedures and/or applicable site contingencies initially during site orientation and as part of the ongoing site safety program with EA and subcontractor personnel. Onsite emergencies will ultimately be handled by offsite emergency personnel. Initial response and first-aid treatment, however, will be provided onsite.

Person(s) identifying an accident, injury, emergency condition, or a scenario requiring implementation of a response in support of this SHERP will immediately take actions to report the situation to the Field Manager and Site Safety and Health Officer/Emergency Coordinator. Notification may take place by runner, hand-held radio, or telephone. The Field Manager and Site Safety and Health Officer/Emergency Coordinator will initiate the required response based upon the type of incident, following the procedures contained in this SHERP. Chain-of-command and sign-in sheets for personnel on the site will be established at the beginning of each work day to ensure personnel are accounted for and who will take control should the Field Manager and/or Site Safety and Health Officer/Emergency Coordinator become injured. The following items constitute those site conditions requiring an emergency response or contingency action in accordance with this SHERP:

- Fire/explosion
- Heavy equipment accident
- Natural disaster
- Medical emergency
- Discovery of unanticipated hazards (e.g., unmarked utility lines, heavily contaminated material).

Follow-on operations to evaluate and control the source of fire, explosions, and hazardous materials incidents will occur only after discussion with the Project Manager, Field Manager, and/or Site Safety and Health Officer/Emergency Coordinator. The Field Manager and/or Site Safety and Health Officer/Emergency Coordinator will act as the Emergency Coordinator at the site to coordinate onsite activities and contingencies with outside response organizations. If the Field Manager is unable to act as the emergency coordinator, then the authority to take action will be transferred to the Site Safety and Health Officer/Emergency Coordinator, or other designee, as indicated in the daily updated chain-of-command.

6.2 OPERATIONS SHUTDOWN

Operations shutdown may be mandated by the former Gorham Manufacturing Site Safety and Health Officer/Emergency Coordinator or the Project Manager. Conditions warranting work stoppage will include (but are not limited to):

- Uncontrolled fire
- Explosion
- Uncovering potentially dangerous buried hazardous materials
- Conditions immediately dangerous to life and health or the environment
- Potential for electrical storms
- Treacherous weather-related conditions
- Limited visibility
- Air contaminant concentrations in excess of the action levels contained in Table 3.

6.3 PROCEDURES FOR HANDLING EMERGENCY INCIDENTS

In the event of an emergency, the information available at that time must be properly evaluated and the appropriate steps taken to implement the emergency response plan. The Site Safety and Health Officer/Emergency Coordinator will assume command of the situation. He/she will alert the emergency management system per Table 2, and evacuate personnel to the pre-designated evacuation location. The Site Safety and Health Officer/Emergency Coordinator will make required notifications to include, but not be limited to the EA Project Manager or EA Regional Safety and Health Officer, as defined in this SHERP and Table 2, and the appropriate federal and state agencies.

Site personnel will have the capability of notifying emergency responders directly from the site using the phone in the company vehicle or in the site support office.

The Project Manager will complete and submit to a City of Providence-appointed representative an Accident/Loss and Incident Report using the format contained in Attachment C. The following information will be provided when reporting an emergency:

1. Name and location of person reporting
2. Location of accident/incident
3. Name and affiliation of injured party
4. Description of injuries, fire, spill, or explosion
5. Status of medical aid and/or other emergency control efforts
6. Details of chemicals involved
7. Summary of accident, including suspected cause and time it occurred
8. Temporary control measures taken to minimize further risk.

This information is not to be released under any circumstances to parties other than those listed in this section and emergency response team members. Once emergency response agencies have been notified, the Project Manager will be immediately notified.

6.4 MEDICAL EMERGENCIES

Personnel should always be alert for signs and symptoms of illnesses related to chemical, physical, and onsite health hazards. Severe injuries resulting from accidents must be recognized as emergencies and treated as such. At least one person currently trained in first aid/ cardiopulmonary resuscitation must be present onsite at all times. This will normally be the Site Safety and Health Officer/Emergency Coordinator.

In a medical emergency, the Site Safety and Health Officer/Emergency Coordinator must sound the emergency alarm, upon which work must stop and personnel must move to the predesignated evacuation location. **If the emergency situation cannot be conveyed by word of mouth, a whistle or other horn will be sounded. Three short blasts, separated by a 2-second silence, will be used as the emergency signal.** Personnel currently trained in first aid will evaluate the nature of the injury, decontaminate the victim (if necessary), and initiate first aid assistance immediately and transport if appropriate. First aid will be administered only to limit further injury and stabilize the victim. The local Emergency Medical Services must be notified immediately if needed.

Although not anticipated, victims who are heavily contaminated with toxic or dangerous materials must be decontaminated before being transported from the site. Since no hazardous materials are anticipated, a formal decontamination station will not be available; however, there is an emergency eyewash station in each of the EA vehicles. Decontamination will consist of removal of contaminated coveralls/clothing, and wrapping the victim in a sheet or other clothlike material. No persons will re-enter the site of injury/illness until the cause of the injury or symptoms has been determined and controlled. At no time will personnel transport victims to emergency medical facilities unless the injury does not pose an immediate threat to life and transport to the emergency medical facility can be accomplished without the risk of further injury. Emergency Medical Services will be used to transport serious injuries offsite unless deemed otherwise by the Site Safety and Health Officer/Emergency Coordinator.

The Site Safety and Health Officer/Emergency Coordinator must complete an Accident/Loss and Incident Report (Attachment C) and submit it to the Project Manager within 24 hours of the following types of incidents:

- Job-related injuries and illnesses
- Accidents resulting in loss or damage to property
- Accidents involving vehicles and/or vessels, whether or not they result in damage to property or personnel
- Accidents in which there may have been no injury or property damage, but which have a high probability of recurring with at least a moderate risk to personnel or property
- Near-miss incidents that could have resulted in any of the conditions defined above.

An accident that results in a fatality or the hospitalization of three or more employees must be reported within 8 hours to the U.S. Department of Labor through the Project Manager. Subcontractors are responsible for their reporting.

In order to support onsite medical emergencies, first aid/emergency medical equipment will be available at the following locations:

• First-aid kit	Company vehicle
• Eyewash	Company vehicle
• Emergency alarm	Horn on the company vehicle
• Copy of the SHERP	Company vehicle
• Telephone	Company vehicle.

The eyewash kit must be portable and capable of supplying at least a 15-minute supply of potable water to the eyes.

6.5 FIRE/EXPLOSION EMERGENCIES

Fire and explosion must be immediately recognized as an emergency. The Site Safety and Health Officer/Emergency Coordinator must sound an emergency signal, and personnel must be decontaminated (if necessary) and evacuated to the pre-designated evacuation location. Only persons properly trained in fire suppression and other emergency response procedures will support control activities. Control activities will consist of the use of onsite portable fire extinguishers for limited fire suppression and employee evacuation. Upon sounding the emergency alarm, personnel will evacuate the hazard location and assemble at the designated site meeting area. Only the Site Safety and Health Officer/Emergency Coordinator, or those site personnel trained in the use of portable fire extinguishers will attempt to suppress a site fire. Small, multi-purpose dry chemical extinguishers will be maintained in each EA vehicle onsite. Fires not able to be extinguished using onsite extinguishers will require the support of the local Fire Department. The Site Safety and Health Officer/Emergency Coordinator should take measures to reduce injury and illness by evacuating personnel from the hazard location as quickly as possible. The Site Safety and Health Officer/Emergency Coordinator must then notify the local Fire Department. The Site Safety and Health Officer/Emergency Coordinator will determine proper followup actions. Site personnel will not resume work during or after a fire/explosion incident until the Emergency Coordinator has directed that the incident is over and work may resume. During the incident, site personnel will remain outside the incident area and obey the instructions of the Emergency Coordinator.

6.6 EMERGENCY TELEPHONE NUMBERS

Communications will be by telephones located in the EA vehicle onsite; field personnel will have access to this telephone to directly contact offsite emergency response organizations. Refer to Table 2 for a listing of emergency telephone numbers.

6.7 CONTROL OF SITE-PRODUCED AMBIENT NOISE LEVELS

In order to maintain ambient noise levels within acceptable standards, site activities can only take place between the hours of 0700 to 1900 hours each work day. Complaints by local inhabitants received by the Site Safety and Health Officer/Emergency Coordinator will prompt sound level reduction measures as needed.

7. SITE CONTROL AND WORK ZONES

The following work zones will be established during implementation of RAWP activities at Parcel B of the former Gorham Manufacturing site as a means of site control.

7.1 WORK ZONES

Work zones will be established in accordance with the following:

- **Exclusion Zone (EZ)**—The EZ at Parcel B of the former Gorham Manufacturing site will be designated prior to intrusive activities. For this investigation, the entire site will be considered as the EZ. Personnel entering the EZ must wear the prescribed level of protective equipment. Unauthorized personnel will not be allowed in this area. This area has either known or potential contamination and has the highest potential for exposure to chemicals onsite.

  Persons who enter the EZ must wear the appropriate level of PPE for the degree and types of hazards present at the site. If the EZ is subdivided, different levels of PPE may be appropriate. Each sub-area of the EZ should be clearly marked to identify hazards and required level of PPE.

- **Contamination Reduction Zone (CRZ)**—One access point from the CRZ to the EZ will be designated by the Site Safety and Health Officer/Emergency Coordinator. The purpose of the CRZ is to reduce the possibility that the Support Zone (SZ) will become contaminated or affected by the site hazards. Because of both distance and decontamination procedures, the degree of contamination in the CRZ generally will decrease as one moves from the hotline to the SZ.

  The CRZ will be established outside the areas of known or potential contamination. Contamination Reduction Corridors, which are access control points between the EZ and CRZ, should be established for both personnel and heavy equipment. These corridors should consist of an appropriate number of decontamination stations necessary to address the contaminants of the particular site (see National Institute of Occupational Safety and Health/OSHA/U.S. Coast Guard/U.S. Environmental Protection Agency *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985 for information on decontamination procedures and work zones).

- **Support Zone**—The SZ is the uncontaminated area where workers are unlikely to be exposed to hazardous substances or dangerous conditions. The SZ is the appropriate location for the command post, equipment and supply center, field laboratory, vehicles, and other administrative or support functions that are necessary to keep site operations running efficiently.

Potentially contaminated clothing, equipment, and samples must remain outside the SZ until decontaminated. However, personnel located in the SZ must receive instruction in proper evacuation procedures in case of a hazardous substance emergency. The SZ should be upwind and as far from the EZ as practicable.

7.2 PERSONAL PROTECTIVE EQUIPMENT IN WORK ZONES

The level of PPE will depend upon the type of work performed and site monitoring data. Level D will be the minimum protection in the EZ. The CRZ will require a minimum Level D. No specific PPE requirements are needed in the SZ, as contaminated materials are prohibited from being stored in this area. Only authorized personnel will be permitted in the EZ and CRZ. Entering these zones will require donning the required PPE prior to entry. These zones will be established prior to beginning the field activities. Exiting the EZ will require going through decontamination in the CRZ.

7.3 SAFE WORK PRACTICES IN WORK ZONES

Safe work practices to be followed by site workers include:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited in the EZ and CRZ.
- Hands and face must be thoroughly washed upon leaving the work area.
- Prescription drugs must not be taken by personnel unless specifically approved by a licensed physician who is familiar with the issues of worker exposure to hazardous materials.
- When respirators are required, facial hair that interferes with the face-to-facepiece fit of the respirator will not be permitted.
- Personnel onsite must use the buddy system; visual contact must be maintained between team members at all times.
- Work is allowed during daylight hours only.
- If dust is being visually generated in the EZ, the Site Safety and Health Officer/ Emergency Coordinator will advise on procedures for misting or wetting the soil to prevent possible exposure from inhalation of soil contaminants.

- Possessing, using, purchasing, distributing, selling, or having controlled substances in your system during the work day, including meal or break periods onsite, is strictly prohibited.

- The use or possession of alcoholic beverages onsite is prohibited. Similarly, reporting to work or performing one's job assignments with excessive levels of alcohol in one's system will not be permitted.

TABLE 1 POTENTIALLY PRESENT COMPOUNDS OR SUBSTANCES

Compound	PEL/TLV[(a)]	Signs and Symptoms of Exposure
POTENTIAL SITE CONTAMINANTS OF CONCERN		
Petroleum Hydrocarbon	No PEL/TLV	Overexposure may cause: irritation to the eyes, skin, mucous membranes; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid); possible liver, kidney damage; potential occupational carcinogen.
Semi Volatile Organic Compounds	No PEL/TLV	Can irritate eyes and skin. Toxic by ingestion, inhalation, or skin adsorption. Can cause headache, malaise, nausea, vomiting, abdominal pains, irritated bladder, profuse sweating, jaundice, hematuria, hemoglobinnuria, liver damage, convulsions, and coma.
Chlorinated Volatile Organic Compounds	1 ppm	Overexposure may cause irritation to the eyes, skin, mucous membranes; kidney damage; potential occupational carcinogen.
Trichloroethene	270 mg/m^3	This substance is an irritant to the eyes and skin. TCE overexposure can cause headaches, vertigo, visual disturbances, tremors, somnolence, nausea/vomiting, and cardiac arrhythmia. Suspected carcinogen.
Asbestos	OSHA: 0.1 f/cc (PEL) OSHA: 1.0 f/cc (STEL) RIDOH: 0.01 f/cc	Exposure to asbestos fibers by inhalation may cause Asbestosis, Mesothelioma, or Lung Cancer. The latency period from asbestos exposure to disease onset is between 20-40 years. Known carcinogen.
DECONTAMINATION FLUIDS		
Isopropyl Alcohol	400 ppm	This product is an irritant of the eyes, nose, and throat. Overexposure can cause drowsiness and headache.

(a) Permissible Exposure Limit (Occupational Safety and Health Administration) or Threshold Limit Value American Conference of Governmental Industrial Hygienists for time-weighted average exposure for an 8-hour workday or 40-hour work week. When both Permissible Exposure Limits and Threshold Limit Values are available for a chemical, the lowest (i.e., most conservative) value is presented.

NOTE: ppm = Parts per million.
mg/m^3 = Milligrams per cubic meter.
f/cc = Fibers per cubic centimeter.
STEL = Short Term Exposure Limit (based upon a 30 minute sample during highest anticipated exposure).
RIDOH = RI Department of Health has a non-occupational exposure limit used as a clearance criteria.

TABLE 2 EMERGENCY TELEPHONE NUMBERS

Title	Name	Telephone No.
OFFSITE EMERGENCY NUMBERS		
Police	Providence Police Department	911
Fire	Providence Fire Department	911
Ambulance	General emergency 911	911
Hospital	Rhode Island Hospital 593 Eddy Street Providence, RI 02903	(401) 444-4000
Directions to Hospital: Go southeast from Site on Downing Street. Turn LEFT onto ALVIN ST. Turn LEFT onto Route 2 North. Bear LEFT onto ELMWOOD AVE/(Rte 1 North). Turn RIGHT onto PUBLIC ST. Follow for 1 mile and turn LEFT onto EDDY ST. Hospital is 0.1 miles on left at 593 EDDY ST. Driving time: 7 minutes Distance: 2 miles		
EA Emergency Numbers		
Project Manager	Peter Grivers	(401) 736-3440 (401) 270-2591
Program Safety and Health Officer	Kris Hoiem	(410) 329-5149
Field Manager	Peter Grivers	(401) 935-5080
Site Safety and Health Officer/Emergency Coordinator	Jill Ann Parrett	(401) 465-7138
Environmental Emergency Numbers		
Rhode Island Department of Environmental Management Spill Reporting	---	(401) 222-3070
Chemical Emergency Center (significant chemical leak or spill)	---	(800) 424-9300

ATTACHMENT A

SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN REVIEW RECORD

I have read the Safety, Health, and Emergency Response Plan for this site and have been briefed on the nature, level, and degree of exposure likely as a result of participation in this project. I agree to conform to all the requirements of this Plan.

SITE: Former Gorham Manufacturing – Parcel B, Providence, Rhode Island
PROJECT NO.: 61965.01

Name	Signature	Affiliation	Date

TABLE 3 SITE CONTAMINANT MONITORING REQUIREMENTS

Task	Instrument	Frequency and Location	Action Levels[a]	Required Response
Intrusive work	PID	Initially during intrusive work and when excavation is started; every 30 minutes in the breathing zone.	Background	Continue work.
			>Background to 5 ppm	Evacuate to a safe upwind location and wait for levels to dissipate. Retest the area after 15 minutes. If levels have not dissipated, upgrade to Level C. Continue work in Level C personal protective equipment or retest in another 15 minutes.
			>5 ppm	Evacuate to a safe upwind location immediately. Retest area after 15 minutes wearing Level C personal protective equipment. If sampling results defined by the flame ionization detector have not dissipated in 30 minutes, contact the Program Safety and Health Officer and Project Manager for further guidance.
Intrusive work	Combustible Gas Meter	Initially during intrusive work and when excavation is started; every 30 minutes in breathing zone and areas occupied by personnel and spark-producing equipment.	0-10% LEL (0-0.5% Methane)	Continue work. Monitor continuously.
Intrusive work	Combustible Gas Meter		> 10% LEL	Evacuate personnel from work area. Move upwind. Keep unnecessary equipment out of area.
Intrusive work	Low Flow Personnel Pump (1-3 LPM) with a 25 mm, 0.8 um pore size cassette	Initially as a baseline and during site preparation activities, daily personnel asbestos samples will be collected on operators in or about the breathing zone, and asbestos samples along the fence line at upgradient and downgradient wind locations.	> 0.01 f/cc	Utilize proper PPE and respirator protection with HEPA (P100) cartridges, re-evaluate engineering controls, and continue wet methods for dust minimization.
Intrusive work	Low Flow Personnel Pump (1-3 LPM) with a 37 mm PVC membrane	Initially as a baseline and during site preparation activities, daily personnel dust samples will be collected on operators in or about the breathing zone, and area dust samples along the fence line at upgradient and downgradient wind locations.	> 15 ug/m^3	Utilize proper PPE and respirator protection with HEPA (P100) cartridges, re-evaluate engineering controls, and continue wet methods for dust minimization.

(a) Action levels for photo-ionization detector (PID) or flame-ionization detector (FID) are based upon unknown concentrations and measurements taken above background concentrations when background concentration is less than 1 ppm. When background concentrations exceed 1 ppm total volatile hydrocarbons, PID, or FID action levels will be inclusive of background concentrations and so noted on the environmental monitoring record.

NOTE:
- LEL = Lower explosive limit.
- LPM = Liters per minute
- PPE = Personal protective equipment.
- HEPA = High efficiency particulate air [filter].

ATTACHMENT B

SITE ENTRY AND EXIT LOG

SITE: Former Gorham Manufacturing – Parcel B, Providence, Rhode Island
PROJECT NO.: 61965.01

Name	Date	Time of Entry	Time of Exit	Initials

EA®

ACCIDENT/LOSS REPORT

THIS REPORT MUST BE COMPLETED BY THE INJURED EMPLOYEE'S SUPERVISOR AND FAXED TO EA CORPORATE HUMAN RESOURCES WITHIN 24 HOURS OF ANY ACCIDENT. THE FAX NUMBER IS (410) 771-1780.

NOTE: WHENEVER AN EMPLOYEE IS SENT FOR MEDICAL TREATMENT FOR A WORK RELATED INJURY OR ILLNESS, PAGE 4 OF THIS REPORT MUST ACCOMPANY THAT INDIVIDUAL TO ENSURE THAT ALL INVOICES/BILLS/ CORRESPONDENCE ARE SENT TO CORPORATE CENTER FOR TIMELY RESPONSE.

DATE OF ACCIDENT: ______________________ TIME OF ACCIDENT: __________

EXACT LOCATION WHERE ACCIDENT OCCURRED (including street, city, and state): _____

____

NAME OF INJURED EMPLOYEE: ____________________________________

HOME ADDRESS: ____

HOME PHONE: ____________________________ DATE OF BIRTH: __________

AGE: ____________ SEX: ☐ MALE ☐ FEMALE MARITAL STATUS: __________

SOCIAL SECURITY NUMBER: ________________ DATE OF HIRE: __________

NUMBER OF DEPENDENTS: ______________________________________

EMPLOYEE JOB TITLE: ____

DEPARTMENT IN WHICH REGULARLY EMPLOYED: ______________________

EXPLAIN WHAT HAPPENED (include what the employee was doing at the time of the accident and how the accident occurred): ______________________________

____

____

____

____

____

____

____

DESCRIBE THE INJURY AND THE SPECIFIC PART OF THE BODY AFFECTED (i.e., laceration, right hand, third finger, second joint): ______________________

____

____

____

OBJECT OR SUBSTANCE THAT DIRECTLY INJURED EMPLOYEE: ______

NAME AND ADDRESS OF THE PHYSICIAN (if medical attention was administered): ______

* PLEASE ATTACH THE PHYSICIAN'S WRITTEN RETURN TO WORK SLIP *

NOTE: A PHYSICIAN'S RETURN TO WORK SLIP IS REQUIRED PRIOR TO ALLOWING THE WORKER TO RETURN TO WORK.

IS THE EMPLOYEE EXPECTED TO LOSE AT LEAST ONE FULL DAY OF WORK? ______
WAS THE EMPLOYEE ASSIGNED TO RESTRICTED DUTY? ______
NUMBER OF DAYS AND HOURS EMPLOYEE USUALLY WORKS PER WEEK: ______
LIST ALL PPE EMPLOYEE WAS WEARING AND ALL SAFETY DEVICES IN USE AT THE TIME OF THE ACCIDENT: ______

DESCRIBE THE PREVENTIVE MEASURES TAKEN TO AVERT A RECURRENCE OF THIS TYPE OF INCIDENT: ______

DATE WHEN MEASURES WERE IMPLEMENTED AND BY WHOM: ______

AUTOMOBILE ACCIDENT INFORMATION

AUTHORITY CONTACTED AND REPORT NO.: ______
EA EMPLOYEE VEHICLE YEAR, MAKE, AND MODEL: ______
V.I.N.: ______ PLATE/TAG NO: ______
OWNER'S NAME AND ADDRESS: ______

DRIVER'S NAME AND ADDRESS: ______

RELATION TO INSURED: ______ DRIVER'S LICENSE NO.: ______
DESCRIBE DAMAGE TO YOUR PROPERTY: ______

DESCRIBE DAMAGE TO OTHER VEHICLE OR PROPERTY: ______

OTHER DRIVER'S NAME AND ADDRESS: ______________________________

____

OTHER DRIVER'S PHONE: ______________________________

OTHER DRIVER'S INSURANCE COMPANY AND PHONE: ______________________________

____

LOCATION OF OTHER VEHICLE: ______________________________

NAME, ADDRESS, AND PHONE OF OTHER INJURED PARTIES: ______________________________

____

WITNESS:

NAME: ____________________ PHONE: ____________________

ADDRESS: ______________________________

STATEMENT: ______________________________

____

SIGNATURE: ______________________________

NAME: ____________________ PHONE: ____________________

ADDRESS: ______________________________

STATEMENT: ______________________________

____

SIGNATURE: ______________________________

DATE OF THIS REPORT: __________ REPORT PREPARED BY: ____________________

I have read this report and the contents as to how the accident/loss occurred are accurate to the best of my knowledge.

Signature: ______________________________ Date: ____________________

Injured Employee

I am seeking medical treatment for a work related injury/illness.

Please forward all bills/invoices/correspondence to:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

CORPORATE OFFICE

11019 MCCORMICK ROAD

HUNT VALLEY, MD 21031

ATTENTION: HUMAN RESOURCES

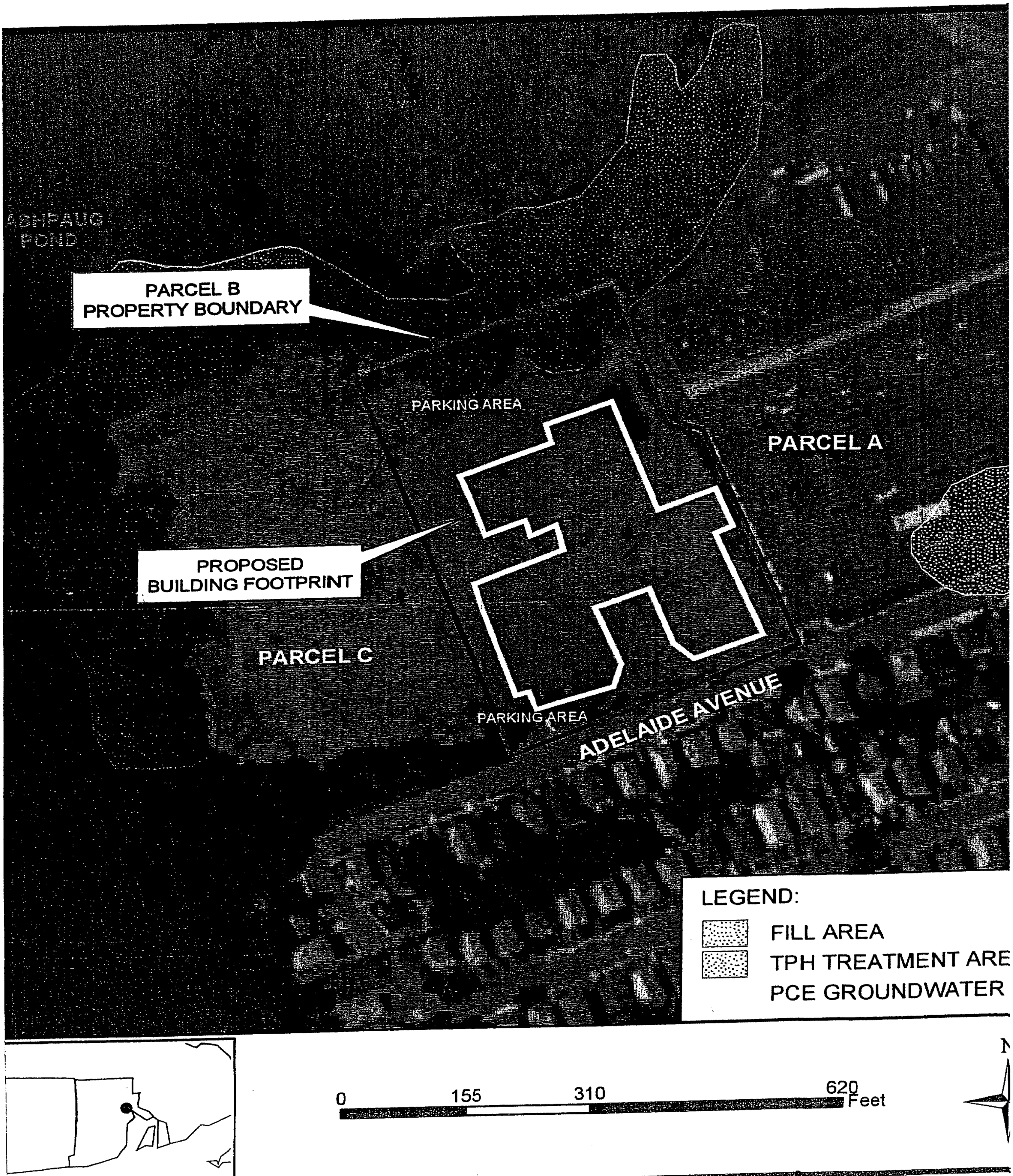
(410) 771-1625

INCIDENT REPOR'

THIS REPORT IS TO BE COMPLETED WHEN A NEAR MISS OCCURS THAT COULD HAVE POTENTIALLY RESULTED IN SERIOUS PHYSICAL HARM. PLEASE FAX THIS FORM TO EA CORPORATE SAFETY AND HEALTH DEPARTMENT AT (972) 315-5181, ATTN: RALPH BRADLEY.

EXPLAIN WHAT HAPPENED (include what the employee was doing at the time of the near miss and how it occurred): ____

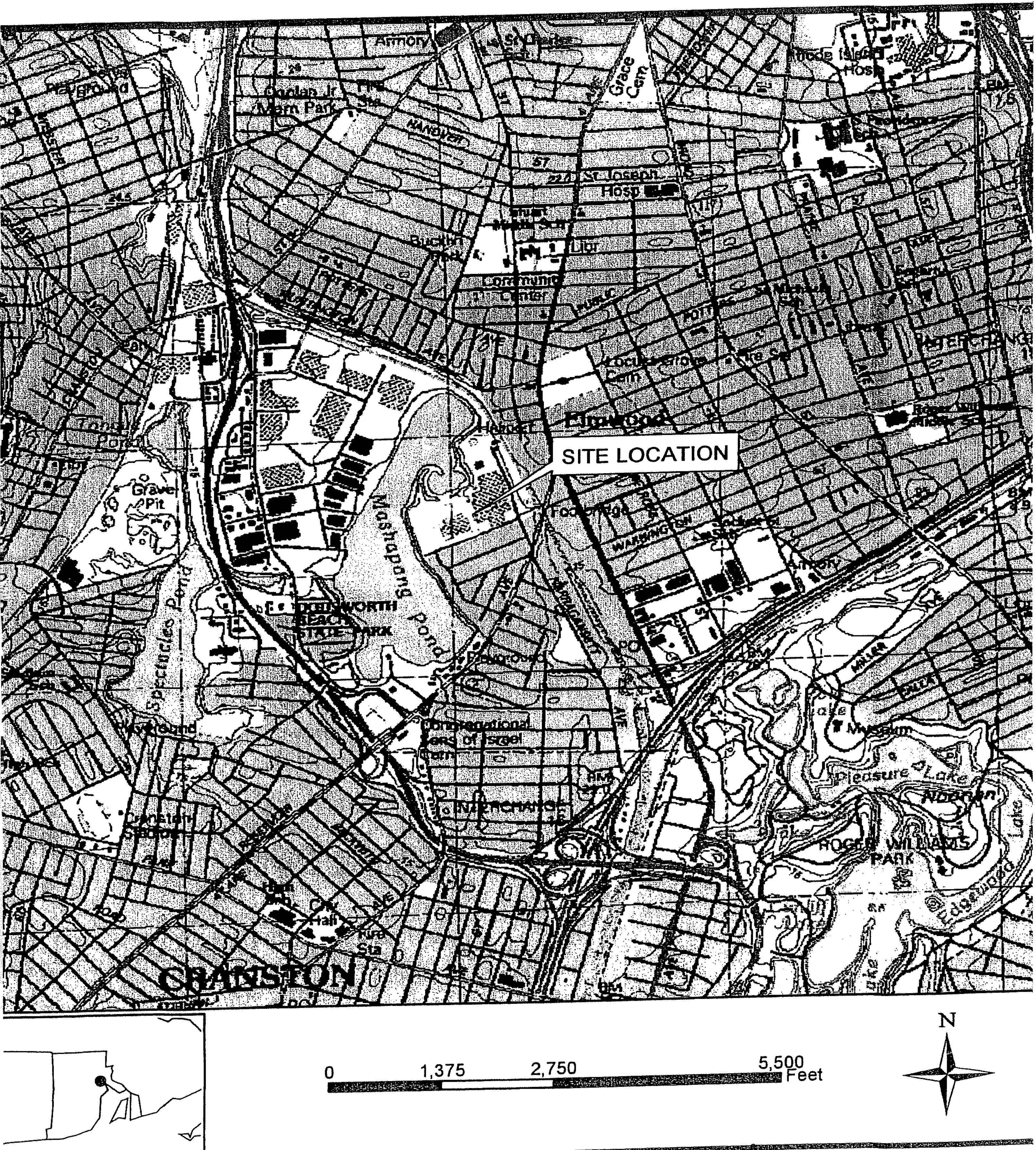
REPORT PREPARED BY: ______________________ DATE: ______________



FORMER GORHAM MANUFACTURING SITE, PARCEL B
333 ADELAIDE AVENUE
PROVIDENCE, RHODE ISLAND

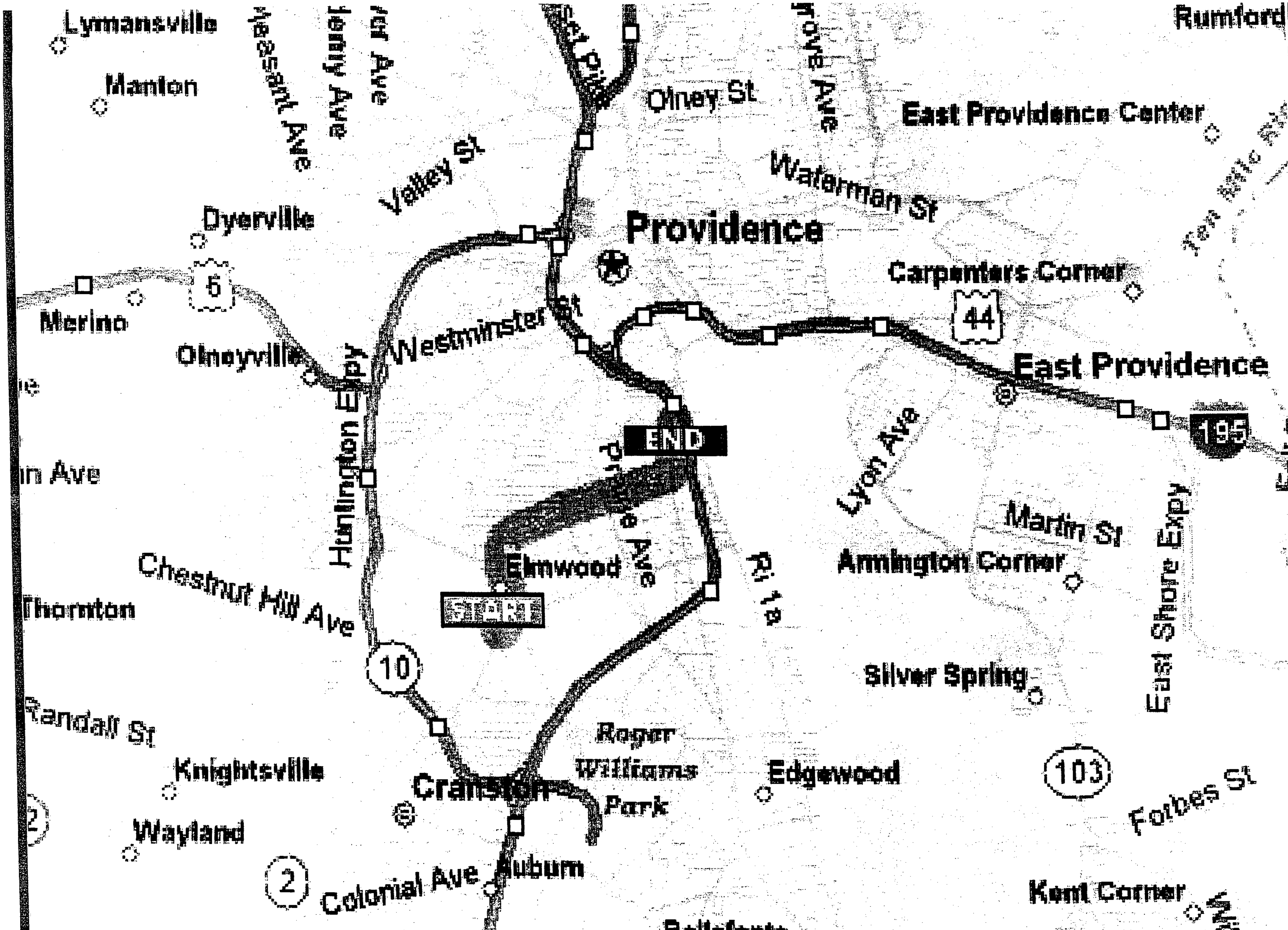
FIGURE 2
SITE PLAN AND
AREAS OF CONCE

ROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO
TR	DC	DC	JP	AS SHOWN	MARCH 2005	6196501	I:\RI\FIG2- AE 333 ADELAIDE_P



EA	FORMER GORHAM MANUFACTURING SITE, PARCEL B 333 ADELAIDE AVENUE PROVIDENCE, RHODE ISLAND	FIGURE 1 SITE LOCATION MAP

OJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
TR	DC	DC	JP	AS SHOWN	FEBRUARY 2005	6196501	I:\RI\FIG1 333 ADELAIDE_PROV.MXD



EA Engineering, Science, and Technology 2350 Post Road Warwick, Rhode Island 02886	Former Gorham Manufacturing Facility Property, Parcel B Providence, Rhode Island	FIGURE 3 HOSPITAL ROUTE

PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT No	FILE No
TR	JAP	MDG	JAP	N/A	MARCH 2005	61965.01	

Appendix C

Draft Environmental Land Usage Restriction (including Soil Management Plan)

DRAFT ENVIRONMENTAL LAND USAGE RESTRICTION

This Declaration of Environmental Land Usage Restriction (.Restriction.) is made on this _____ day of ____________________, 20___ by the City of Providence, and its successors and/or assigns (hereinafter, the "Grantor").

WITNESSETH:

WHEREAS, the Grantor, the City of Providence is the owner in fee simple of certain real property identified as Plat 51, Lot 323, Parcel B at 333 Adelaide Avenue in Providence, Rhode Island (the "Property"), more particularly described in Exhibit A (Legal Description), which is attached hereto and made a part hereof;

WHEREAS, the Property has been determined to contain soil, which is contaminated with certain hazardous materials in excess of applicable residential direct exposure criteria, pursuant to the Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases ("Remediation Regulations");

WHEREAS, the Grantor has determined that the environmental land use restrictions set forth below are consistent with the regulations adopted by the Rhode Island Department of Environmental Management ("Department") pursuant to R.I.G.L. § 23-19.14-1 et seq.;

WHEREAS, the Department's written approval of this Restriction is contained in the document entitled: Remedial Approval Letter issued pursuant to the Remediation Regulations;

WHEREAS, to prevent exposure to or migration of hazardous materials and to abate hazards to human health and/or the environment, and in accordance with the Remedial Approval Letter, the Grantor desires to impose certain restrictions upon the use, occupancy, and activities of and at the Property;

WHEREAS, the Grantor believes that this Restriction will effectively protect public health and the environment from such contamination; and

WHEREAS, the Grantor intends that such restrictions shall run with the land and be binding upon and enforceable against the Grantor and the Grantor's successors and assigns.

NOW, THEREFORE, Grantor agrees as follows:

A. Restrictions Applicable to the Property: In accordance with the Remedial Approval Letter, the use, occupancy and activity of and at the Property is restricted as follows:

i No residential use of the Property shall be permitted that is contrary to Department approvals and restrictions contained herein;

ii No groundwater at the Property shall be used as potable water;

iii No soil at the Property shall be disturbed in any manner without written permission of the Department's Office of Waste Management, except as permitted in the Soil Management Plan (SMP) approved by the Department in a written approval letter dated _____________(date) Exhibit B and attached hereto;

iv Humans engaged in activities at the Property shall not be exposed to soils containing hazardous materials in concentrations exceeding the applicable Department approved direct exposure criteria set forth in the Remediation Regulations;

v Water at the Property shall be prohibited from infiltrating soils containing hazardous materials in concentrations exceeding the applicable Department approved leachability criteria set forth in the Remediation Regulations;

vi No subsurface structures shall be constructed on the Property over groundwater containing hazardous materials in concentrations exceeding the applicable Department approved GB Groundwater Objectives set forth in the Remediation Regulations;

vii The engineered controls at the Property described in the SMP contained in Exhibit B attached hereto shall not be disturbed and shall be properly maintained to prevent humans engaged in residential activity from being exposed to soils containing hazardous materials in concentrations exceeding the applicable Department-approved residential direct exposure criteria in accordance with the Remediation Regulations; and

viii The engineered controls at the Property described in the SMP contained in Exhibit B attached hereto shall not be disturbed and shall be properly maintained so that water does not infiltrate soils containing hazardous materials and/or petroleum in concentrations exceeding the applicable Department-approved leachability criteria set forth in the Remediation Regulations.

B. No action shall be taken, allowed, suffered, or omitted at the Property without the prior written approval of the Department if such action or omission is reasonably likely to:

i Create a risk of migration of hazardous materials and/or petroleum;

ii Create a potential hazard to human health or the environment; or

iii Result in the disturbance of any engineered controls utilized at the Property, except as permitted in the Department-approved SMP contained in Exhibit B.

C. Emergencies: In the event of any emergency which presents a significant risk to human health or to the environment, including but not limited to, maintenance and repair of utility lines or a response to emergencies such as fire or flood, the application of Paragraphs A (iii.-viii.) and B above may be suspended, provided such risk cannot be abated without suspending such Paragraphs and the Grantor complies with the following:

i Grantor shall notify the Department's Office of Waste Management in writing of the emergency as soon as possible but no more than three (3) business days after Grantor's having learned of the emergency. (This does not remove Grantor's obligation to notify any other necessary state, local or federal agencies.);

ii Grantor shall limit both the extent and duration of the suspension to the minimum period reasonable and necessary to adequately respond to the emergency;

iii Grantor shall implement reasonable measures necessary to prevent actual, potential, present and future risk to human health and the environment resulting from such suspension;

iv Grantor shall communicate at the time of written notification to the Department its intention to conduct the emergency response actions and provide a schedule to complete the emergency response actions;

v Grantor shall continue to implement the emergency response actions, on the schedule submitted to the Department, to ensure that the Property is remediated in accordance with the Remediation Regulations (or applicable variance) or restored to its condition prior to such emergency. Based upon information submitted to the Department at the time the ELUR was recorded pertaining to known environmental conditions at the Property, emergency maintenance and repair of utility lines shall only require restoration of the Property to its condition prior to the maintenance and repair of the utility lines; and

vi Grantor shall submit to the Department, within ten (10) days after the completion of the emergency response action, a status report describing the emergency activities that have been completed.

D. Release of Restriction; Alterations of Subject Area: The Grantor shall not make, or allow or suffer to be made, any alteration of any kind in, to, or about any portion of the Property inconsistent with this Restriction unless the Grantor has received the Department's prior written approval for such alteration. If the Department determines that the proposed alteration is significant, the Department may require the amendment of this Restriction. Alterations deemed insignificant by the Department will be approved via a letter from the Department. The Department shall not approve any such alteration and shall not release the Property from the provisions of this Restriction unless the Grantor demonstrates to the Department's satisfaction that Grantor has managed the Property in accordance with applicable regulations.

E. Notice of Lessees and Other Holders of Interests in the Property: The Grantor, or any future holder of any interest in the Property, shall cause any lease, grant, or other transfer of any interest in the Property to include a provision expressly requiring the lessee, grantee, or transferee to comply with this Restriction. The failure to include such provision shall not affect the validity or applicability of this Restriction to the Property.

F. Enforceability: If any court of competent jurisdiction determines that any provision of this Restriction is invalid or unenforceable, the Grantor shall notify the Department in writing within fourteen (14) days of such determination.

G. Binding Effect: All of the terms, covenants, and conditions of this Restriction shall run with the land and shall be binding on the Grantor, its successors and assigns, and each owner and any other party entitled to control, possession or use of the Property during such period of ownership or possession.

H. Inspection & Non-Compliance: It shall be the obligation of the Grantor, or any future holder of any interest in the Property, to provide for annual inspections of the Property for compliance with the ELUR in accordance with Department requirements.

A qualified environmental professional will, on behalf of the Grantor or future holder of any interest in the Property, evaluate the compliance status of the Property. Upon completion of the evaluation, the environmental professional will prepare and simultaneously submit to the Department and to the Grantor or future holder of any interest in the Property an evaluation report detailing the findings of the inspection, and noting any compliance violations at the Property. If the Property is determined to be out of compliance with the terms of the ELUR, the Grantor or future holder of any interest in the Property shall submit a corrective action plan in writing to the Department within ten (10) days of receipt of the evaluation report, indicating the plans to bring the Property into compliance with the ELUR, including, at a minimum, a schedule for implementation of the plan.

In the event of any violation of the terms of this Restriction, which remains uncured more than ninety (90) days after written notice of violation, all Department approvals and agreements relating to the Property may be voided at the sole discretion of the Department.

I. **Terms Used Herein:** The definitions of terms used herein shall be the same as the definitions contained in Section 3 (DEFINITIONS) of the Remediation Regulations.

IN WITNESS WHEREOF, the Grantor has hereunto set (his/her) hand and seal on the day and year set forth above.

By: ________________________________ ________________________________

Grantor (signature) Grantor (typed name)

STATE OF RHODE ISLAND

COUNTY OF PROVIDENCE

In Providence, in said County and State, on the _____ day of ___________, 20___, before me personally appeared ___________________________, to me known and known by me to be the party executing the foregoing instrument and (he/she) acknowledged said instrument by (him/her) executed to be (his/her) free act and deed.

Notary Public: ________________________________

My Comm. Expires: ________________________________

Exhibit A

Legal Property Description

PARCEL B

That certain tract or parcel of land with all buildings and improvements thereon situated on the northerly side of Adelaide Avenue in the City of Providence, County of Providence, and State of Rhode Island as herein bounded and described;

Beginning at the most southeasterly corner of the herein described parcel, said corner being located south 67° 27'49" west a distance of four hundred seventy four and 72/100 (474.72') feet from the intersection of the northerly street line of Adelaide Avenue with the easterly street line of Downing Street as measured along the northerly street line of said Adelaide Avenue;

Thence proceeding south 67° 27'49" west along the northerly street line of Adelaide Avenue a distance of three hundred forty eight and 85/100 (348.85') feet to the most southwesterly corner of the herein described parcel;

Thence proceeding north 22° 32' 11" west a distance of five hundred twenty three and 53/100 (523.53') feet to the most northwesterly corner of the herein described parcel;

Thence proceeding north 67° 27'49" east a distance of three hundred seventeen and 84/100 (317.84) feet to the most northeasterly corner of the herein described parcel, the last two (2) courses bounded westerly and northerly by Parcel C;

Thence proceeding south 22° 32' 11" east a distance of one hundred seventy six and 57/100 (176.57') feet to a point;

Thence proceeding south 54° 32'43" east a distance of fifty eight and 49/100 (58.49') feet to a point;

Thence proceeding south 22° 32' 11" east a distance of two hundred ninety seven and 36/100 (297.36') feet to the point and place of beginning, the last three (3) courses bounded easterly, northeasterly and easterly by Parcel A;

Said parcel contains 176,390 square feet or 4.0 acres more or less.

Meaning and intending to show and describe and hereby describing Parcel B as shown on that certain plan entitled "ADMINISTRATIVE SUBDIVISION PLAN OF A.P. 51, LOTS 8, 170 & 171 FORMER GORHAM MANUFACTURING SITE SITUATED ON ADELAIDE AVENUE PROVIDENCE, RHODE ISLAND GORHAM MILLS PREPARED FOR: Churchill & Banks Ltd.", dated May 14,2001 Prepared by Garofalo & Associates, Inc., Job No. 5687 Drawing No. 5687-ADMIN-SUBDVN.DWG.

churchil/gorham/memorandum of ground lease

PROVIDENCE, RI
RECEIVED FOR RECORD
2001 DEC -4 P 2:06
BARBARA A. TRONCY
ACTING RECORDER OF DEEDS

Barbara A. Troncy

Exhibit B

Soil Management Plan

SOIL MANAGEMENT PLAN

Former Gorham Manufacturing Facility – Parcel B
333 Adelaide Avenue
Providence, Rhode Island

Plat 51, Lot 323

B.1. PURPOSE

The purpose of this Soil Management Plan (SMP) is to develop a strategy for managing impacted soil encountered during soil disturbance activities, if any, for the Parcel B area at the Former Gorham Manufacturing site, located at 333 Adelaide Avenue in the City of Providence, Rhode Island. It is important that all personnel responsible for working with soil on the site (including equipment operators) are familiar with this SMP.

The goal of this SMP is to ensure that all disturbed soil at the site is managed properly and handled in a safe manner.

B.2 SITE DESCRIPTION AND BACKGROUND

The former Gorham Manufacturing facility was once the country's largest producer of silverware, and was also renowned for its statues, memorials, and architectural bronze work. The facility at the Site reportedly began operations in 1890. Site activities included milling, forging, heat treating, plating, lacquering, polishing, and degreasing. Gorham Manufacturing operated at the Site until 1967, at which time the facility was purchased by Textron. Operations ceased at the facility in 1986, and the facility was demolished in 2001. The current retail operations to the east of Parcel B began in 2002.

Parcel B of the former Gorham Manufacturing facility is proposed to be developed as a municipal school. To the east of the Site is the Parcel A area of the former Gorham Manufacturing facility, which is currently developed with a commercial retail facility and associated fueling station and parking area. To the west of the Site is the Parcel C portion of the former Gorham Manufacturing facility, which is proposed to be developed as a YMCA facility. Mashapaug Pond is located to the north of the Site (approximately 120 ft to the north), and Adelaide Avenue and its associated residences are located to the south. The Providence Water Supply Board provides potable water for the residences along Adelaide Avenue and the adjacent retail complex. No public water supplies are located within 1 mi of the Site.

Multiple environmental investigations and some remedial actions have been conducted at the former Gorham Manufacturing site. These investigations and remedial actions include activities conducted both prior to and following the demolition of the former buildings and subdivision of the Site into separate parcels. The most recent site investigations for Parcel B were completed in 2005 by EA Engineering, Science, and Technology, Inc. (EA) on behalf of the City.

The conclusions of the 2005 Site Investigation were:

- Groundwater is not a media of concern at the Site
- Polycyclic aromatic hydrocarbons (PAHs) in surficial soil at the site and volatile organic compounds (VOCs) in soil vapor are compounds of concern at the Site
- The proposed remedial action for the Site includes: 1) construction of an engineered cap and instituting an Environmental Land Usage Restriction (ELUR) to eliminate the potential for direct exposure to contaminated soil by Site users; and 2) the installation of an active, sub-slab venting system to remove potentially harmful soil vapors from beneath the future school building slab, thereby eliminating the potential for such vapors to enter into the future school building via subsurface infiltration

RIDEM issued a Remedial Decision Letter, dated 7 April 2006, to the City that conceptually concurred with the proposed remedial alternative (engineered cap and sub-slab venting system) for the Site.

B.3 GOAL

The goal of this SMP is to ensure that all impacted soil excavated, temporarily stockpiled, graded, or moved during future soil disturbance activities is managed properly and handled in a safe manner.

This SMP will be included as an attachment to the final ELUR for the site. Any future intrusive activities conducted at the site will be subject to the procedures contained in the ELUR and this SMP.

B.4 HEALTH AND SAFETY

Direct contact with any impacted material during implementation of the intrusive activities will be minimized with the use of Level D personal protective equipment (PPE), as appropriate, including gloves, steel toe boots, long sleeve shirts, and safety glasses. Best soil management practices will be employed at all times. Dust control measures will also be kept in place to prevent any impacted soil from becoming airborne. The existing Safety, Health, and Emergency Response Plan (SHERP) prepared by EA on behalf of the City and included in Appendix B of the April 2006 Remedial Action Work Plan will be reviewed and updated as needed prior to implementation of new site development activities.

B.5 FUTURE DEVELOPMENT/SOIL DISTURBANCE ACTIVITIES

During future site development or soil disturbance activities, if any, at the Parcel B site, soils that are excavated during utility trenching, site grading activities, or any other construction-related activity will be physically observed for signs of potential contamination including staining, odors, sheens, etc. In the event that potentially impacted soils are encountered, they will be segregated and field screened via visual/olfactory methods and/or a Photoionization Detector (PID). If field screening indicates that the soil may be contaminated, analytical testing which may include VOCs, PAHs, or other compounds of concern will be conducted to determine if the material is suitable to be used on-site. Excavated materials deemed to be suitable fill based on visual/olfactory and PID screening will be used as backfill according to the protocols established by the excavation subcontractor. Excavated material that is determined to be potentially contaminated based on field screening results will be drummed or temporarily stockpiled on appropriate polyethylene sheeting, sampled, and covered in a secured area while awaiting laboratory results. The temporary secured area will be created to prohibit access to the stockpile by users of the site, and may include temporary fencing or other engineered controls.

Unsuitable soils that are to be disposed of off-site will be done so at a licensed facility in accordance with all local, state, and federal laws. Copies of the material shipping records associated with the disposal of the material shall be maintained by the City of Providence and included in the annual inspection report for the site.

B.6 ENGINEERED CAP

The designed engineered cap components at the Site consists of the following layers:

- Closure cap subgrade
- Geosynthetic fabric filter layer (for landscaped areas only)
- Protective cover soil
- Vegetative cover
- Site improvements.

A closure cap subgrade will be prepared from the existing site grade that will create adequate stormwater drainage for the Site, and serve as a suitable base for the components of the closure cap system.

A geosynthetic fabric filter layer (ProPex 4510 or equivalent) will be placed above the closure cap subgrade and below a protective soil cover for all landscaped areas of the site to prevent human exposure to impacted soil. Geosynthetic fabric filter materials are currently the standard of practice in landfill cap systems and are recommended by most designers and the regulatory community. The fabric filter will be installed so that the seams overlap to prevent the underlying impacted soil from mixing with the clean soil.

The protective cover soil layer of the closure cap system, also commonly termed the vegetative support soil layer, will consist of a minimum of 2 ft of certified clean fill material or equivalent in all areas of the site, and a minimum of 2 ft of clean soil in all areas known or suspected to be subject to the RIDEM Rules and Regulations for Composting Facilities and Solid Waste Management Facilities (Solid Waste Regulations), and under the jurisdiction of RIDEM's Solid Waste Program. This layer is designed to provide for root growth while buffering the underlying layers from damage due to the effects of frost penetration, root penetration, and loading of the finished surface of the landfill closure cap. The upper 6 in. of this soil layer will be specified as an organic topsoil having characteristics to promote adequate vegetation, stability, and erosion resistance in the landscaped areas of the Site.

The vegetative cover component will be specified to be a locally adapted perennial plant mix that is suitable for the Rhode Island area climate. The species will be capable of surviving in a low nutrient soil with little or no requirements for nutrient addition. Root penetration into the soil should be less than the minimum thickness of the soil cover layer so as not to affect the drainage media or geosynthetic material beneath.

The proposed Parcel B development will include extensive non-landscaped areas containing the proposed school structure, paved roadways, paved walkways, and paved parking areas. The engineered cap design proposed for asphalted areas will include a minimum of 6 in. of appropriate base coarse fill material covered with a minimum of 4 in. of bituminous asphalt. The engineered cap design proposed for concrete pavement areas will include a minimum of 4 in. of poured concrete over a minimum of 6 in. of appropriate base coarse material. An active sub-slab venting system, consisting of a network of suction fans, piping, and suction pits designed to create a negative pressure beneath the school, will be installed beneath the building structure. The components of the sub-slab venting system and the school's concrete slab foundation will cap the area beneath the school.

During all future operations on the site, the integrity of the existing engineered cap will be maintained. Operations that require the temporary removal or alteration of the cap may be permissible subject to Rhode Island Department of Environmental Management approval of a work plan. This work plan must include a description of the anticipated site activity, including the volume of soil to be excavated, anticipated contaminants of concern, a site figure identifying the proposed area to be excavated or disturbed, the expected duration of the project, and the proposed disposal location for excavated soil. This work plan must be submitted to RIDEM no later than 60 days prior to the proposed initiation of these activities. RIDEM will determine if the submittal of a Closure Report for these activities will be required, as well as if Public Notice is required prior to the initiation of soil disturbance. RIDEM will be subsequently notified, following the approval of the work plan, at least 2 days prior to the initiation of soil disturbance activities. If these operations are performed in areas where the existing cap exists, the cap must be replaced within 14 days unless otherwise approved.

Any operations that may require contact with capped, impacted soil, such as utility trenching, must follow the same procedures listed above, including those detailed in the SHERP. If the cap is disturbed, it must be replaced with the appropriate layer of clean fill, asphalt, concrete, and/or geotextile fabric within 14 days unless otherwise approved. Any impacted soil below the cap must be handled properly and the use of Level D PPE would be required.

B.7 SITE SECURITY

The site is completely secured with fences, which will be locked during off-work hours. During site development/school construction activities, all areas will remain securely fenced to prevent trespassers from coming onto the site. After site development/school construction activities are complete, a fencing barrier prohibiting access to the Park Parcel will remain in the vicinity of the northern property boundary of Parcel B.

Appendix D

Proposed State of Connecticut Remediation Standard Regulations Volatilization Criteria

Proposed
Revisions

Connecticut's
Remediation Standard Regulations
Volatilization Criteria

March 2003

Permitting, Enforcement and Remediation Division
Bureau of Water Management
Connecticut Department of Environmental Protection

Comments regarding this document may be sent to:

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before
June 30, 2003

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INTRODUCTION

The volatilization criteria were developed to identify situations where contaminants in groundwater and soil vapor volatilize, travel into an overlying building and result in the potential risk to human health from the inhalation of the contaminants by occupants of the building. Since the development and adoption of the volatilization criteria in the Remediation Standard Regulations (RSRs) in 1996, the Department of Environmental Protection (DEP), the Department of Public Health (DPH), the U.S. Environmental Protection Agency (USEPA), other state agencies and researchers across the country have collected additional laboratory and field information regarding the volatilization of contaminants. This work has resulted in a better understanding of the vapor migration pathway and the associated risk to public health posed by volatile organic compounds present in the subsurface. Consequently, DEP, with the assistance and input of DPH, is proposing revisions to the volatilization criteria. This document describes the basis for the proposed criteria, as well as the basis for the original criteria issued in 1996 for comparison.

The proposed revisions reflect new toxicological information, a revised transport model and additional information and understanding of this potential pathway of exposure that have all become available since the RSRs were formally adopted in 1996. The proposed revised target indoor air concentrations, groundwater volatilization criteria and soil vapor volatilization criteria are presented in Tables 1, 2 and 3, respectively.

The CTDEP is proposing revisions to the volatilization criteria at this time as part of the Department's application to the USEPA for authorization of the RCRA Corrective Action Program. These proposed changes make Connecticut's criteria more consistent with the EPA Draft Guidance "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soil" that was issued in November 2002.

BASIS FOR DEVELOPMENT OF ORIGINAL VOALTLIZATION CRITERIA

The numerical volatilization criteria adopted in 1996 are listed in Appendices E and F of the RSRs and also in Tables C1, C2 and C3 in Appendix C of this document. These numerical criteria were developed using the transport model presented in ASTM ES 38-94 "Emergency Standard Guide for Risk Based Corrective Action Applied at Petroleum Release Sites" and toxicity information that was available in 1995.

Original Transport Model

The original transport model presented in the ASTM ES 38-94 was based on a model developed by Johnson and Ettinger and utilized a simplified approach for simulating the transport of volatiles from groundwater, through the soil media and building foundations, and into building structures as airborne contaminants. That model was based on the assumption that diffusion is the sole method of transport from subsurface contamination into the indoor air environment. Diffusion is the process resulting from random motion of molecules by which there is a net flow of matter from a region of high concentration to a region of low concentration. Equations used to develop the original volatilization criteria are shown in Appendix G of the RSRs and in Tables X2.1, X2.2, and X2.3 of ASTM ES 38-94.

The original transport model required the input of a variety of parameters to define the subsurface conditions, the building foundation and the interior environment of the building. Since these parameters are widely variable depending on site-specific conditions, default values were developed. Default values for the various parameters used in the model are presented in Appendix G of the RSRs and are the default values recommended in Tables X2.4 and X2.5 of ASTM ES 38-94. In general, these input parameters describe a conservative scenario in an effort to best protect human health and the environment in the generic or broad application of these criteria.

Original Target Indoor Air Concentrations

The volatilization criteria were developed by calculating a target indoor air concentration (TAC) for each chemical using risk assessment algorithms and toxicity values recommended by USEPA in 1995 and exposure assumptions recommended in ASTM ES 39-94. Background concentrations for certain chemicals were also taken into consideration when establishing the TACs. The background concentrations were described in Table 4 of ASTM ES 38-94 and in Table 3-1 of Massachusetts DEP's "Background Documentation for the Development of the MCP Numerical Standards". For some chemicals, the background concentrations were greater than the calculated risk-based concentrations. For these chemicals, the TACs were set at the background concentrations.

Ceiling Value for Groundwater Volatilization Criteria

A ceiling value of 50,000 micrograms per liter ("µg/L") was applied to all of the groundwater volatilization criteria for which the risked-based criteria were greater than 50,000 µg/L. The purpose of the ceiling value was to prevent gross contamination from being overlooked and to ensure that remediation in accordance with these criteria would address potential odor problems.

Quantification Limits

In general, if the risk-based criteria for a contaminant in soil, groundwater or soil vapor was a concentration lower than that which could be reasonably quantified, the RSR criteria was adjusted upward to a level that could be quantified by laboratories in Connecticut. In 1996, the soil vapor volatilization criteria were adjusted such that any risk-based soil vapor volatilization criteria that was determined to be less than one part per million ("ppm") was adjusted up to 1 ppm.

PROPOSED REVISIONS TO THE VOLATILIZATION CRITERIA

The proposed volatilization criteria are based on:

1) The Johnson and Ettinger (1991) model, incorporating its extensions developed in 1998 and 1999 (Johnson et al. 1998 and Johnson et al. 1999),
2) New toxicity information,
3) New exposure assumptions,
4) Ceiling values for target indoor air concentrations, and
5) Updated quantification limits.

Proposed revised target indoor air concentrations, groundwater volatilization criteria and soil vapor volatilization criteria are shown in Tables 1, 2 and 3 of this document.

Revised Transport Model

The revised Johnson and Ettinger model incorporates both diffusion and advection as the mechanisms of transport of subsurface contamination into the indoor air environment. While diffusion is a passive process, advection is an active process brought about by pressure gradients. Gases will move from areas of high pressure to areas of low pressure. Buildings, particularly under wintertime conditions, are depressurized due to warmed air constantly rising towards the roof. This allows influx of air from the soil gas, which follows the pressure gradient from soil gas into the basement. The greater the depressurization of the building, the greater the zone of influence will be. The zone of influence is the depth from which soil gas can be drawn into the building.

Since the revised model incorporates both diffusion and advection as transport mechanisms, the total amount of transport is greater than that calculated using the original model. Sampling at sites in Connecticut show that the original model under-predicted indoor air concentrations based on groundwater and soil vapor sample results. Therefore, the revised model provides a more accurate and realistic representation of volatile transport. USEPA is also currently using the revised Johnson and Ettinger model to develop their "Guidance for Evaluating the Vapor Intrusion into Indoor Air". In addition, many states including Massachusetts, Michigan, Pennsylvania, Virginia, West Virginia and California are also using this model to develop criteria for this exposure pathway. Appendix A describes the revised model in detail.

The default input values used in the revised model are the same as those used in the 1996 model with one exception, Q_{soil}/Q_B. Q_{soil}/Q_B is the ratio of soil gas intrusion rate to building ventilation rate and was not part of the original model. The default input value used for Q_{soil}/Q_B is taken from USEPA's "Guidance for Evaluating the Vapor Intrusion into Indoor Air". All variables used in the revised model are listed and defined in Tables A1 and A2. Table A3 shows the typical values or range of values for these parameters as well as the default values used to calculate the proposed volatilization criteria.

Revised and Updated Target Indoor Air Concentrations

The target indoor air concentrations (TACs) were again derived by CT DPH for each chemical using risk-based calculations recommended by USEPA, the chemical-specific reference concentrations (RfCs) and cancer unit risks currently available. Appendix B presents these risk-based equations. The following issues were addressed in the TAC revisions:

1) Updated toxicity values,
2) Revised exposure assumptions for industrial/commercial settings,
3) Increased exposure and susceptibility for children for residential settings,
4) Updated background concentrations, and
5) Ceiling value for TACs.

Toxicity Values

All of the toxicity values have been reviewed and revised to reflect up-to-date toxicity values. The most significant changes are the toxicity values for several chlorinated hydrocarbons including 1,1-dichloroethylene ("DCE"), trichloroethylene ("TCE"), and vinyl chloride. 1,1-Dichloroethylene is no longer regulated as a low dose linear carcinogen; although, there remains considerable uncertainty regarding its potential carcinogenicity, which is reflected in the new TAC. The net result of this is an increase in the 1,1-DCE TAC by 200 fold over the former value. The evidence for the carcinogenicity of trichloroethylene in humans has become strengthened with an associated increase in USEPA's estimate of its cancer potency (Cogliano, et al., 2001). This change would have led to a considerable lowering of the TCE TAC, if not for the fact that TCE is a background indoor air contaminant. Setting the TAC for TCE at its background concentration leads to a 5 fold lowering of the TAC, relative to the 1996 value. USEPA's carcinogenicity reassessment of vinyl chloride has led to a decrease in its potency estimate by 10 fold, leading to a commensurate increase in the TAC for vinyl chloride.

While USEPA's Integrated Risk Information System (IRIS) database was relied upon as the primary source of toxicity values, other federal and state risk assessment databases (USEPA's Health Effects Assessment Summary Tables – HEAST, ATSDR's Chronic Minimum Risk Levels – MRLs, California EPA's Chronic RELs) were reviewed to determine the consistency of toxicity values across agencies. These other data sources were used in derivation of TACs in cases where USEPA did not have a value listed on IRIS. Appendix B presents all of the new toxicity values and how they were used in deriving TACs for both residential and industrial/commercial scenarios.

Exposure Assumptions

Exposure assumptions for the residential scenario have not changed: 30 year residence at the affected location, daily exposure for 350 days/year, with an inhalation rate of 20 m^3/day for a 70 kg adult. The exposure assumptions for the industrial/commercial scenario are revised to better reflect likely workplace exposures. The inhalation rate per day has been reduced by one half to 10 m^3/day to reflect a shorter exposure time in the industrial/commercial exposure scenario. The other exposure assumptions for this scenario have not changed (25 years exposure, 250 days/year, 70 kg body weight).

Increased Exposure and Susceptibility of Children to Carcinogens

Increased exposure and susceptibility of children in a residential scenario to carcinogens was taken into consideration during these revisions. The residential scenario involves young children, which is a receptor group that is likely to be at elevated risk relative to adults due to several factors: 1) their greater respiratory rate per body weight and lung surface area (Child-Specific Exposure Factors Handbook, USEPA, 2000; Thurlbeck, 1982); and 2) due to the likelihood that they have increased sensitivity to carcinogens (Ginsberg, 2003; USEPA, 2003; USEPA, 2000). TACs based on adult exposure parameters and sensitivity may not be adequately protective of children.

The first factor, children's increased inhalation rate, is the basis for a 2-fold adjustment of the TAC to ensure protection of children.

The second factor, increased sensitivity to carcinogens, was the rationale for an additional 2-fold adjustment factor, but in this case it is applied only for genotoxic carcinogens. Juvenile animal studies indicate that even very brief exposures in early life can lead to substantial cancer risk (Vessinovitch, 1979; Toth, 1968). However, the standard rodent cancer bioassay upon which unit risks are derived starts dosing after this period of development. For these reasons, the development of TACs for the residential scenario incorporates a children's carcinogen sensitivity factor. This factor is applied to genotoxicants, a type of carcinogen whose effects in early life are most clearly documented at the present time. The adjustment factor is 2 fold based upon the vinyl chloride example on IRIS (USEPA, 2000). The underlying principle is that the risk from short-term early life exposure can be equal to the risk stemming from much longer exposure beginning later in life, and that risks must be additive across these age groups (Ginsberg, 2003). This approach is consistent with USEPA's IRIS file for vinyl chloride and draft Cancer Risk Assessment Guidelines (USEPA, 2000; USEPA, 2003).

Background Concentrations in Indoor Air

Since 1996, there has been an increased focus around the United States on measuring indoor air quality in impacted and non-impacted (or "background") homes, offices, schools and other environments. This had led to an enhanced database for background indoor air data (Foster, et al., 2002; Kurtz and Folkes, 2002; NYSDOH, 1997; Clayton, et al., 1999; Shields, et al., 1996; USEPA/BASE Study, 1999). These datasets, along with the pre-existing indoor air datasets (Stolwick, 1990; Vermont DOH, 1992; Brown, et al., 1994; Daisey, et al., 1994; Sheldon, et al., 1992; Shah and Singh, 1988) have been reviewed while giving particular attention to those volatile oraganic compounds (VOCs) (typically carcinogens) with risk-based TACs that approach or are below what can be considered background. VOC indoor air measurements are typically lognormally distributed; therefore, the central tendency background concentration (the median) was chosen to represent background. While higher concentrations may be found in certain background locations, the central tendency was used because of the way it would be applied: 1) to replace a risk-based TAC such that the background concentration would already be above a risk target; and 2) to back-calculate the allowable contribution from subsurface VOC contamination, such that the amount that is from background sources plus the amount allowed from subsurface sources would still be within the range of the background data distribution.

VOC background concentrations and how they are used in the derivation of TACs are shown chemical-by-chemical in Appendix B.

TAC Ceiling Value

A ceiling value of 500 ug/m^3 was applied to both the residential and industrial/commercial scenarios for those VOCs with risk-based TACs exceeding this ceiling value. This ceiling value was derived as an upper bound concentration that signals the presence of an unusual indoor air source for an individual VOC. It is prudent to keep the concentration of individual VOCs below this level to avoid odor complaints, degraded air quality, or non-specific health complaints. VOC odor thresholds were separately considered but only in isolated cases where the odor threshold is the key factor in setting a TAC. Appendix B provides a detailed discussion of this topic.

Current Quantification Limits

Based on the use of current analytical methods, concentrations in soil vapor can be reliably quantified at a level significantly lower than 1ppm. Therefore, the soil vapor volatilization criteria were adjusted such that any risk-based soil vapor volatilization criteria that are determined to be less than 0.5 ppb, are adjusted up to 0.5 ppb. The only criteria adjusted up to 0.5 ppb, is the residential soil vapor volatilization criteria for ethylene dibromide (EDB).

Criteria for New Chemicals

Since 1996, the DEP has approved volatilization criteria for a number of compounds for which criteria had not been established in the original regulations. Based on all of the requests for additional criteria for additional chemicals submitted since 1996, the following compounds have been added to the list of volatilization criteria: trichlorofluoromethane, chloroethane, chloromethane, dichlorodiflouromethane, isopropylbenzene (cumene), cis-1,2-dichloroethene, trans-1,2-dichloroethene, bromodichloromethane, n-butylbenzene, sec-butylbenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene and 4-isopropyltoluene (4-cymene).

APPLICATION OF THE VOLATILIZATION CRITERIA

Under the current regulations, the groundwater volatilization criteria are applicable to "all ground water polluted with a volatile organic substance within 15 feet of the ground surface or a building". However, research since 1996 has demonstrated that volatiles in groundwater at depths much deeper than 15 feet have been the source of vapor intrusion into overlying structures at concentrations that pose a risk to public health. The USEPA in their "Guidance for Evaluating the Vapor Intrusion into Indoor Air" is recommending applying criteria up to buildings up to 100 feet from the contamination source. Other states including Michigan and Pennsylvania require that volatilization issues be addressed when polluted ground water is within 30 feet of the surface. After evaluating geology and hydrogeology in Connecticut, DEP is proposing that the volatilization criteria should be applied to groundwater within 30 feet of the ground surface or a building.

The RSRs adopted in 1996 provide baseline numeric criteria that can be used to demonstrate compliance or that can be used as a screening level. The regulations also provide the option of developing a site-specific criteria by calculating an attenuation factor using input parameters that are appropriate for the circumstances at a specific site. The site-specific option will also be retained in the proposed revisions to the regulations. However, the revised Johnson and Ettinger model should be used for such calculations. Further, the option to take measures that would prevent the migration of volatiles into indoor air rather than remediate the ground water and the option to record a land use restriction that would prohibit the construction of a building over ground water polluted by VOCs will be retained in the revised regulations.

SUMMARY

DEP is proposing to revise the volatilization criteria to better protect human health and to remain consistent with federal programs. The revisions proposed in this document are in keeping with the following objectives:

- The proposed revised volatilization criteria are similar to those used by USEPA and other states.
- The revised transport model more accurately predicts indoor air concentrations.
- The toxicity information has been updated to current toxicity values.
- The exposure assumptions have been refined to be both protective and realistic.
- The depth to groundwater to which these criteria should be applied has been increased to 30 feet based on new research that demonstrates indoor exposures resulting from the migration of volatiles from a ground water source significantly deeper than 15 feet.

A comparison of 1996 TACs and volatilization criteria to proposed revised TACs and volatilization criteria is presented in the three tables in Appendix C.

DEP is seeking comments from the public on these revisions before proposing revised regulations in July 2003. Please send you comments to:

Ruth Lepley Parks
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79 Elm Street
Hartford, Ct 06106

before
June 30, 2003

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Table 1

Proposed Target Indoor Air Concentrations

Compound	CAS Number	Residential TAC (ug/m^3)	Industrial/Commercial TAC (ug/m^3)
Acetone	67641	180	500[1]
Acrylonitrile	107131	NA	NA
Benzene	71432	3.3[2]	3.3[2]
Bromoform	75252	0.55	7.3
2-Butanone (MEK)	78933	500[1]	500[1]
Carbon tetrachloride	56235	0.5[2]	0.54)
Chlorobenzene	108907	37	200
Chloroform	67663	0.5[2]	0.5[2]
Dibromochloromethane	124481	NA	NA
1,2-Dichlorobenzene	95501	73	410
1,3-Dichlorobenzene	541731	73	410
1,4-Dichlorobenzene	106467	24	24
1,1-Dichloroethane	75343	77	430
1,2-Dichloroethane	107062	0.07	0.31
1,1-Dichloroethylene	75354	10	20
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	See **New Criteria** below
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	See **New Criteria** below
1,2-Dichloropropane	78875	0.13	0.42
1,3-Dichloropropene	542756	0.21	2.9
Ethyl benzene	100414	53	290
Ethylene dibromide (EDB)	106934	0.0028	0.038
Methyl-tert-butyl-ether	1634044	160	190[3]
Methyl isobutyl ketone	108101	37	200
Methylene chloride	75092	3[2]	17
Styrene	100425	52	290

Table 1
(Continued)

Proposed Target Indoor Air Concentrations

Compound	CAS Number	Residential TAC (ug/m³)	Industrial/Commercial TAC (ug/m³)
1,1,1,2-Tetrachloroethane	630206	0.082	1.1
1,1,2,2-Tetrachloroethane	79345	0.011	0.14
Tetrachloroethylene	127184	5(2)	5(2)
Toluene	108883	210	500(1)
1,1,1 Trichloroethane	71556	500	500(1)
1,1,2-Trichloroethane	79005	2.2	12
Trichloroethylene	79016	1(2)	1(2)
Vinyl chloride	75014	0.14	1.9
Xylenes	1330207	220	500(1)
New Criteria			
Trichlorofluoromethane	75694	370	500(1)
Chloroethane	75003	500(1)	500(1)
Chloromethane	74873	14	80
Dichlorodiflouromethane	75718	91	500(1)
Isopropylbenzene (Cumene)	98828	120(3)	120(3)
cis-1,2-dichloroethene	156592	18	100
trans-1,2-dichloroethene	156605	37	200
Bromodichloromethane	75274	0.034	0.46
N-butylbenzene	104518	73	410
Sec-butylbenzene	135988	73	410
1,2,4-trimethylbenzene	95636	9.3	52
1,3,5-trimethylbenzene	108678	9.3	52
4-isopropyltoluene (4-cymene)	99876	67	370

(1) Based on a ceiling value. (2) Based on a background concentration.
(3) Based on an odor threshold concentration.

Table 2

Proposed Ground Water Volatilization Criteria

Compound	CAS Number	Residential GWVC (ug/L)	Industrial/Commercial GWVC (ug/L)
Acetone	67641	50000	50000
Acrylonitrile	107131	NA	NA
Benzene	71432	130	310
Bromoform	75252	75	2300
2-Butanone (MEK)	78933	50000	50000
Carbon tetrachloride	56235	5.3	14
Chlorobenzene	108907	1800	23000
Chloroform	67663	26	62
Dibromochloromethane	124481	NA	NA
1,2-Dichlorobenzene	95501	5100	50000
1,3-Dichlorobenzene	541731	4300	50000
1,4-Dichlorobenzene	106467	1400	3400
1,1-Dichloroethane	75343	3000	41000
1,2-Dichloroethane	107062	6.5	68
1,1-Dichloroethylene	75354	190	920
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	See **New Criteria** below
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	See **New Criteria** below
1,2-Dichloropropane	78875	7.4	58
1,3-Dichloropropene	542756	11	360
Ethyl benzene	100414	2700	36000
Ethylene dibromide (EDB)	106934	0.3	11
Methyl-tert-butyl-ether	1634044	21000	50000
Methyl isobutyl ketone	108101	13000	50000
Methylene chloride	75092	160	2200
Styrene	100425	3100	42000

Table 2
(Continued)

Proposed Ground Water Volatilization Criteria

Compound	CAS Number	Residential GWVC (ug/L)	Industrial/Commercial GWVC (ug/L)
1,1,1,2-Tetrachloroethane	630206	2	64
1,1,2,2-Tetrachloroethane	79345	1.8	54
Tetrachloroethylene	127184	340	810
Toluene	108883	7100	41000
1,1,1 Trichloroethane	71556	6500	16000
1,1,2-Trichloroethane	79005	220	2900
Trichloroethylene	79016	27	67
Vinyl chloride	75014	1.6	52
Xylenes	1330207	8700	48000
New Criteria			
Trichlorofluoromethane	75694	1300	4200
Chloroethane	75003	12000	29000
Chloromethane	74873	390	5500
Dichlorodiflouromethane	75718	93	1200
Isopropylbenzene (Cumene)	98828	2800	6800
Cis-1,2-dichloroethene	156592	830	11000
trans-1,2-dichloroethene	156605	1000	13000
Bromodichloromethane	75274	2.3	73
N-butylbenzene	104518	1500	21000
Sec-butylbenzene	135988	1500	20000
1,2,4-trimethylbenzene	95636	360	4800
1,3,5-trimethylbenzene	108678	280	3900
4-isopropyltoluene (4-cymene)	99876	1600	22000

Table 3

Proposed Soil Vapor Volatilization Criteria

Compound	CAS Number	Residential SVVC (ppm)	Industrial/Commercial SVVC (ppm)
Acetone	67641	57	290
Acrylonitrile	107131	NA	NA
Benzene	71432	0.78	1.4
Bromoform	75252	0.04	0.98
2-Butanone (MEK)	78933	130	230
Carbon tetrachloride	56235	0.06	0.12
Chlorobenzene	108907	6.1	60
Chloroform	67663	0.078	0.14
Dibromochloromethane	124481	NA	NA
1,2-Dichlorobenzene	95501	9.2	95
1,3-Dichlorobenzene	541731	9.2	95
1,4-Dichlorobenzene	106467	3	5.5
1,1-Dichloroethane	75343	14	150
1,2-Dichloroethane	107062	0.013	0.11
1,1-Dichloroethylene	75354	1.9	7
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	See **New Criteria** below
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	See **New Criteria** below
1,2-Dichloropropane	78875	0.021	0.13
1,3-Dichloropropene	542756	0.035	0.89
Ethyl benzene	100414	9.3	93
Ethylene dibromide (EDB)	106934	0.0005	0.007
Methyl-tert-butyl-ether	1634044	34	73
Methyl isobutyl ketone	108101	6.8	68
Methylene chloride	75092	0.65	6.8
Styrene	100425	9.3	95

Table 3
(Continued)

Proposed Soil Vapor Volatilization Criteria

Compound	CAS Number	Residential SVVC (ppm)	Industrial/Commercial SVVC (ppm)
1,1,1,2-Tetrachloroethane	630206	0.009	0.22
1,1,2,2-Tetrachloroethane	79345	0.0012	0.028
Tetrachloroethylene	127184	0.56	1
Toluene	108883	42	180
1,1,1 Trichloroethane	71556	70	130
1,1,2-Trichloroethane	79005	0.31	3.1
Trichloroethylene	79016	0.14	0.26
Vinyl chloride	75014	0.041	1
Xylenes	1330207	38	160
New Criteria			
Trichlorofluoromethane	75694	50	120
Chloroethane	75003	140	260
Chloromethane	74873	5.1	53
Dichlorodiflouromethane	75718	14	140
Isopropylbenzene (Cumene)	98828	19	34
Cis-1,2-dichloroethene	156592	3.4	35
trans-1,2-dichloroethene	156605	7.1	70
Bromodichloromethane	75274	0.0038	0.095
N-butylbenzene	104518	10	100
Sec-butylbenzene	135988	10	100
1,2,4-trimethylbenzene	95636	1.4	15
1,3,5-trimethylbenzene	108678	1.4	15
4-isopropyltoluene (4-cymene)	99876	9.3	94

Appendix A

Johnson and Ettinger Model

APPENDIX A

JOHNSON AND ETTINGER MODEL

The revised Johnson and Ettinger model incorporates both diffusion and advection as mechanisms of transport of subsurface contamination into indoor air environment. Diffusion is the mechanism by which vapor moves from a region of higher concentration to a region of lower concentration. Diffusion is typically the vertical component of transport in this model. Advection is the transport mechanism by which vapor moves to a region where there is a difference in pressure, temperature or other factor. This Johnson and Ettinger model is the most widely used vapor transport model across the United States.

The Johnson and Ettinger model uses the conservation of mass principle and makes the following assumptions:

- Steady state conditions exist
- An infinite source of contamination exists
- The subsurface is homogeneous
- Air mixing in the building is uniform
- Preferential pathways do not exist
- Biodegradation (or any other transformation process) does not occur
- Contaminants are homogeneously distributed
- Contaminant vapors enter a building primarily through cracks and other openings in the foundation and walls
- Ventilation rates and pressure differences are assumed to remain constant

The output of the Johnson and Ettinger model is the dimensionless attenuation factor (α) that represents the ratio of the indoor air concentration to the vapor concentration at a subsurface source. Using the attenuation factor and the recommended target indoor air concentrations, allowable soil vapor and ground water concentrations were back calculated. These concentrations are the recommended volatilization criteria. The Connecticut Department of Public Health recommended appropriate target indoor air concentrations for residential and industrial/commercial scenarios.

- For ground water volatilization criteria:

  GWVC (ug/L) = Target Indoor Air Concentration (μg/m^3) / (1000 L/m^3 x α x H)

  where H = Henry's Law Constant (unitless)

- For soil vapor volatlization criteria:

  SVVC (mg/m^3) = Target Indoor Air Concentration (μg/m^3) / (1000 μg/mg x α)

  SVVC (ppm) = SVVC (mg/m^3) x 24.45 / Molecular Weight

  where 24.45 = molar volume in liters at 760 torr barometric pressure at 25 ° C

The Johnson and Ettinger model calculates the attenuation factor as follows:

Attenuation Factor for Diffusion and Advection –

$$\alpha = (A \times e^{B}) / [e^{B} + A + (A/C)(e^{B}-1)]$$

where:

$A = (D^{eff}_{T} A_{B}) / (Q_{B}L_{T})$ ***or*** $(D^{eff}_{T}) / (E_{B}(V_{B}/A_{B})L_{T})$

$B = (Q_{soil}L_{crack}) / (D^{eff}_{crack}\eta A_{B})$ ***or*** $[(Q_{soil}/Q_{b})E_{B}(V_{B}/A_{B})L_{crack}] / [D^{eff}_{crack}\eta]$

$C = Q_{soil}/Q_{B}$

where:

$D^{eff}_{T} = L_{T} / [(L_{vadose}/D^{eff}_{vadose}) + (L_{cap}/D^{eff}_{cap})$

$D^{eff}_{crack} = D^{air}(\theta_{V\text{-}crack}{}^{3.33}/\theta_{T\text{-}crack}{}^{2}) + (D^{water}/H)(\theta_{m\text{-}crack}{}^{3.33}/\theta_{T\text{-}crack}{}^{2})$

where:

$D^{eff}_{vadose} = D^{air}(\theta_{V\text{-}vadose}{}^{3.33}/\theta_{T\text{-}vadose}{}^{2}) + (D^{water}/H)(\theta_{m\text{-}vadose}{}^{3.33}/\theta_{T\text{-}vadose}{}^{2})$

$D^{eff}_{cap} = D^{air}(\theta_{V\text{-}cap}{}^{3.33}/\theta_{T\text{-}cap}{}^{2}) + (D^{water}/H)(\theta_{m\text{-}cap}{}^{3.33}/\theta_{T\text{-}cap}{}^{2})$

The input values for these equations are defined in Tables A1 and A2 of this Appendix. Conservative default values for each input variable were used to calculate the generic volatilization criteria listed in Tables 2 and 3. The acceptable ranges for these default values are presented in Table A3 along with the default input values used by CTDEP to calculate the generic criteria. In addition, Table A4 presents molecular weights and Henry's Law Constants (H) used by CTDEP.

Basically the input values describe the vapor transport pathway including the

- subsurface soils and stratigraphy;
- foundation of the structure;
- interior environment of the structure; and
- transport properties of the contaminants.

The subsurface soils are assumed to be sand and the stratigraphy is assumed to be homogeneous. The default input values for the moisture content (θ_{m}) and vapor content (θ_{V}) of the soils in both the vadose zone and the capillary fringe were chosen to represent sandy soils in the subsurface. The thickness of the capillary fringe (L_{cap}) is also based on an estimated thickness of capillary fringe for a typical sand. The default input values used for the total depth (L_{T}) to groundwater and the total depth to a soil vapor sample are 3 meters and 1 meter, respectively.

The default values used to describe the foundation of the building are the thickness of the foundation (L_{crack}) assumed at 0.15 meters and the areal fraction of cracks in foundation (η) assumed at 0.01 (worst case value). Also, the soil properties of the soil in the cracks (θ_{m} and θ_{V}) are estimated based on a sand soil type. The default values used to describe the indoor environment are the enclosed space air exchange rate (E_B), the volume of the building divided by the area of the building (or just the height of the building) (V_B/A_B) and the ratio of soil gas intrusion rate to the building ventilation rate (Q_{soil}/Q_B). These values differ for the residential scenario and the industrial commercial scenario.

The default values used describe the transport properties of the contaminants are Henry's Law Constants (H) listed for specific chemical on Table A4, and the diffusion in water (D^{water}) and the diffusion in air (D^{air}). Though the diffusion rates can be chemical-specific, a general diffusion rates in air (8.64 x 10^{-5} M^2/d) and in water (7.26 x 10^{-1} M^2/d) were used for all of the chemicals.

All of the default input values used in this current model were also used in the original model with the exception of the ratio Q_{soil}/Q_B. This ratio was not part of the original model. The default input value used for Q_{soil}/Q_B is also the default value used in USEPA's "Guidance of revaluating the Vapor Intrusion into Indoor Air" dated November 2002. The default input values used in the original model remain unchanged. The default values are those recommended by ASTM 38-94 in Tables X2.4 and X2.5.

The article written by Johnson titled "Identification of Critical Parameters for the Johnson and Ettinger (1991) Vapor Intrusion Model" dated May 2002 provides additional information regarding the input values and the sensitivity of the final attenuation factor to various input values.

The attenuation factors used to calculate the proposed revised criteria are based on the default input values listed in Table A3 and the revised Johnson and Ettinger model. In general, the attenuation factors used to calculate the proposed revised criteria are greater than the attenuation factors used to calculate the original criteria in 1996. For the ground water scenario, the attenuation factor increased by a multiple of approximately 2.5, from about 8 x 10^{-5} to 2 x 10^{-4} for the residential scenario and from 3 x 10^{-5} to 7 x 10^{-5} for the industrial/commercial scenario. For the soil vapor scenario, the attenuation factor increased by a multiple of approximately 10, from about 1.5 x 10^{-4} to 1.3 x 10^{-3} for residential the scenario and from 6 x 10^{-5} to 7 x 10^{-4} for the industrial/commercial scenario. The revised Johnson and Ettinger model produces a more conservative attenuation factor compared to the original model.

Table A1

Definition of Variables

	Definition	Units
H	Chemical Specific Henry's Law constant	μg/m^3-vapor / μg/m^3-H_2O
$\theta_{m\text{-}vadose}$	Volumetric Moisture Content in Vadose Zone	m^3-H_2O / m^3-soil
$\theta_{T\text{-}vadose}$	Total Porosity in Vadose Zone	m^3-voids / m^3-soil
$\theta_{m\text{-}crack}$	Volumetric Moisture Content in Cracks	m^3-H_2O / m^3-soil
$\theta_{T\text{-}crack}$	Total Porosity in Cracks	m^3-voids / m^3-soil
$\theta_{m\text{-}cap}$	Volumetric Moisture Content in Cracks in Capillary Fringe	m^3-H_2O / m^3-soil
$\theta_{T\text{-}cap}$	Total Porosity in Capillary Fringe	m^3-voids / m^3-soil
D^{air}	Chemical Specific Molecular Diffusion Coefficient in Air	m^2 / d
D^{water}	Chemical Specific Molecular Diffusion Coefficient in Water	m^2 / d
K	Soil Permeability (near foundation) to Air Flow	m^2
ΔP	Indoor-Outdoor Air Pressure Difference	g / ms^2
X_{crack}	Total Length of Cracks through which Soil Gas Vapors are Flowing	m
μ	Viscosity of Air	g / ms
Z_{crack}	Crack Opening Depth Below Grade	m
η	Fraction of Enclosed Space Area Open for Vapor Intrusion	m^2 / m^2
A_B	Surface Area of the Enclosed Space in Contact with Soil	m^2
V_B	Enclosed Space Volume	m^3
E_B	Enclosed Space Air Exchange Rate	1/d
L_T	Depth from Foundation to Source	m
L_{cap}	Thickness of Capillary Fringe	m
L_{crack}	Foundation Thickness	m

Table A2

Calculated Variables

	Definition	Calculation	Units
V_B/A_B	Ratio of Enclosed Space Volume to Exposed Surface Area		m
Q_B	Enclosed Space Volumetric Air Flow Rate	$= V_B E_B$	m^3 / d
R_{crack}	Effective Crack Radius or Width	$= \eta A_B/X_{crack}$	m
$\theta_{V\text{-}vadose}$	Volumetric Vapor Content in Vadose Zone	$= \theta_{T\text{-}vadose} - \theta_{m\text{-}vadose}$	m^3-vapor / m^3-soil
$\theta_{V\text{-}crack}$	Volumetric Vapor Content in Cracks	$= \theta_{T\text{-}crack} - \theta_{m\text{-}crack}$	m^3-vapor / m^3-soil
$\theta_{V\text{-}cap}$	Volumetric Vapor Content in Capillary Fringe	$= \theta_{T\text{-}cap} - \theta_{m\text{-}cap}$	m^3-vapor / m^3-soil
Q_{soil}	Pressure Driven Soil Gas Flow Rate from the subsurface into the enclosed space	$= (2\pi k \Delta P X_{crack}) / [\mu \ln(2Z_{crack}/R_{crack})]$	m^3 / d
Q_{soil}/Q_B	Ratio of Soil Gas Intrusion Rate to Building Ventilation Rate		unitless
D^{water}/D^{air}	Ratio of Molecular Diffusion in water to air		unitless
L_{vadose}	Thickness of Vadose Zone	$= L_T - L_{cap}$	m

Table A3

Default Input Values

	Units	Typical Value Range [1]	Notes	Res GWVC	I/C GWVC	Res SVVC	I/C SVVC
H	µg/m^3-vapor / µg/m^3-H_2O	0.01 - 1.0	For most aromatic & chlorinated solvents	---	---	---	---
$\theta_{m\text{-}vadose}$	m^3-H_2O / m^3-soil		ASTM default value. Typical for sand.	0.12	0.12	0.12	0.12
$\theta_{T\text{-}vadose}$	m^3-voids / m^3-soil		ASTM default value. Typical for sand.	0.38	0.38	0.38	0.38
$\theta_{m\text{-}crack}$	m^3-H_2O / m^3-soil		ASTM default value. Typical for sand.	0.12	0.12	0.12	0.12
$\theta_{T\text{-}crack}$	m^3-voids / m^3-soil		ASTM default value. Typical for sand.	0.38	0.38	0.38	0.38
$\theta_{m\text{-}cap}$	m^3-H_2O / m^3-soil		ASTM default value. Typical for sand.	0.342	0.342	0.342	0.342
$\theta_{T\text{-}cap}$	m^3-voids / m^3-soil		ASTM default value. Typical for sand.	0.38	0.38	0.38	0.38
D^{air}	M^2 / d	0.1 - 1	For most chemicals	7.26E-01	7.26E-01	7.26E-01	7.26E-01
D^{water}	M^2 / d			8.64E-05	8.64E-05	8.64E-05	8.64E-05
k	m^2	1E-6 - 1E-12					
ΔP	g / ms^2	0 - 200	or 0 to 20 Pascals				
X_{crack}	m						
μ	g / ms						
Z_{crack}	m						
η	m^2 / m^2	0.0005 - 0.005	ASTM default value. 0.01 for worst-case scenario.	0.01	0.01	0.01	0.01
A_B	m^2						
V_B	m^3	147 - 672	Range from USDOE (1995)				
E_B	1/d	4.8 - 24	ASTM default values. 12 for Residential scenario and 19.9 for Industrial/Commercial scenario.	12	19.9	12	19.9
L_T	m	0.01 - 50	ASTM default values. 3 for Groundwater criteria and 1 for Soil Vapor criteria.	3	3	1	1
L_{cap}	m		ASTM default values. 0.05 for Groundwater criteria and 0 for Soil Vapor criteria.	0.05	0.05	0	0
L_{crack}	m	0.15 - 0.5	ASTM default value.	0.15	0.15	0.15	0.15

Table A3
(continued)

Default Input Values

	Units	**Typical Value Range [1]**	**Notes**	**Res GWVC**	**I/C GWVC**	**Res SVVC**	**I/C SVVC**
V_B/A_B	m	2 - 3	ASTM default values. 2 for Residential scenario and 3 for Industrial/Commercial scenario.	2	3	2	3
Q_B	m^3 / d						
R_{crack}	m						
$\theta_{V\text{-}vadose}$	m^3-vapor / m^3-soil		ASTM default value. Typical for sand.	0.26	0.26	0.26	0.26
$\theta_{V\text{-}crack}$	m^3-vapor / m^3-soil		ASTM default value. Typical for sand.	0.26	0.26	0.26	0.26
$\theta_{V\text{-}cap}$	m^3-vapor / m^3-soil		ASTM default value. Typical for sand.	0.038	0.038	0.038	0.038
Q_{soil}	m^3 / d						
Q_{soil}/Q_B	unitless	0.0001 – 0.05	EPA Vapor Intrusion Guidance default value.	0.003	0.003	0.003	0.003
D^{water}/D^{air}	unitless	~ 1E-4		1.19E-04	1.19E-04	1.19E-04	1.19E-04
L_{vadose}	m		ASTM default value. 2.95 for Groundwater criteria and 1 for Soil Vapor criteria.	2.95	2.95	1	1

[1] Johnson, (2002), *Identification of Critical Parameters for the Johnson and Ettinger (1991) Vapor Intrusion Model*, API Bulletin #17, May.

Table A4

Henry's Law Constants and Molecular Weights

Compound	CAS Number	Henry's Law Constant (unitless)	Molecular Weight (g/mole)
Acetone	67641	1.75E-03	58
Acrylonitrile	107131		
Benzene	71432	2.26E-01	78
Bromoform	75252	2.18E-02	253
2-Butanone (MEK)	78933	1.12E-03	72
Carbon tetrachloride	56235	1.20E+00	154
Chlorobenzene	108907	1.61E-01	113
Chloroform	67663	1.39E-01	119
Dibromochloromethane	124481		
1,2-Dichlorobenzene	95501	7.95E-02	147
1,3-Dichlorobenzene	541731	1.08E-01	147
1,4-Dichlorobenzene	106467	1.12E-01	147
1,1-Dichloroethane	75343	2.23E-01	99
1,2-Dichloroethane	107062	4.51E-02	99
1,1-Dichloroethylene	75354	6.11E-01	97
cis-1,2-Dichlroethylene	156592	See listing below	See listing below
trans-1,2-Dichloroethylene	156605	See listing below	See listing below
1,2-Dichloropropane	78875	1.16E-01	113
1,3-Dichloropropene	542756	1.44E-01	111
Ethyl benzene	100414	1.41E-01	106
Ethylene dibromide (EDB)	106934	2.76E-02	188
Methyl-tert-butyl-ether	1634044	2.42E-02	88
Methyl isobutyl ketone	108101	5.66E-03	100
Methylene chloride	75092	1.31E-01	85
Styrene	100425	1.07E-01	104

Table A4
(Continued)

Henry's Law Constants and Molecular Weights

Compound	CAS Number	Henry's Law Constant (unitless)	Molecular Weight (g/mole)
1,1,1,2-Tetrachloroethane	630206	4.51E-01	168
1,1,2,2-Tetrachloroethane	79345	1.56E-02	168
Tetrachloroethylene	127184	8.36E-02	166
Toluene	108883	2.74E-01	92
1,1,1 Trichloroethane	71556	9.47E-01	133
1,1,2-Trichloroethane	79005	3.73E-02	133
Trichloroethylene	79016	3.74E-01	131
Vinyl chloride	75014	1.14E+00	63
Xylenes	1330207	2.16E-01	106
New Criteria			
Trichlorofluoromethane	75694	4.00E+00	137
Chloroethane	75003	4.50E-01	65
Chloromethane	74873	3.60E-01	51
Dichlorodiflouromethane	75718	1.40E+01	121
Isopropylbenzene (Cumene)	98828	4.70E-01	120
Cis-1,2-dichloroethene	156592	1.70E-01	97
trans-1,2-dichloroethene	156605	3.80E-01	97
Bromodichloromethane	75274	8.70E-02	164
N-butylbenzene	104518	5.24E-01	134
Sec-butylbenzene	135988	5.68E-01	134
1,2,4-trimethylbenzene	95636	2.30E-01	120
1,3,5-trimethylbenzene	108678	3.20E-01	120
4-isopropyltoluene (4-cymene)	99876	4.51E-01	134

Appendix B

Derivation of Target Indoor Air Concentrations

APPENDIX B

DERIVATION OF TARGET INDOOR AIR CONCENTRATIONS

This Appendix presents the derivation of target indoor air concentrations (TACs) for the volatile organic compounds (VOCs) listed in the existing Remediation Standard Regulations (RSR) volatilization criteria, together with TACs for 13 additional VOCs not previously listed. These additional VOCs though not originally listed, have appeared in groundwater and/or soil gas at sites in Connecticut. This Appendix includes two tables that list the TACs and the underlying toxicity values, modifying factors and background considerations. The following is a brief overview of the risk-based derivation methodology followed by the specific approaches used for the residential and industrial/commercial scenarios.

General TAC Methodology

TACs are air concentrations within homes or workplaces that are not expected to cause adverse health effects from chronic exposure. TACs rely upon chemical-specific toxicity values that describe the VOC's potency in terms of: 1) the reference concentration (RfC) - air concentration which will be free of risk for non-cancer health effects from chronic exposure; or 2) the unit risk factor – potency of VOC to produce carcinogenic effects per microgram per cubic meter (ug/m^3) of air chronically inhaled. These toxicity values are typically derived by USEPA from studies in which laboratory animals were exposed for chronic periods, with the toxic response based upon continuous exposure (24 hours per day (hr/d), every day of the year). Therefore, these targets need modification for exposure scenarios in which less than continuous exposure is likely (e.g., the industrial/commerical scenario). The TACs are set such that the lifetime cancer risk is at the de minimis risk level (one in a million or 1E-06) and the hazard index (TAC/RfC_m where RfC_m is the RfC modified for the time-weight averaged amount of exposure in the specific scenario) for non-carcinogens is equal to unity.

While USEPA's Integrated Risk Information System (IRIS) database is the primary source of toxicology information for TAC development, other toxicology databases are also recognized as having well documented and widely used toxicity values. These include the Agency for Toxic Substances and Disease Registry (ATSDR)'s chronic Minimum Risk Levels (MRLs), California EPA's chronic Reference Exposure Levels (RELs) and USEPA's Health Effects Assessment Summary Tables (HEAST). In cases where a toxicity value was not available on IRIS, the value was sought from these other data sources. If still no value could be found, CTDPH conducted its own chemical-specific risk assessment. In certain cases, USEPA has listed provisional toxicity values that rely upon the best available science currently available, but these values may be somewhat more uncertain and are not supported by USEPA to the same extent as those values on IRIS. CTDPH has examined the basis for these particular values closely and, in isolated cases, has made adjustments.

A number of VOCs in the TAC list are possible rather than proven animal carcinogens, or, if proven, their cancer mechanism has uncertain relevance to low dose exposures in humans. These types of carcinogens were labeled as Group C carcinogens in USEPA's former cancer guidelines and are considered as Class 3 agents by IARC. Their carcinogenicity database is either too uncertain or incomplete to allow an extrapolation of risk to low dose human exposures. Rather than applying the classical low dose linear approach on the one hand, or ignoring their carcinogenic potential on the other, this derivation lowers the RfC by an uncertainty factor to account for this potential hazard. This approach is consistent with that developed by USEPA's Office of Drinking Water to establish Maximum Contaminant Levels

(MCLs). The default cancer uncertainty factor is 10 fold, although 3.33 fold (one half log lower) was used in cases where the uncertainty already built into the RfC was large (1000 fold or greater); this reduction in the cancer uncertainty factor was used to keep the overall uncertainty factor to less than 10,000.

In several cases toxicity values were available for the oral but not inhalation dose route. A dose route extrapolation to convert from the reference dose (in mg/kg/d) to RfC (ug/m^3) was used as long as the target site was not local to the site of bodily entry, but rather was at a systemic location (i.e., internal organs or systems).

The following are the general equations for the derivation of TACs. These equations and most of the parameter value inputs have not changed since the setting of the 1996 RSRs

For carcinogenic effects:

$$TAC = \frac{TR \times BW \times AT_c \times 365\ d/yr \times 10^3 \mu g/mg}{Sf_i \times IR_{air} \times EF \times ED}$$

For non-carcinogenic effects:

$$TAC = \frac{THQ \times BW \times RfD_i \times AT_n \times 365\ d/yr \times 10^3 \mu g/mg}{IR_{air} \times EF \times ED}$$

where:

AT_c = averaging time for carcinogens, years
Use AT_c = 70 years

AT_n = averaging time for non-carcinogens, years
For residential use AT_n = 30 years
For commercial/industrial use AT_n = 25 years

BW = adult body weight, kg
Use BW = 70 kg

ED = exposure duration, years
For residential use ED = 30 years
For commercial/industrial use ED = 25 years

EF = exposure frequency, days/years
For residential use EF = 350 days/year
For commercial/industrial use EF = 250 days/year

IR_{air} = daily indoor inhalation rate, m^3/day
For residential use IR_{air} = 20 m^3/day
For commercial/industrial use IR_{air} = 10 m^3/day

TAC = target indoor air concentration, µg/m^3-air

RfD_i = inhalation chronic reference dose, mg/kg-day
Use numbers from IRIS and/or HEAST and/or other sources.

SF_i = inhalation cancer slope factor, kg-day/mg
Use numbers from IRIS and/or HEAST and/or other sources.

THQ = target hazard quotient for individual constituents, dimensionless
Use THQ = 1

TR = target excess individual lifetime cancer risk, dimensionless
Use TR = 1×10^{-6}

Modifications to the Residential Scenario

The exposure assumptions shown in the equations above pertain to adults (70 kg body weight, 20 m^3/d inhalation rate). However, young children inhale more air per body weight and respiratory surface area than do adults (Child-Specific Exposure Factors Handbook, USEPA, 2000; Thurlbeck, 1982). This is an especially important consideration with regards to VOCs that can cause respiratory irritation and thus have the potential to exacerbate asthma due to the local dose in the lung. However, it also applies to systemic toxicants. The child/adult dose differential from inhalation exposure is approximately 2 fold over the first six years of life (e.g., at 1 year of age: 4.5 m^3/d inhalation rate for 7.4 kg body weight for an inhalation rate/body weight ratio that is 2.1 fold larger than the adult assumption). Thus, the systemic and local respiratory tract dose to young children can be assumed to be approximately 2 fold larger than in adults for a significant portion of childhood. Since young children may be more generally sensitive to toxicants (many systems are immature and rapidly developing - Faustman, 2000), the potential importance of this exposure differential is accentuated. Thus, to be protective of children as potentially the most highly exposed and sensitive group, the residential TACs are adjusted by a 2 fold factor that corresponds with the greater inhalation exposure rate in children.

Children's increased vulnerability to toxicants has perhaps been best characterized in the area of carcinogenic risk. Standard cancer bioassays from which most unit risk values are derived, begin chemical administration when rodents are 4-6 weeks of age. At this age the animals are sexually mature and growth is not as rapid as in juvenile animals. Thus, this type of cancer study misses a potentially important vulnerability window. In fact, numerous cancer studies in which rodents were dosed beginning in early life demonstrate considerably greater potency in the neonatal period than at older ages (Vesselinovitch, et al., 1979; Toth, 1968; Maltoni, et al., 1981).

The reason for this greater susceptibility likely stems from the greater time period for expression of cancer when testing begins earlier in life, and because rapidly dividing tissues are more sensitive to genotoxicants (Laib, et al., 1985, Anderson, 2000). These issues have recently been summarized in a publication by CTDPH (Ginsberg, 2003) and by USEPA in their draft revisions to the cancer risk assessment guidelines (USEPA, 2003). The case of vinyl chloride sensitivity in early life stages has been evaluated closely by USEPA to support their recent revision to the vinyl chloride IRIS file (USEPA, 2000). That assessment showed that brief exposures in early life produced a cancer response later in life that was roughly equivalent to what would be seen from an adult-only (lifetime) exposure. On that basis, the IRIS file recommends that the unit risk factor for vinyl chloride derived for adults be doubled if there will be long-term exposure that will include children. Analysis of other juvenile animal bioassays indicates that this also appears to be true for a wide variety of chemicals, particularly those with a genotoxic mode of action (Ginsberg, 2003; USEPA, 2003). For this reason, the revised TACs for genotoxic carcinogens have an adjustment factor (2 fold lowering of TAC) to account for the greater sensitivity of early life stages (Ginsberg, 2003; USEPA, 2003).

In summary, the residential scenario includes a 2 fold adjustment factor for children's increased inhalation exposure rate relative to adults, and a 2 fold adjustment factor for children's increased sensitivity when exposed to genotoxic carcinogens. In this latter case, the combined children's adjustment factor is 4 fold. This approach is consistent with USEPA's IRIS file for vinyl chloride and draft Cancer Risk Assessment Guidelines. The Table B1 shows the use of these factors in deriving TACs.

Industrial/Commercial TAC Calculations

The industrial/commercial scenario is simpler than the residential scenario in that it only involves adults. The exposure parameters shown above for this scenario indicate that relative to the assumptions that go into RfCs and cancer unit risk values, workers will be exposed to less inhaled contaminant due to fewer hours/day of exposure (8 instead of 24 hr), fewer days per year of exposure (250 instead of 365), and fewer total years of exposure (25 instead of 70). The shorter hours per day of worker exposure is partially compensated for by the higher breathing rate workers may have compared to the general public. This leads to the assumption that 50% of the day's inhalation volume occurs while at work. In setting TACs for the workplace it is appropriate to increase the RfC by a factor of 2 for inhalation rate ($20m^3$/d vs. 10 m^3/d) and by a factor of 1.46 for exposure days per year (365 vs. 250). This yields a combined workplace adjustment factor for RfCs of 2.92 (i.e., the workplace TAC can be 2.92 fold higher than the RfC). For carcinogens, the cumulative number of years is also part of the exposure calculation and so the 70/25 yr factor (2.8) is multiplied by 2.92 to yield a combined 8.176 adjustment factor. This factor is multiplied by the air concentration associated with de minimis risk for the general public to yield the air concentration corresponding to de minimus risk for workers. These exposure factors are in the Table B2 to show their use in deriving TACs for this scenario.

Ceiling TAC

The Tables B1 and B2 list a number of VOCs whose risk-based TAC is relatively high, a value that would allow gross contamination of indoor air. In these cases a ceiling value of 500 ug/m^3 is used. The ceiling value is based upon datasets showing that individual VOC concentrations in buildings tend to average less than 500 ug/m^3 across a broad array of building types and indoor air contaminants (Brown, et al., Indoor Air 4: 123-134, 1994). The 98th percentile value for these indoor air contaminants was highly variable but most values were between 50 and 1000 ug/m^3, indicating that a level of 500 ug/m^3 represents an upper bound concentration that stems from an unusual contamination source. Such high concentrations may contribute to decreases in air quality that are noticeable to building inhabitants (Otto, et al., 1990). Therefore, this ceiling value is a prudent default value that can be replaced when more specific information becomes available (e.g., odor threshold data), as indicated for several VOCs in this derivation.

Indoor Air Background Concentrations

Since 1996, there has been an increased focus around the United States on measuring indoor air quality in impacted and non-impacted (or "background") homes, offices, schools and other environments. This had led to an enhanced database for background indoor air data (Foster, et al., 2002; Kurtz and Folkes, 2002; NYSDOH, 1997; Clayton, et al., 1999; Shields, et al., 1996; Girman, et al. report of USEPA/BASE Study, 1999). These datasets, along with the pre-existing indoor air datasets (Stolwick, 1990; Vermont DOH, 1992; Brown, et al., 1994; Daisey, et al., 1994; Sheldon, et al., 1992; Shah and Singh, 1988) have been reviewed while giving particular attention to those VOCs (typically carcinogens) with risk-based TACs that are in the range where they may approach or are below what can be considered background. VOC indoor air measurements are typically lognormally distributed; therefore, the central tendency background concentration (the median) was chosen to represent background. While higher concentrations may be found in certain background locations, the central tendency was used because of the way it would be applied: 1) to replace a risk-based TAC such that the background concentration would already be above a risk target; and 2) to back-calculate the allowable contribution from subsurface VOC contamination, such that the amount that is from background sources plus the amount allowed from subsurface sources would still be within the range of the background data distribution.

VOC background concentrations and how they are used in the derivation of TACs are shown chemical-by-chemical in Tables B1 and B2.

Table B1

Target Air Concentrations (TACs) for Residential Scenario (Page 1)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Acetone	IRIS RfD (0.1mg-kg-d) converted to RfC (350 ug/m^3)	2x CexpF	183 ug/m^3	---[7]	180 ug/m^3
Benzene	IRIS unit risk (8.3E-6/ug/m^3)	2x CexpF; 2x CsensF	0.07 ug/m^3	3.25 ug/m^3	3.3 ug/m^3
Bromoform	IRIS unit risk (1.1E-6/ug/m^3)	2x CexpF; 2x CsensF	2.2 ug/m^3	Not available	0.55 ug/m^3
2-Butanone (MEK)	IRIS RfC (1000 ug/m^3)	2x CexpF	520 ug/m^3	---[7]	500 ug/m^3 – C[3]
Carbon Tetrachloride	IRIS unit risk (1.5E-5/ug/m^3)	2x CexpF; 2x CsensF	0.04 ug/m^3	0.5 ug/m^3	0.5 ug/m^3
Chlorobenzene	IRIS RfD (0.02 mg-kg-d) converted to RfC (70 ug/m^3)	2x CexpF	37 ug/m^3	---[7]	37 ug/m^3
Chloroform	IRIS unit risk (2.3E-5/ug/m^3)	2x CexpF	0.05 ug/m^3	0.5 ug/m^3	0.5 ug/m^3
1,2-Dichlorobenzene	HEAST RfC (140 ug/m3)	2x CexpF	73 ug/m^3	---[7]	73 ug/m^3
1,3-Dichlorobenzene	Analogy with 1,2-DCB	2x CexpF	73 ug/m^3	---[7]	73 ug/m^3
1,4-Dichlorobenzene	EPA Provisional unit risk (6.3E-06/ug/m^3)	None – since provisional unit risk	0.39 ug/m^3	24 ug/m^3	24 ug/m^3
1,1-Dichloroethane	HEAST ("A") RfC (490ug/m^3)	3.33x Cancer UF; 2x CexpF	77 ug/m^3	---[7]	77 ug/m^3
1,2-Dichloroethane	IRIS unit risk (2.6E-5/ug/m^3)	2x CexpF; 2x CsensF	0.023 ug/m^3	0.07 ug/m^3	0.07 ug/m^3
1,1-Dichloroethylene	CalEPA REL (70 ug/m^3); ATSDR MRL (80 ug/m^3)	10x Cancer UF	7 ug/m^3	<5 ug/m^3	10 ug/m^3
1,2-Dichloropropane	EPA provisional oral slope → unit risk (1.9E-05/ug/m^3)	None – since provisional unit risk	0.13 ug/m^3	Not available	0.13 ug/m^3
1,3-Dichloropropene	IRIS unit risk (2.9E-6/ug/m^3)	2x CexpF; 2x CsensF	0.21 ug/m^3	Not available	0.21 ug/m^3
Ethylbenzene	IRIS RfC (1000 ug/m^3)	10x Cancer UF; 2x CexpF	53 ug/m^3	<10 ug/m^3	53 ug/m^3
Ethylene dibromide	IRIS unit risk (2.2E-04)	2x CexpF; 2x CsensF	0.003 ug/m^3	Not available	0.0028 ug/m^3

Table B1

Target Air Concentrations (TACs) for Residential Scenario (Page 2)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Methyl-t-butyl ether	IRIS RfC (3000 ug/m^3)	10x Cancer UF; 2x CexpF	160 ug/m^3	---[7]	160 ug/m^3
Methyl isobutyl ketone	HEAST(A") RfC (70 ug/m^3)	2x CexpF	37 ug/m^3	---[7]	37 ug/m^3
Methylene chloride	IRIS unit risk (4.7E-07/ug/m^3)	2x CexpF	2.6 ug/m^3	3 ug/m^3	3 ug/m^3
Styrene	IRIS RfC (1000 ug/m^3)	10x Cancer UF; 2x CexpF	52 ug/m^3	---[7]	52 ug/m^3
1,1,1,2-Tetrachloroethane	IRIS unit risk (7.43E-06/ug/m^3)	2x CexpF; 2x CsensF	0.082 ug/m^3	Not available	0.082 ug/m^3
1,1,2,2-Tetrachloroethane	IRIS unit risk (5.7E-05/ug-m3)	2x CexpF; 2x CsensF	0.01 ug/m^3	Not available	0.01 ug/m^3
Tetrachloroethylene (PERC)	CalEPA unit risk (5.9E-06/ug/m^3)	2x CexpF	0.21 ug/m^3	5 ug/m^3	5 ug/m^3
Toluene	IRIS RfC (400 ug/m^3)	2x CexpF	208 ug/m^3	---[7]	210 ug/m^3
1,1,1-Trichloroethane	CalEPA REL (1000 ug/m^3)	2x CexpF	520 ug/m^3	---[7]	500 ug/m^3 - C[3]
1,1,2-Trichloroethane	IRIS RfD converted to RfC (14 ug/m^3)	3.33x Cancer UF; 2x CexpF	2.2 ug/m^3	0.03 ug/m^3	2.2 ug/m^3
Trichloroethylene	IRIS provisional unit risk (1.1E-04/ug/m^3)	2x CexpF; 2x CsensF	0.006 ug/m^3	1 ug/m^3	1 ug/m^3
Vinyl chloride	IRIS unit risk for early life + adult exposure (8.6E-06/ug/m^3)	2x CexpF	0.14 ug/m^3	0.01 ug/m^3	0.14 ug/m^3
Xylenes	ATSDR MRL (430 ug/m^3)	2x CexpF	220 ug/m^3	---[7]	220 ug/m^3
Trichlorofluoromethane	HEAST ("A")RfC (700 ug/m^3)	2x CexpF	365 ug/m^3	---[7]	370 ug/m^3

Table B1

Target Air Concentrations (TACs) for Residential Scenario (Page 3)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Chloroethane	IRIS RfC (10,000 ug/m^3)	10x Cancer UF; 2x CexpF	520 ug/m^3	---[7]	500 ug/m^3 - C[3]
Chloromethane	IRIS RfC (90 ug/m^3)	3.33x Cancer UF; 2x CexpF	14 ug/m^3	Not available	14 ug/m^3
Dichlorodifluoromethane	HEAST ("A")RfC (175 ug/m^3)	2x CexpF	91 ug/m^3	---[7]	91 ug/m^3
Isopropylbenzene (cumene)	IRIS RfC (385 ug/m^3)	2x CexpF	200 ug/m^3	---[7]	120 ug/m^3 (odor threshold)
cis-1,2-Dichloroethene	HEAST RfD → RfC (35 ug/m^3)	2x CexpF	18 ug/m^3	Not available	18 ug/m^3
trans-1,2-Dichloroethane	IRIS RfD → RfC (70 ug/m^3)	2x CexpF	37 ug/m^3	---[7]	37 ug/m^3
Bromodichloromethane	IRIS oral slope factor → unit risk (1.8E-05/ug/m^3)	2x CexpF; 2x CsensF	0.034 ug/m^3	Not available	0.034 ug/m^3
n-Butylbenzene	EPA provisional RfD → RfC (140 ug/m^3)	2x CexpF	73 ug/m^3	---[7]	73 ug/m^3
sec-Butylbenzene	EPA provisional RfD → RfC (140 ug/m^3)	2x CexpF	73 ug/m^3	---[7]	73 ug/m^3
1,2,4-Trimethylbenzene	EPA Provisional RfC (6 ug/m^3)	RfC ↑ed 3x[5] 2x CexpF	9 ug/m^3	Not available	9.3 ug/m^3
1,3,5Trimethylbenzene	EPA Provisional RfC (6 ug/m^3)	RfC ↑ed 3x[5] 2x CexpF	9 ug/m^3	Not available	9.3 ug/m^3
4-Isopropyltoluene	DPH risk assessment[6] yields RfC of 133 ug/m^3	2x CexpF	67 ug/m^3	---[7]	67 ug/m^3

Footnotes for Residential TAC Table B1

[1] Tox Value Notes: Values from IRIS, HEAST, CalEPA chronic RELs or ATSDR chronic MRLs; EPA provisional values have been derived by the agency but not fully documented or supported; HEAST "A" refers to values from Alternative Table within HEAST. Dose route extrapolation conducted when no inhalation tox value available and oral toxicity is to systemic sites.

[2] Modifying Factors: CexpF = children's exposure factor for increased respiratory rate per body wt and respiratory surface area;
CsensF = children's sensitivity factor for genotoxic carcinogens
Cancer UF = uncertainty factor for evidence of carcinogenicity but extrapolation to low dose uncertain.

[3] "C" designation indicates ceiling value of 500 ug/m^3.

[4] TACs based upon de minimis (1 in a million) cancer risk or a hazard index of 1 for non-cancer effects.

[5] EPA provisional RfC for 1,2,4- and 1,3,5-TMB have unnecesarily large uncertainty factors which drive very low RfC.

[6] 4-Isopropyltoluene risk assessment based upon analogy with isopropylbenzene with evidence neurotoxicity as key endpoint (4-IPT 3x > potency than IPB).

[7] Background concentration not sought since risk-based TAC is relatively high and unlikely to be in range of background.

Table B2

Target Air Concentrations (TACs) for Industrial/Commercial Scenario (Page 1)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Acetone	IRIS RfD (0.1mg-kg-d) converted to RfC (350 ug/m^3)	2.92 less worker exp.	1022 ug/m^3	---[7]	500 ug/m^3 – C[3]
Benzene	IRIS unit risk (8.3E-6/ug/m^3)	8.176 less worker exp.	0.99 ug/m^3	3.25 ug/m^3	3.3 ug/m^3
Bromoform	IRIS unit risk (1.1E-6/ug/m^3)	8.176 less worker exp.	7.34 ug/m^3	Not available	7.3 ug/m^3
2-Butanone (MEK)	IRIS RfC (1000 ug/m^3)	2.92 less worker exp.	2900 ug/m^3	---[7]	500 ug/m^3 – C[3]
Carbon Tetrachloride	IRIS unit risk (1.5E-5/ug/m^3)	8.176 less worker exp.	0.54 ug/m^3	0.5 ug/m^3	0.54 ug/m^3
Chlorobenzene	IRIS RfD (0.02 mg-kg-d) converted to RfC (70 ug/m^3)	2.92 less worker exp.	200 ug/m^3	---[7]	200 ug/m^3
Chloroform	IRIS unit risk (2.3E-5/ug/m^3)	8.176 less worker exp.	0.36 ug/m^3	0.5 ug/m^3	0.5 ug/m^3
1,2-Dichlorobenzene	HEAST RfC (140 ug/m^3)	2.92 less worker exp.	410 ug/m^3	---[7]	410 ug/m^3
1,3-Dichlorobenzene	Analogy with 1,2-DCB	2.92 less worker exp.	410 ug/m^3	---[7]	410 ug/m^3
1,4-Dichlorobenzene	EPA Provisional unit risk (6.3E-06/ug/m^3)	8.176 less worker exp.	1.3 ug/m^3	24 ug/m^3	24 ug/m^3
1,1-Dichloroethane	HEAST ("A") RfC (490 ug/m^3)	3.33x Cancer UF; 2.92 less worker exp.	430 ug/m^3	---[7]	430 ug/m^3
1,2-Dichloroethane	IRIS unit risk (2.6E-5/ug/m^3)	8.176 less worker exp.	0.31 ug/m^3	0.07 ug/m^3	0.31 ug/m^3
1,1-Dichloroethylene	CalEPA REL (70 ug/m^3); ATSDR MRL (80 ug/m^3)	10x Cancer UF	20 ug/m^3	<5 ug/m^3	20 ug/m^3
1,2-Dichloropropane	EPA provisional oral slope → unit risk (1.9E-05/ug/m^3)	8.176 less worker exp.	0.42 ug/m^3	Not available	0.42 ug/m^3
1,3-Dichloropropene	IRIS unit risk (2.9E-6/ug/m^3)	8.176 less worker exp.	2.9 ug/m^3	Not available	2.9 ug/m^3
Ethylbenzene	IRIS RfC (1000 ug/m^3)	10x Cancer UF; 2.92 less worker exp.	290 ug/m^3	<10 ug/m^3	290 ug/m^3
Ethylene dibromide	IRIS unit risk (2.2E-04)	8.176 less worker exp.	0.038 ug/m^3	Not available	0.038 ug/m^3

Table B2

Target Air Concentrations (TACs) for Industrial/Commercial Scenario (Page 2)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Methyl-t-butyl ether	IRIS RfC (3000 ug/m^3)	10x Cancer UF; 2.92 less worker exp.	876 ug/m^3	---[7]	190 ug/m^3 (odor threshold)
Methyl isobutyl ketone	HEAST(A") RfC (70 ug/m^3)	2.92 less worker exp.	200 ug/m^3	---[7]	200 ug/m^3
Methylene chloride	IRIS unit risk (4.7E-07/ug/m^3)	8.176 less worker exp.	17 ug/m^3	3 ug/m^3	17 ug/m^3
Styrene	IRIS RfC (1000 ug/m^3)	10x Cancer UF; 2.92 less worker exp.	290 ug/m^3	---[7]	290 ug/m^3
1,1,1,2-Tetrachloroethane	IRIS unit risk (7.43E-06/ug-3)	8.176 less worker exp.	1.1 ug/m^3	Not available	1.1 ug/m^3
1,1,2,2-Tetrachloroethane	IRIS unit risk (5.7E-05/ug-m3)	8.176 less worker exp.	0.14 ug/m^3	Not available	0.14 ug/m^3
Tetrachloroethylene (PERC)	CalEPA unit risk (5.9E-06/ug/m^3)	8.176 less worker exp.	1.4 ug/m^3	5 ug/m^3	5 ug/m^3
Toluene	IRIS RfC (400 ug/m^3)	2.92 less worker exp.	1165 ug/m^3	---[7]	500 ug/m^3 - C[3]
1,1,1-Trichloroethane	CalEPA REL (1000 ug/m^3)	2.92 less worker exp.	2900 ug/m^3	---[7]	500 ug/m^3 - C[3]
1,1,2-Trichloroethane	IRIS RfD converted to RfC (14 ug/m^3)	3.33x Cancer UF; 2.92 less worker exp.	12.3 ug/m^3	0.03 ug/m^3	12 ug/m^3
Trichloroethylene	IRIS provisional unit risk (1.1E-04/ug/m^3)	8.176 less worker exp.	0.074 ug/m^3	1 ug/m^3	1 ug/m^3
Vinyl chloride	IRIS unit risk for adult exposure (4.3E-6/ug/m^3)	8.176 less worker exp.	1.9 ug/m^3	0.01 ug/m^3	1.9 ug/m^3
Xylenes	ATSDR MRL (430 ug/m^3)	2.92 less worker exp.	1256 ug/m^3	---[7]	500 ug/m^3 - C[3]
Trichlorofluoromethane	HEAST ("A")RfC (700 ug/m^3)	2.92 less worker exp.	2044 ug/m^3	---[7]	500 ug/m^3– C[3]

Table B2

Target Air Concentrations (TACs) for Industrial/Commercial Scenario (Page 3)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Chloroethane	IRIS RfC (10,000 ug/m^3)	10x Cancer UF; 2.92 less worker exp.	2920 ug/m^3	---[7]	500 ug/m^3 - C[3]
Chloromethane	IRIS RfC (90 ug/m^3)	3.33x Cancer UF; 2.92 less worker exp.	80 ug/m^3	Not available	80 ug/m^3
Dichlorodifluoromethane	HEAST ("A")RfC (175 ug/m^3)	2.92 less worker exp.	511 ug/m^3	---[7]	500 ug/m^3 - C[3]
Isopropylbenzene (cumene)	IRIS RfC (385 ug/m^3)	2.92 less worker exp.	1168 ug/m^3	---[7]	120 ug/m^3 (odor threshold)
cis-1,2-Dichloroethene	HEAST RfD → RfC (35 ug/m^3)	2.92 less worker exp.	102 ug/m^3	Not available	100 ug/m^3
trans-1,2-Dichloroethane	IRIS RfD → RfC (70 ug/m^3)	2.92 less worker exp.	204 ug/m3	---[7]	200 ug/m^3
Bromodichloromethane	IRIS oral slope factor → unit risk (1.8E-05/ug/m^3)	8.176 fold less exp.	0.46 ug/m^3	Not available	0.46 ug/m^3
n-Butylbenzene	EPA provisional RfD → RfC (140 ug/m^3)	2.92 less worker exp.	410 ug/m^3	---[7]	410 ug/m^3
sec-Butylbenzene	EPA provisional RfD → RfC (140 ug/m^3)	2.92 less worker exp.	410 ug/m^3	---[7]	410 ug/m^3
1,2,4-Trimethylbenzene	EPA Provisional RfC (6 ug/m^3)	RfC ↑ed 3x[5] 2.92 less worker exp.	52 ug/m^3	Not available	52 ug/m^3
1,3,5-Trimethylbenzene	EPA Provisional RfC (6 ug/m^3)	RfC ↑ed 3x[5] 2.92 less worker exp.	52 ug/m^3	Not available	52 ug/m^3
4-Isopropyltoluene	DPH risk assessment[6] yields RfC of 133 ug/m^3	2.92 less worker exp.	370 ug/m^3	---[7]	370 ug/m^3

Footnotes for Industrial/Commercial TAC Table

[1] Tox Value Notes: Values from IRIS, HEAST, CalEPA chronic RELs or ATSDR chronic MRLs; EPA provisional values have been derived by the agency but not fully documented or supported; HEAST "A" refers to values from Alternative Table within HEAST. Dose route extrapolation conducted when no inhalation tox value available and oral toxicity is to systemic sites.

[2] Modifying Factors: Worker exposure assumptions for non-cancer effects: 250d/year and $10 m^3$ inhaled per day leads to 2.92 fold less cumulative exposure than assumed for RfC – general public. For carcinogenic effects, this factor is increased 2.8 fold because workers exposed 25 yr instead of 70 yr leading to an overall 8.176 fold lower cumulative exposure than general public.

[3] "C" designation indicates ceiling value of 500 ug/m^3.

[4] TACs based upon de minimis (1 in a million) cancer risk or a hazard index of 1 for non-cancer effects.

[5] EPA provisional RfCs for 1,2,4- and 1,3,5-TMB have unnecessarily large uncertainty factors which drive very low RfC.

[6] 4-Isopropyltoluene risk assessment based upon analogy with isopropylbenzene with neurotoxicity as key endpoint (4-IPT 3x > potency than IPB).

[7] Background concentration not sought since risk-based TAC is relatively high and unlikely to be in range of background.

Appendix C

Comparison to 1996 Volatilization Criteria

Table C1

Comparison of Target Indoor Air Concentrations

Compound	CAS Number	Residential TAC (ug/m³)	1995 Residential TAC (ug/m³)	Ind/Com TAC (ug/m³)	1995 Ind/Com TAC (ug/m³)
Acetone	67641	▼180	834	▼500(1)	1170
Acrylonitrile	107131	NA	NA	NA	NA
Benzene	71432	►3.3(2)	3.25(2)	▼3.3(2)	21.5(2)
Bromoform	75252	▼0.55	2.21	▲7.3	3.72
2-Butanone (MEK)	78933	▼500(1)	1040	▼500(1)	1460
Carbon tetrachloride	56235	▼0.5(2)	1(2)	▼0.54	1(2)
Chlorobenzene	108907	▲37	20.9	▲200	29.2
Chloroform	67663	▼0.5(2)	3(2)	▼0.5(2)	3(2)
Dibromochloromethane	124481	NA	NA	NA	NA
1,2-Dichlorobenzene	95501	▼73	209	▲410	292
1,3-Dichlorobenzene	541731	▼73	209	▲410	292
1,4-Dichlorobenzene	106467	▼24(2)	834	▼24(2)	1170
1,1-Dichloroethane	75343	▼77	521	▼430	730
1,2-Dichloroethane	107062	▼0.07	0.0936	▲0.31	0.157
1,1-Dichloroethylene	75354	▲10	0.0487	▲20	0.0818
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	NA	See **New Criteria** below	NA
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	NA	See **New Criteria** below	NA
1,2-Dichloropropane	78875	►0.13	0.128	▲0.42	0.215
1,3-Dichloropropene	542756	▲0.21	0.0658	▲2.9	0.11
Ethyl benzene	100414	▼53	1040	▼290	1460
Ethylene dibromide (EDB)	106934	▼0.0028	0.0111	▲0.038	0.0186
Methyl-tert-butyl-ether	1634044	▼160	521	▼190(3)	730
Methyl isobutyl ketone	108101	▼37	83.4	▲200	117
Methylene chloride	75092	▼3(2)	45(2)	▼17	45(2)
Styrene	100425	▲52	5(2)	▲290	7.17

Table C1
(Continued)

Comparison of Target Indoor Air Concentrations

Compound	CAS Number	Residential TAC (ug/m^3)	1996 Residential TAC (ug/m^3)	Ind/Com TAC (ug/m^3)	1996 Ind/Com TAC (ug/m^3)
1,1,1,2-Tetrachloroethane	630206	▼0.082	0.329	▲1.1	0.552
1,1,2,2-Tetrachloroethane	79345	▼0.011	0.042	▲0.14	0.0705
Tetrachloroethylene	127184	▼5[(2)]	11[(2)]	▼5[(2)]	11[(2)]
Toluene	108883	▼210	417	▼500[(1)]	584
1,1,1 Trichloroethane	71556	▼500	1040	▼500[(1)]	1460
1,1,2-Trichloroethane	79005	▼2.2	30[(2)]	▼12	30[(2)]
Trichloroethylene	79016	▼1[(2)]	5[(2)]	▼1[(2)]	5[(2)]
Vinyl chloride	75014	▲0.14	0.029	▲1.9	0.0487
Xylenes	1330207	▼220	313	▲500[(1)]	438
New Criteria					
Trichlorofluoromethane	75694	370	NA	500[(1)]	NA
Chloroethane	75003	500[(1)]	NA	500[(1)]	NA
Chloromethane	74873	14	NA	80	NA
Dichlorodiflouromethane	75718	91	NA	500[(1)]	NA
Isopropylbenzene (Cumene)	98828	120[(3)]	NA	120[(3)]	NA
cis-1,2-dichloroethene	156592	18	NA	100	NA
trans-1,2-dichloroethene	156605	37	NA	200	NA
Bromodichloromethane	75274	0.034	NA	0.46	NA
N-butylbenzene	104518	73	NA	410	NA
Sec-butylbenzene	135988	73	NA	410	NA
1,2,4-trimethylbenzene	95636	9.3	NA	52	NA
1,3,5-trimethylbenzene	108678	9.3	NA	52	NA
4-isopropyltoluene (4-cymene)	99876	67	NA	370	NA

(1) Based on a ceiling value. (2) Based on a background concentration. (3) Based on an odor threshold concentration. ▲TAC increased. ▼ TAC decreased. ► TAC stayed the same.

Table C2

Comparison of Ground Water Volatilization Criteria

Compound	CAS Number	Residential GWVC (ug/L)	1996 Residential GWVC (ug/L)	Ind/Com GWVC (ug/L)	1996 Ind/Com GWVC (ug/L)
Acetone	67641	►50000	50000	►50000	50000
Acrylonitrile	107131	NA	NA	NA	NA
Benzene	71432	▼130	215	▼310	3491
Bromoform	75252	▼75	920	▼2300	3800
2-Butanone (MEK)	78933	►50000	50000	►50000	50000
Carbon tetrachloride	56235	▼5.3	16	▼14	40
Chlorobenzene	108907	►1800	1800	▲23000	6150
Chloroform	67663	▼26	287	▼62	710
Dibromochloromethane	124481	NA	NA	NA	NA
1,2-Dichlorobenzene	95501	▼5100	30500	►50000	50000
1,3-Dichlorobenzene	541731	▼4300	24200	►50000	50000
1,4-Dichlorobenzene	106467	▼1400	50000	▼3400	50000
1,1-Dichloroethane	75343	▼3000	34600	▼41000	50000
1,2-Dichloroethane	107062	▼6.5	21	▼68	90
1,1-Dichloroethylene	75354	▲190	1	▲920	6
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	NA	See **New Criteria** below	NA
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	NA	See **New Criteria** below	NA
1,2-Dichloropropane	78875	▼7.4	14	►58	60
1,3-Dichloropropene	542756	▲11	6	▲360	25
Ethyl benzene	100414	▼2700	50000	▼36000	50000
Ethylene dibromide (EDB)	106934	▼0.3	4	▼11	16
Methyl-tert-butyl-ether	1634044	▼21000	50000	►50000	50000
Methyl isobutyl ketone	108101	▼13000	50000	►50000	50000
Methylene chloride	75092	▼160	4512	▼2200	11117
Styrene	100425	▲3100	580	▲42000	2065

Table C2
(Continued)

Comparison of Ground Water Volatilization Criteria

Compound	CAS Number	Residential GWVC (ug/L)	1996 Residential GWVC (ug/L)	Ind/Com GWVC (ug/L)	1996 Ind/Com GWVC (ug/L)
1,1,1,2-Tetrachloroethane	630206	▼2	12	▲64	50
1,1,2,2-Tetrachloroethane	79345	▼1.8	23	▼54	100
Tetrachloroethylene	127184	▼340	1500	▼810	3820
Toluene	108883	▼7100	23500	▼41000	50000
1,1,1-Trichloroethane	71556	▼6500	20400	▼16000	50000
1,1,2-Trichloroethane	79005	▼220	8000	▼2900	19600
Trichloroethylene	79016	▼27	219	▼67	540
Vinyl chloride	75014	►1.6	2	▲52	2
Xylenes	1330207	▼8700	21300	▼48000	50000
New Criteria					
Trichlorofluoromethane	75694	1300	NA	4200	NA
Chloroethane	75003	12000	NA	29000	NA
Chloromethane	74873	390	NA	5500	NA
Dichlorodiflouromethane	75718	93	NA	1200	NA
Isopropylbenzene (Cumene)	98828	2800	NA	6800	NA
Cis-1,2-dichloroethene	156592	830	NA	11000	NA
trans-1,2-dichloroethene	156605	1000	NA	13000	NA
Bromodichloromethane	75274	2.3	NA	73	NA
N-butylbenzene	104518	1500	NA	21000	NA
Sec-butylbenzene	135988	1500	NA	20000	NA
1,2,4-trimethylbenzene	95636	360	NA	4800	NA
1,3,5-trimethylbenzene	108678	280	NA	3900	NA
4-isopropyltoluene (4-cymene)	99876	1600	NA	22000	NA

▲GWVC increased. ▼ GWVC decreased. ► GWVC stayed the same.

Table C3

Comparison of Soil Vapor Volatilization Criteria

Compound	CAS Number	**Residential SVVC (ppm)**	1996 Residential SVVC (ppm)	**Ind/Com SVVC (ppm)**	1996 Ind/Com SVVC (ppm)
Acetone	67641	▼57	2400	▼290	8250
Acrylonitrile	107131	NA	NA	NA	NA
Benzene	71432	▼0.78	1	▼1.4	113
Bromoform	75252	▼0.04	1.5	▼0.98	6
2-Butanone (MEK)	78933	▼130	2400	▼230	8285
Carbon tetrachloride	56235	▼0.06	1	▼0.12	2.7
Chlorobenzene	108907	▼6.1	31	▼60	106
Chloroform	67663	▼0.078	4.5	▼0.14	10.4
Dibromochloromethane	124481	NA	NA	NA	NA
1,2-Dichlorobenzene	95501	▼9.2	240	▼95	818
1,3-Dichlorobenzene	541731	▼9.2	240	▼95	818
1,4-Dichlorobenzene	106467	▼3	950	▼5.5	3270
1,1-Dichloroethane	75343	▼14	850	▼150	3037
1,2-Dichloroethane	107062	▼0.013	1	▼0.11	1
1,1-Dichloroethylene	75354	▲1.9	1	▲7	1
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	NA	See **New Criteria** below	NA
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	NA	See **New Criteria** below	NA
1,2-Dichloropropane	78875	▼0.021	1	▼0.13	1
1,3-Dichloropropene	542756	▼0.035	1	▼0.89	1
Ethyl benzene	100414	▼9.3	1650	▼93	5672
Ethylene dibromide (EDB)	106934	▼0.0005	1	▼0.007	1
Methyl-tert-butyl-ether	1634044	▼34	1000	▼73	3415
Methyl isobutyl ketone	108101	▼6.8	140	▼68	480
Methylene chloride	75092	▼0.65	89	▼6.8	218
Styrene	100425	▲9.3	8	▲95	28

Table C3
(Continued)

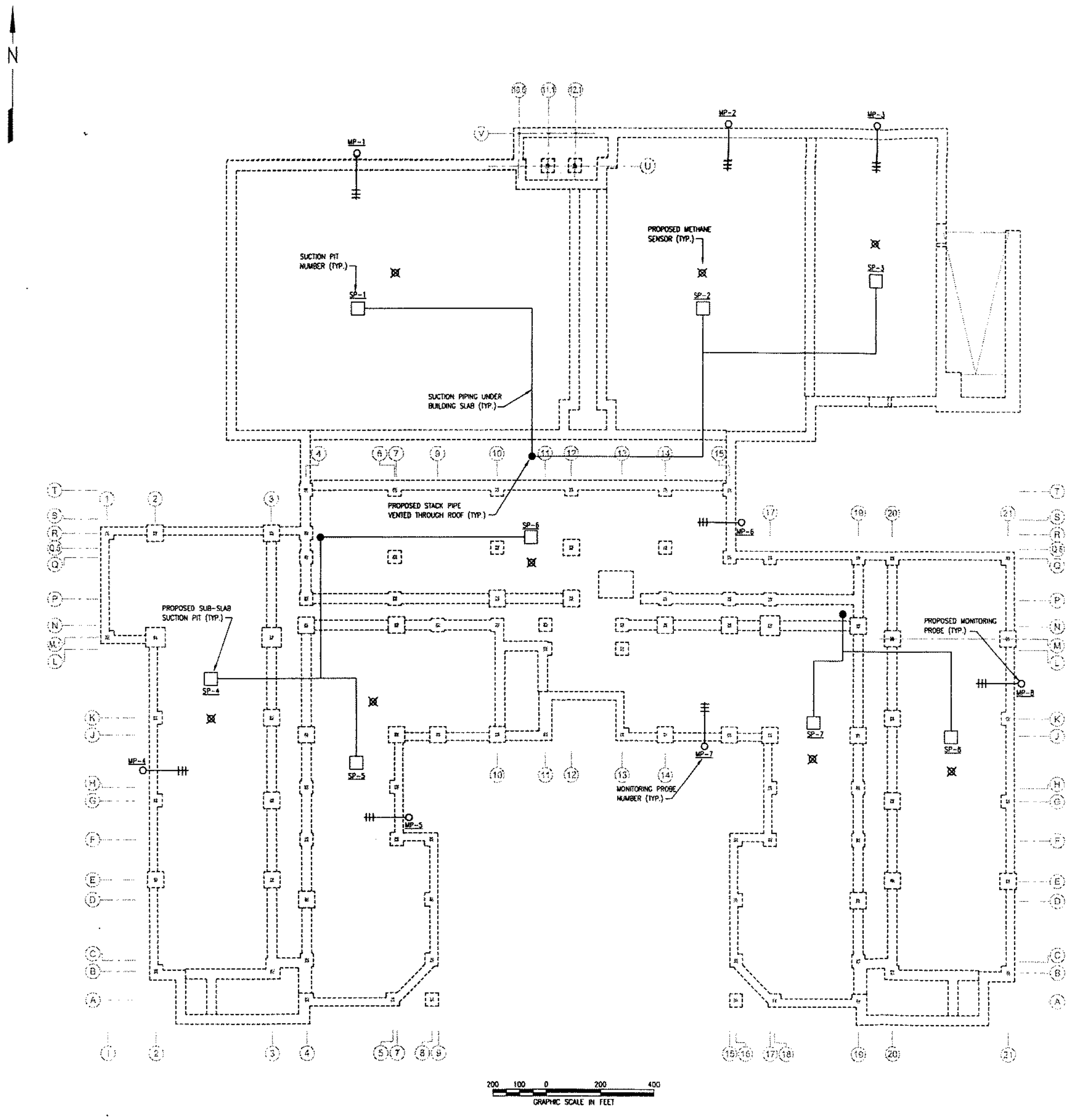
Comparison of Soil Vapor Volatilization Criteria

Compound	CAS Number	Residential SVVC (ppm)	1996 Residential SVVC (ppm)	Ind/Com SVVC (ppm)	1996 Ind/Com SVVC (ppm)
1,1,1,2-Tetrachloroethane	630206	▼0.009	1	▼0.22	1.5
1,1,2,2-Tetrachloroethane	79345	▼0.0012	1	▼0.028	1
Tetrachloroethylene	127184	▼0.56	11	▼1	27
Toluene	108883	▼42	760	▼180	2615
1,1,1 Trichloroethane	71556	▼70	1310	▼130	4520
1,1,2-Trichloroethane	79005	▼0.31	40	▼3.1	93
Trichloroethylene	79016	▼0.14	7	▼0.26	16
Vinyl chloride	75014	▼0.041	1	►1	1
Xylenes	1330207	▼38	500	▼160	1702
New Criteria					
Trichlorofluoromethane	75694	50	NA	120	NA
Chloroethane	75003	140	NA	260	NA
Chloromethane	74873	5.1	NA	53	NA
Dichlorodiflouromethane	75718	14	NA	140	NA
Isopropylbenzene (Cumene)	98828	19	NA	34	NA
Cis-1,2-dichloroethene	156592	3.4	NA	35	NA
trans-1,2-dichloroethene	156605	7.1	NA	70	NA
Bromodichloromethane	75274	0.0038	NA	0.095	NA
N-butylbenzene	104518	10	NA	100	NA
Sec-butylbenzene	135988	10	NA	100	NA
1,2,4-trimethylbenzene	95636	1.4	NA	15	NA
1,3,5-trimethylbenzene	108678	1.4	NA	15	NA
4-isopropyltoluene (4-cymene)	99876	9.3	NA	94	NA

▲SVVC increased. ▼ SVVC decreased. ► SVVC stayed the same.

Appendix E

Design Drawings and Specifications



SUB-SLAB VENTING SYSTEM SPECIFICATIONS

1.01 GENERAL REQUIREMENTS

A. PLACE A CONTINUOUS 6" LAYER OF CLEAN, COARSE AGGREGATE BENEATH THE SLAB.

B. INSTALL A 4'x4' AREA BY 8" DEEP RADON SUCTION PIT UNDER THE SLAB IN THE AGGREGATE.

C. INSTALL A 4" DIAMETER VENT PIPE FROM THE SUCTION PIT(S) UNDER THE SLAB TO THE ROOF.

D. INSTALL A SUCTION FAN ON THE VENT STACK. (THE FAN SHOULD BE OPERATED CONTINUOUSLY, AND THE SYSTEM SHOULD BE EQUIPPED WITH A WARNING DEVICE TO INDICATE LOSS OF NEGATIVE PRESSURE THROUGH FAN FAILURE OR OTHER CAUSES.)

E. SEAL MAJOR GAS ENTRY ROUTES INCLUDING SLAB AND FOUNDATION JOINTS AND CRACKS AND UTILITY AND PIPE PENETRATIONS. SEE REFERENCE D BELOW IN SPECIFICATION 1.02 FOR SUGGESTED METHODS OF SEALING.

1.02 REFERENCES

A. ALL DRAWINGS AND ALL OTHER SECTIONS OF THE SPECIFICATIONS.

B. RHODE ISLAND STATE BUILDING CODE, LATEST EDITION.

C. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) REGULATION 29 CFR PART 1926 - OCCUPATIONAL SAFETY AND HEALTH.

D. "RADON PREVENTION IN THE DESIGN AND CONSTRUCTION OF SCHOOLS AND OTHER LARGE BUILDINGS", THIRD PRINTING WITH ADDENDUM, JUNE 1994, U.S. ENVIRONMENTAL PROTECTION AGENCY.

E. INDUSTRIAL VENTILATION 19TH EDITION: A MANUAL OF RECOMMENDED PRACTICES, COMMITTEE ON INDUSTRIAL VENTILATION, LANSING, MI, 1986.

F. 1989 ASHRAE FUNDAMENTALS HANDBOOK, CHAPTER 14, PAGE 14.4, FIGURE 17.

1.03 AGGREGATE SPECIFICATIONS

A. THE PREFERRED AGGREGATE FOR SUB-SLAB VENTING SYSTEMS IS CRUSHED AGGREGATE MEETING SIZE #5 SPECIFICATIONS AS DEFINED IN ASTM C-33-90, "STANDARD SPECIFICATION FOR CONCRETE AGGREGATES".

B. THIS AGGREGATE IS IN THE RANGE OF 1/2" TO 1" DIAMETER WITH LESS THAN 10 PERCENT PASSING THROUGH A 1/2" SIEVE AND HAS A FREE VOID SPACE OF APPROXIMATELY 50 PERCENT.

1.04 SUCTION PITS

A. FOR A 4" DIAMETER VERTICAL STACK, CONSTRUCT A RADON SUCTION PIT WITH A 4'x4' VOID AND 8" DEEP OR AS SHOWN ON THE DRAWINGS.

1.05 VENT PIPE

A. THE VENT PIPE SHALL BE 4" DIAMETER.

B. BUILDING CODES: BUILDING CODES IN SOME AREAS OF THE COUNTRY MIGHT PREVENT THE USE OF PVC IN SOME SECTIONS OF BUILDINGS. FOR EXAMPLE, SPECIAL RESTRICTIONS SOMETIMES APPLY TO PIPE USED IN FIREWALL PENETRATIONS AND PLENUMS ABOVE DROPPED CEILINGS.

ALSO, BUILDING CODES IN SOME AREAS REQUIRE STEEL PIPE; IN MOST AREAS, CODE REQUIRES SUITABLE FIRE STOP DETAILS AT ANY LOCATION WHERE THE EXHAUST PIPING PENETRATES A FIRE WALL, A CEILING DECK, OR A FLOOR DECK. GENERALLY, PVC PIPE CAN PENETRATE A FIREWALL IF A MATERIAL TO BLOCK FIRE IS USED. WHEN INSTALLING THE VENT PIPE, MAKE SURE YOU DO NOT VIOLATE APPLICABLE CODES.

C. PIPING INSTALLATION: STARTING AT THE FLOOR SLAB, SEAL ANY OPENINGS BETWEEN THE PIPE AND THE FLOOR SLAB WITH A HIGH ADHESIVE SEALANT (POLYURETHANE IS CURRENTLY PREFERRED). ALSO, SEAL ALL PIPING JOINTS. AN ILLUSTRATION OF SEALING PIPE PENETRATIONS THROUGH THE ROOF IS SHOWN ON THE DRAWING.

ALL HORIZONTAL PIPE RUNS ARE PITCHED A MINIMUM OF 1/8" PER FOOT IF POSSIBLE SO THAT ACCUMULATING CONDENSATION DRAINS BACK TO THE SUCTION PIT.

D. LABELING OF SYSTEM COMPONENTS: LABEL THE EXPOSED VENT PIPE TO IDENTIFY THE PIPE AS A COMPONENT OF A VENTING SYSTEM THAT MAY CONTAIN GASES/VAPORS. LABELS SHOULD BE PLACED AT REGULAR INTERVALS (AT LEAST EVERY 10 FEET) ALONG THE ENTIRE PIPE RUN. CLEARLY MARK ALL COMPONENTS OF GASES/VAPOR REDUCTION SYSTEMS AS GASES/VAPOR REDUCTION DEVICES TO ENSURE THAT FUTURE OWNERS OF THE BUILDING DO NOT REMOVE OR DEFEAT THE SYSTEM. AT THE ROOF EXIT, ATTACH A PERMANENT LABEL TO THE VENT WITH A WARNING SUCH AS "SOIL GAS VENT STACK MAY CONTAIN GASES/VAPORS"; DO NOT PLACE AIR INTAKE WITHIN 25'. REFER TO LOCAL CODES TO DETERMINE THE SPECIFIC MINIMUM DISTANCE FOR AIR INTAKES.

1.06 SUCTION FAN

A. SUB-SLAB VENTING SYSTEM FANS SHOULD BE OPERATED CONTINUOUSLY.

B. FAN SELECTION AND INSTALLATION: USE FANS MANUFACTURED SPECIFICALLY FOR OUTDOOR USE IN RADON CONTROL SYSTEMS. FANS NORMALLY USED FOR SCHOOLS AND OTHER LARGE BUILDINGS ARE INLINE DUCT FANS RATED FROM 500 TO 600 CFM AT ZERO INCHES STATIC PRESSURE. BECAUSE PIPING ON THE EXHAUST SIDE OF THE FAN IS UNDER POSITIVE PRESSURE AND MIGHT BE SUBJECT TO LEAKS, THE FAN ALWAYS SHOULD BE MOUNTED OUTSIDE THE BUILDING.

MOST INSTALLERS CONNECT THE FANS TO THE **PIPE SYSTEM WITH RUBBER SEWAGE PIPE CONTRACTORS. THIS CONNECTION ALLOWS FOR** A TIGHT SEAL, QUIET OPERATION, AND EASY REPLACEMENT OF THE FAN (IF NEEDED). ADDITIONAL MATERIALS AND COMPONENTS ARE NORMALLY INCLUDED IN A SYSTEM TO SATISFY SAFETY NEEDS, SYSTEM PERFORMANCE, AND NOISE REDUCTION. TYPICALLY CODE REQUIREMENTS DICTATE THAT WATERPROOF ELECTRICAL SERVICE SWITCHES BE PLACED WITHIN VIEW OF THE FAN TO ENSURE THAT THE SYSTEM WILL NOT BE ACTIVATED DURING MAINTENANCE.

C. SUCTION FAN DISCHARGE: THE EXHAUST DISCHARGE CONFIGURATION: OF A SUB-SLAB VENTING SYSTEM SHOULD BE TREATED SIMILARLY TO THE DISCHARGE OF A LABORATORY FUME HOOD OR OTHER ROOFTOP EXHAUST THAT VENTS TOXIC FUMES. SOME BUILDING CODES, FOR EXAMPLE, SPECIFY THAT ANY DISCHARGE OF POLLUTANTS MUST BE LOCATED AT LEAST 25 FEET FROM ANY OUTDOOR AIR INTAKES. EXAMPLES OF SUITABLE DISCHARGE CONFIGURATIONS ARE PRESENTED IN THE INDUSTRIAL MANUAL OF RECOMMENDED PRACTICES, 19TH EDITION, AND THE 1989 ASHRAE FUNDAMENTALS HANDBOOK.

THE VENT PIPE SHALL TERMINATE IN A VERTICAL POSITION ABOVE THE ROOF WITH SUFFICIENT HEIGHT THAT THE DISCHARGE DOES NOT RE-ENTER THE BUILDING. IF THIS CONFIGURATION IS NOT POSSIBLE, WE RECOMMEND THAT YOU CHOOSE A CONFIGURATION THAT PROVIDES AT LEAST A 1,000 TO 1 DILUTION RATIO TO THE NEAREST AIR INTAKE OR OPERABLE WINDOW. THIS DILUTION RATIO IS CALCULATED FROM THE ASHRAE FUNDAMENTALS HANDBOOK CHAPTER 14 EQUATIONS.

D. WARNING DEVICE: SUB-SLAB VENTING SYSTEM SHALL BE INSTALLED TO NOTIFY A RESPONSIBLE BUILDING OFFICIAL IF THE SYSTEM IS NOT OPERATING PROPERLY. THE WARNING SYSTEM SHALL BE AN ELECTRONIC PRESSURE SENSING DEVICE THAT SHALL ACTIVATE A WARNING SIGNAL TO THE OFFICIAL WHEN A SYSTEM PRESSURE DROP OCCURS.

1. THE WARNING DEVICE SHALL BE INSTALLED IN AN AREA FREQUENTLY VISITED BY A RESPONSIBLE PERSON, SUCH AS A MECHANICAL ROOM OR HVAC CONTROLS.

2. THE WARNING DEVICE SHALL BE A TELEMONITORING AND CONTROL SYSTEM. THE SYSTEM SHALL CONNECT TO PRESSURE TRANSDUCERS AT EACH VENT STACK. THE PRESSURE TRANSDUCERS SHALL BE ACCESSIBLE BY INWALL PANEL.

3. THE TELEMONITORING AND CONTROL SYSTEM SHALL SIGNAL THE ENGINEER BY A REMOTE ACCESS MONITORING SYSTEM SUCH AS BY FAX AND CAN BE ACCESSED FROM ANY REMOTE LOCATION TO VIEW VENTING SYSTEM'S OPERATING CONDITIONS.

1.07 SEALING MAJOR VAPOR ROUTES

A. FOR A SUB-SLAB VENTING SYSTEM TO BE MOST EFFECTIVE, IT IS IMPORTANT TO SEAL LARGE OPENINGS (SUCH AS UTILITY PENETRATIONS AND EXPANSION JOINTS) THAT CAN DEFEAT EXTENSION OF A LOW PRESSURE FIELD. LARGE OPENINGS IN THE SLAB NOT ONLY REDUCE SYSTEM EFFECTIVENESS, BUT ALSO INCREASE OPERATING COSTS BY DRAWING TOO MUCH AIR FROM THE INSIDE OF THE BUILDING.

1.08 SEALING RECOMMENDATIONS

A. RECOMMENDED SEALANTS:

1. USE POLYURETHANE SEALANTS SINCE THEY ADHERE WELL TO CONCRETE, HAVE A GOOD SERVICE LIFE, AND GOOD ELASTICITY.

2. SEALANTS SHOULD BE APPLIED, ACCORDING TO MANUFACTURERS RECOMMENDATIONS, ONTO A CLEAN DRY SURFACE.

B. SEALING CONCRETE SLABS:

1. SLAB JOINTS (FLOOR/WALL JOINTS, POUR JOINTS, AND CONTROL SAW JOINTS) SHOULD BE TOOLED WHEN POURED AND SEALED WITH POLYURETHANE CAULK AFTER CURING.

2. OPENINGS AROUND UTILITY PENETRATIONS THAT PASS THROUGH THE SLAB SHOULD BE THOROUGHLY SEALED.

3. DRAIN FOOTING AND INTERIOR DRAINAGE SYSTEMS TO DAYLIGHT IF POSSIBLE. IF A SUMP HOLE IS NECESSARY, A SUBMERSIBLE PUMP SHOULD BE USED, THE HOLE SEALED AIRTIGHT TO THE BUILDING, AND THE SUMP VENTED TO THE OUTDOORS.

1.09 HVAC SYSTEM

A. RECOMMENDED GUIDELINES (TO BUILDING DESIGNERS):

1. IT IS RECOMMENDED THAT THE DESIGNER OF THE BUILDING CONSIDER THE BASIC GUIDELINES OUTLINED UNDER SECTION 2.2.3 OF REFERENCE D (SEE 1.02) FOR HVAC DESIGN AND OPERATION TO ENSURE THE SUB-SLAB VENTING SYSTEM OPERATES AS INTENDED.

REVISIONS			
NO	DATE	BY	DESCRIPTION

SEAL

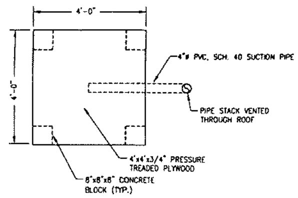
PROPOSED PROVIDENCE HIGH SCHOOL - PARCEL "B" FORMER GORHAM MANUFACTURING PROPERTY

PROVIDENCE, RHODE ISLAND

SUB-SLAB VENTING SYSTEM LOCATION AND SPECIFICATIONS

EA ENGINEERING, SCIENCE, AND TECHNOLOGY
2350 Post Road
Warwick, RI 02886
(401) 736-3440

DATE	APRIL 2006
DESIGNED BY	PMG
DRAWN BY	WEL
CHECKED BY	PMG
PROJECT MANAGER	PMG
PROJECT NUMBER	61965.01
SCALE	AS SHOWN
FILE NAME	6196501_C-1_C-2.DWG
DRAWING NUMBER	E.1
SHEET NUMBER	1 OF 2



TYPICAL SUCTION PIT PLAN

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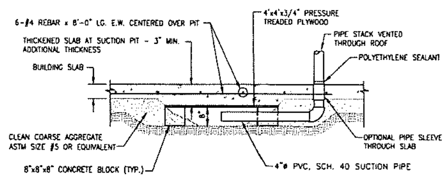

TYPICAL SUCTION PIT SECTION

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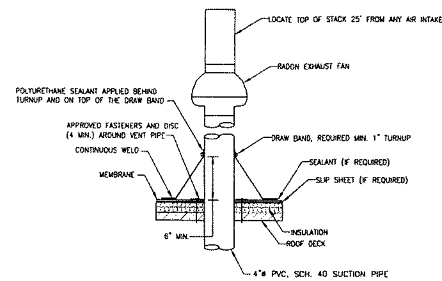

TYPICAL ROOF VENT

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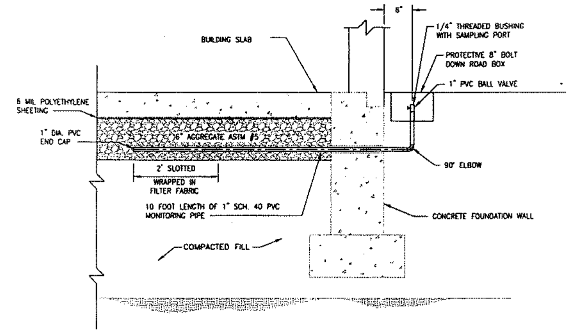

MONITORING PROBE OUTLET SECTION

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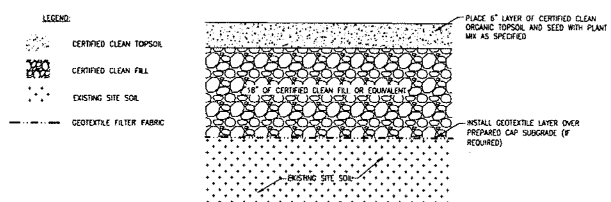
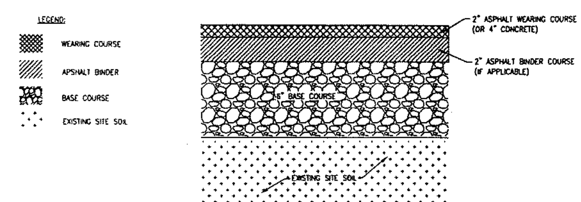


TYPICAL ENGINEERED CAP
CROSS SECTION–UNPAVED AREAS

SCALE: NOT TO SCALE



TYPICAL ENGINEERED CAP
CROSS SECTION–PAVED AREAS

SCALE: NOT TO SCALE

REVISIONS			
NO.	DATE	BY	DESCRIPTION

SEAL

PROPOSED PROVIDENCE HIGH SCHOOL – PARCEL "B"
FORMER GORHAM MANUFACTURING PROPERTY
PROVIDENCE, RHODE ISLAND

SUB SLAB VENTING SYSTEM DETAILS
AND ENGINEERED CAP CROSS SECTIONS

EA ENGINEERING, SCIENCE, AND TECHNOLOGY
2350 Post Road
Warwick, RI 02886
(401) 736-3440

DATE	APRIL 2006
DESIGNED BY	PMG
DRAWN BY	WEL
CHECKED BY	PMG
PROJECT MANAGER	PMG
PROJECT NUMBER	61965.01
SCALE	AS SHOWN
FILE NAME	6196501_C-1_C-2.DWG
DRAWING NUMBER	E.2
SHEET NUMBER	2 OF 2

ProPex®

geotextiles

4510

ProPex 4510 is a polypropylene nonwoven needlepunched fabric. This engineered geotextile is stabilized to resist degradation due to ultraviolet exposure. It is resistant to commonly encountered soil chemicals, mildew and insects, and is non-biodegradable. Polypropylene is stable within a pH range of 2 to 13, making it one of the most stable polymers available for geotextiles today. We wish to advise that **ProPex 4510** meets the following minimum average roll values:

Property	Test Method	Minimum Average Roll Value (English)	Minimum Average Roll Value (Metric)
Unit Weight	ASTM-D-5261	10 oz/yd^2	339 g/m^2
Grab Tensile	ASTM-D-4632	250 lb	1.11 kN
Grab Elongation	ASTM-D-4632	50 %	50 %
Mullen Burst	ASTM-D-3786	520 psi	3584 kPa
Puncture	ASTM-D-4833	155 lb	0.689 kN
Trapezoidal Tear	ASTM-D-4533	100 lb	0.445 kN
UV Resistance	ASTM-D-4355	70 % at 500 hrs	70 % at 500 hrs
AOS(1)	ASTM-D-4751	100 sieve	.15 mm
Permittivity	ASTM-D-4491	1.2 sec^{-1}	1.2 sec^{-1}
Flow Rate	ASTM-D-4491	85 gal/min/ft^2	3460 L/min/m^2
Coefficient of Permeability	ASTM-D-4491	0.20 cm/sec	0.20 cm/sec
Thickness	ASTM-D-5199	85 mils	2.15 mm

(1) max. average roll value

Amoco Fabrics and Fibers Company manufacturers the nonwoven fabric indicated above. The values listed are a result of testing conducted in on-site laboratories. A letter certifying the minimum average roll values will be issued from the manufacturing plant by the Quality Control Manager at the time shipment is made.

DATE ISSUED: 01/02/04

Amoco Fabrics and Fibers Company
260 The Bluffs
Austell, GA 30168
PH: 770-944-4569
FX: 770-944-4584

Published by Amoco Fabrics and Fibers Company
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bp

GSM Gas Monitors:
Carbon Monoxide, Methane, & Hydrogen

Individual Gas Monitors for Vaults & RT's

Monitors Toxic or Combustible Gases

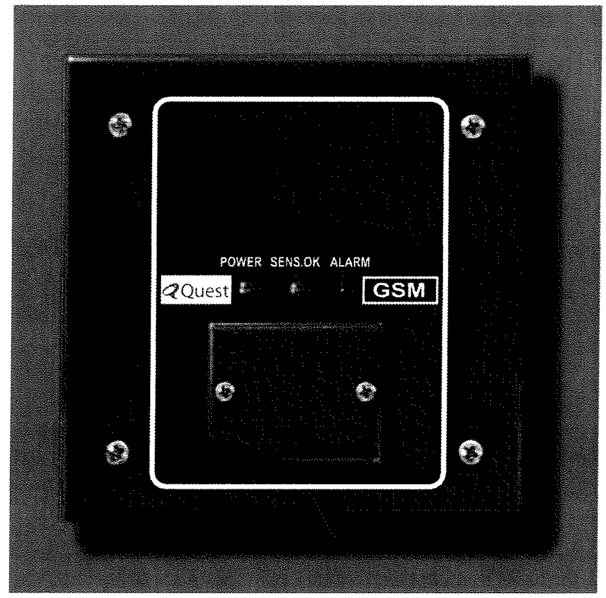
Stays Calibrated up to 5 Years without Drift

Field Adjustable Alarm Thresholds

Alarms for Gas Thresholds & Sensor Fault

Calibrates On-Site without Replacement

Visual LED Alarm Status



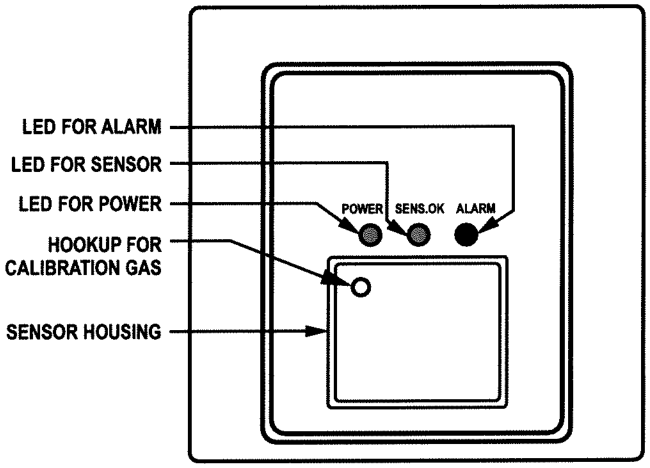
Quest's **GSM Gas Monitors** are designed to provide **safe, reliable,** and **long life** monitoring and alarming for toxic and combustible gases for your underground vaults, CEVs, CEMHs, CUEs, CECs, and WICs.

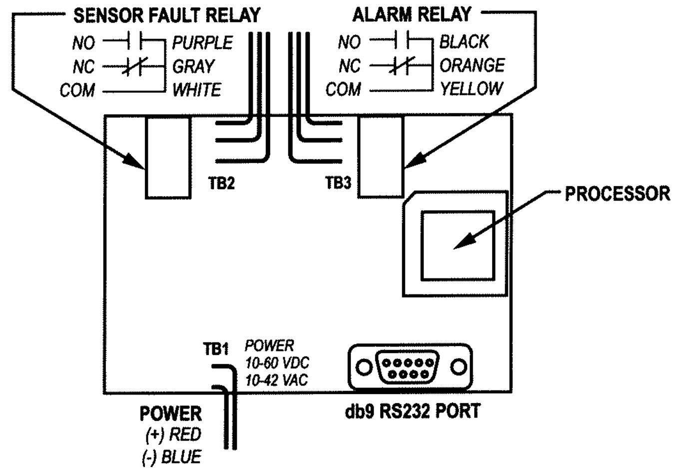
- ***Monitors Carbon Monoxide (CO), Methane (HC), or Hydrogen (H_2) Gases.***
- ***Microprocessor-based design enables gas monitors to stay in calibration up to 5 years; then can be calibrated on-site without replacing monitor.***
- ***Provides separate relays for exceeding pre-set gas thresholds and sensor failure.***
- ***Alarm thresholds adjustable 0 to 90% in the field via RS232 port.***
- ***Powered by –48VDC ensures gases are being monitored during commercial AC power failure.***
- ***Connect directly to the TELSEC® controllers.***

Quest Controls, Inc.
Monitoring, Control & Test Solutions for Telecom
www.questcontrols.com

GSM Gas Monitors: Carbon Monoxide, Methane, & Hydrogen

Individual Gas Monitors





Key Features

- LED indicators exhibit power, alarm and sensor fault status.
- Automatic reset when gas levels fall below alarm thresholds.
- Communicate via RS232 port using standard, off-the-shelf terminal emulation software, such as Procomm® or Hyperterminal®.

Specifications

Sensor Description	**Carbon Monoxide** *(Toxic)*	**Methane** *(Combustible)*	**Hydrogen** *(Combustible)*
Model#	GSM-CO	GSM-HC	GSM-H2
Part#	300151	300149	300148
PID/SSI#	001537000	700253813	001537018
Material ID#	828371	928808	828372
Detection Range	0 to 250 ppm	0 to 10,000 ppm	0 to 500 ppm
Pre-set Alarm Level	50 ppm	5,000 ppm	200 ppm
Outputs			
Relay Contact Rating	0.6 Amps at 125 VAC or 2.0 Amps at 30 VDC (resistive)		
K1	SPDT, Form C, normally de-energized for alarm		
K2	SPDT, Form C, normally energized for sensor fault		
Accuracy	±5% FS (Full Scale)		
RS232 Port	db9: On-site calibration, retrieval of gas values, and adjustment of threshold alarms		
Connections	12"(305mm) wiring harness interfaces power and alarm relay		
Power	10 to 60 VDC or 10 to 42 VAC, 3 Va		
Electrical Compliance	Meets CSA standards (ENTELA Certification)		
Ambient Operating Temp	0 to 110°F (-18 to 43°C)	32 to 110°F (0 to 43°C)	32 to 110°F (0 to 43°C)
Dimensions	5.5"(140mm) W X 5.5"(140mm) H X 4.5"(114mm) D		
Weight	1.8 lb. (0.8kg)		
Warranty	1 year		

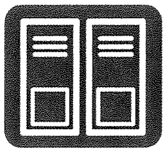
Specifications are subject to change without notice

Quest Controls, Inc.
Monitoring, Control & Test Solutions for Telecom
www.questcontrols.com
208 9th Street Drive West, Palmetto, FL 34221
Tel: (941) 729-4799 Fax: (941) 729-5480

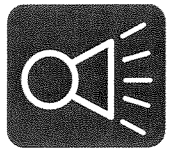
GSM0106 Rev 3.0 Printed in U.S.A.

TELSEC® 2000 *Classic*

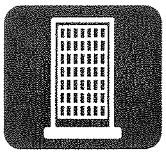
for Monitoring, Control and Facility Surveillance of Remote Sites



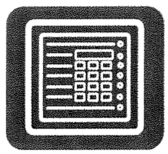
INTELLIGENT LEAD/LAG HVAC MONITORING & CONTROL



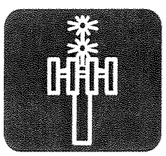
ENVIRONMENTAL ALARM MONITORING & CONTROL



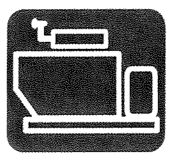
TELEPHONY EQUIPMENT & RECTIFIER MONITORING



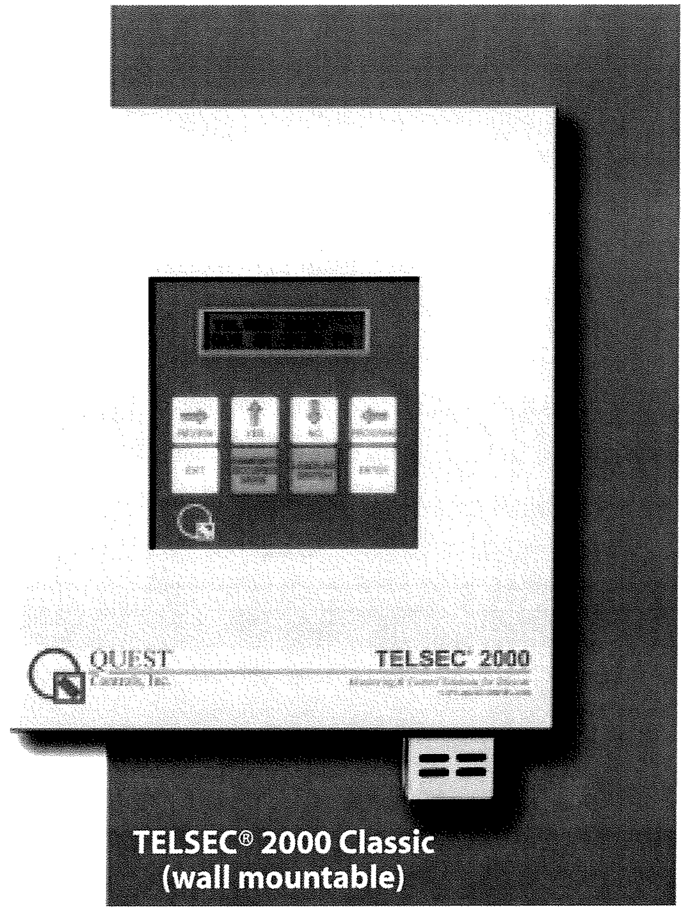
DOOR/HATCH ACCESS CONTROL



TOWER LIGHT MONITORING



GENERATOR MONITORING & CONTROL



TELSEC® 2000 Classic (wall mountable)

The TELSEC® 2000 Controller provides an integrated surveillance solution to monitor and control all environmental and access control functions, and in the remote site:

- Performs controlling, monitoring, and communication functions in a single cost-effective product.
- Install in Remote Sites: CEVs, Huts, CECs, CUEs, WICs, Cabinets, and Customer Prem sites.
- Install in Central Offices, Data and Switching Centers, Cable Vaults, and Head-Ends.
- Compact, versatile package operates with a standard control program or can be customized to meet your requirements.
- Enables remote interrogation of remote sites from any alarm and/or maintenance center.

Acting as your smart eyes and ears at the remote site, the TELSEC® delivers large savings and quick payback by:

- Reducing energy costs via intelligent HVAC lead/lag control strategies.
- Reducing visits to remote sites.
- Eliminating downtime by acting as an early warning system.
- Reducing capital expenditures by replacing multiple devices to accomplish the same task.
- Extending life of critical operating equipment including air conditioners and batteries.

TELSEC® 2000 Features

- Expandable to 64 universal inputs and 64 outputs.
- Controls multiple air conditioning units for fan, cooling, heat, and economizer.
- Alarm outputs for Hi/Lo Temp, Hi/Lo Humidity, Fire/Smoke, Toxic and Combustible Gases, High Water, and more. Alarms sent via modem, TCP/IP, RS232 or contact closures.
- Card Access Control of main door and Intrusion Monitoring.
- Optional TCP/IP Ethernet 10BaseT connectivity with RJ45 connector.
- Versatile programming enables custom configurations to meet specific applications.
- Non-volatile FLASH memory prevents program loss and stores program uploads.
- Supports industry standard dial-up modem enabling remote interrogation and program changes.
- Built-in Craft port for on-site monitoring and programming.
- 5 password levels, up to 25 passwords.

Expandable to 64 Inputs and 64 Outputs

Optional TCP/IP Over Ethernet Connectivity

Monitors Power Plant and Rectifier Alarms

CE and UL Approved

3 Year Warranty

Specifications

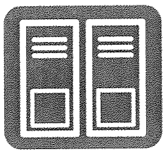
Part Number	150624
Inputs	16 universal inputs expandable to 64 in 16 (order part# 150573-48) input increments, Analog (0-5VDC or 0-20mA) or dry contact closures
Outputs - Digital *Contact Rating* *Outputs - Analog*	16 digital outputs expandable to 64 in 8 (order part# 150574-48) output increments 60VDC, 0.3 amps Optional 2 on-board, expandable to 10 analog outputs (order part# 150624A), 0-10VDC or 0-20/4-20mA
Card Access	Supports industry standard Wiegand format, proximity or swipe card readers Up to 999 cards can be programmed per site. Logs 500 most recent events
Power	±18 to 65VDC, 0.5 amps. Optional 110VAC/220VAC, 60Hz, 0.25 amps
Front Panel	Built-in programming panel with 8 keys and a 32-character backlit LCD Display
Modem	Supports industry standard Modems (V.90, V.34) with error correction and data compression with RJ11 connector
Serial Port	DB9, 9 pin RS232 port. Supports asynchronous communications. Programmable for speed, parity, and bit format
Network Interface (option) *LAN* *Protocols Supported*	 Ethernet 10baseT (order part# 300165) with RJ45 connector TCP/IP, Telnet, DHCP, HTTP (for setup)
Logging	Logs all inputs, outputs, and alarms, up to 16,000 points
Software	Supports any off-the-shelf terminal communication software (e.g. Procomm®, Hyperterminal®)
I/O Terminals	2 piece, pull-off terminals for power, inputs, outputs, and networking
Battery	Long life lithium: 10 year shelf life, 1.5 years under load
Temp/Humidity Sensor Accuracy	Temp: ±1°F (±-0.5°C), Humidity: ±2% of range. Temperature and Humidity sensors included
Ambient Operating Temp	-20 to 180°F (-29 to 82°C), 0-95% RH Non-condensing
Certification	UL, CE
Dimensions	9"W x 10"H x 2"D (229mmW x 254mmH x 51mmD)
Weight	2.5 lbs (1.1 kg)
Warranty	3 years

Specifications are subject to change without notice

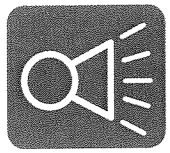
QUEST Controls, Inc.
Monitoring & Control Solutions for Telecom
www.questcontrols.com
208 9th Street Drive West, Palmetto, FL 34221
Tel: (941) 729-4799 Fax: (941) 729-5480
P/n 150624, V1.0, 12.16.02 Printed in U.S.A.

TELSEC® 2000 *Classic*

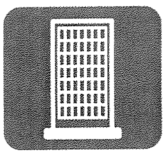
for Monitoring, Control and Facility Surveillance of Remote Sites



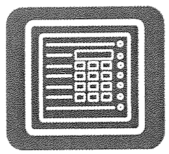
INTELLIGENT LEAD/LAG HVAC MONITORING & CONTROL



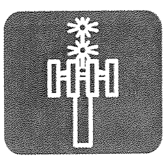
ENVIRONMENTAL ALARM MONITORING & CONTROL



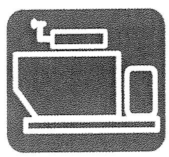
TELEPHONY EQUIPMENT & RECTIFIER MONITORING



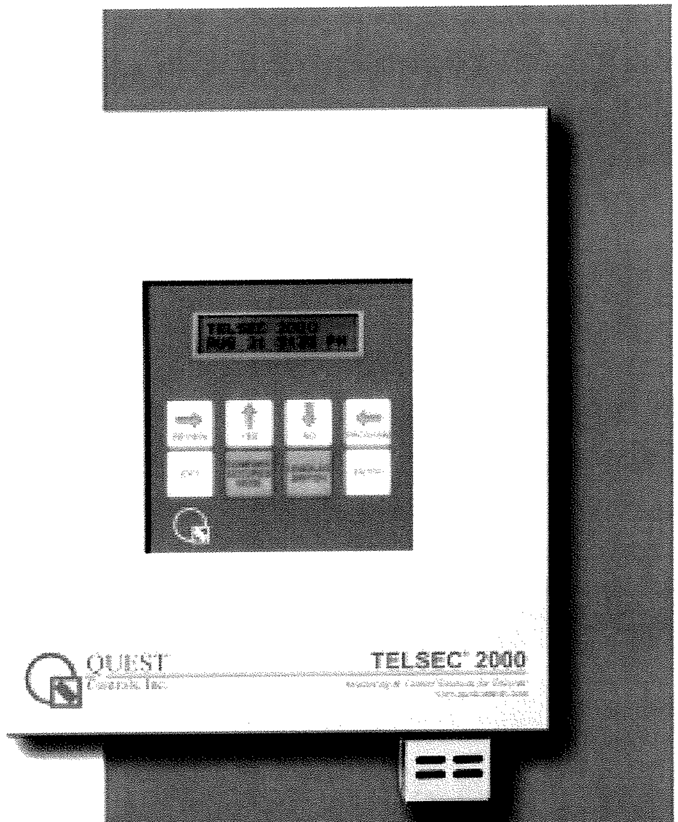
DOOR/HATCH ACCESS CONTROL



TOWER LIGHT MONITORING



GENERATOR MONITORING & CONTROL



TELSEC® 2000 Classic (wall mountable)

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- Compact, versatile package operates with a standard control program or can be customized to meet your requirements.
- Enables remote interrogation of remote sites from any alarm and/or maintenance center.

Acting as your smart eyes and ears at the remote site, the TELSEC® delivers large savings and quick payback by:

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- Reducing visits to remote sites.
- Eliminating downtime by acting as an early warning system.
- Reducing capital expenditures by replacing multiple devices to accomplish the same task.
- Extending life of critical operating equipment including air conditioners and batteries.

TELSEC® 2000 Features

- Expandable to 64 universal inputs and 64 outputs.
- Controls multiple air conditioning units for fan, cooling, heat, and economizer.
- Alarm outputs for Hi/Lo Temp, Hi/Lo Humidity, Fire/Smoke, Toxic and Combustible Gases, High Water, and more. Alarms sent via modem, TCP/IP, RS232 or contact closures.
- Card Access Control of main door and Intrusion Monitoring.
- Optional TCP/IP Ethernet 10BaseT connectivity with RJ45 connector.
- Versatile programming enables custom configurations to meet specific applications.
- Non-volatile FLASH memory prevents program loss and stores program uploads.
- Supports industry standard dial-up modem enabling remote interrogation and program changes.
- Built-in Craft port for on-site monitoring and programming.
- 5 password levels, up to 25 passwords.

Expandable to 64 Inputs and 64 Outputs

Optional TCP/IP Over Ethernet Connectivity

Monitors Power Plant and Rectifier Alarms

CE and UL Approved

3 Year Warranty

Specifications

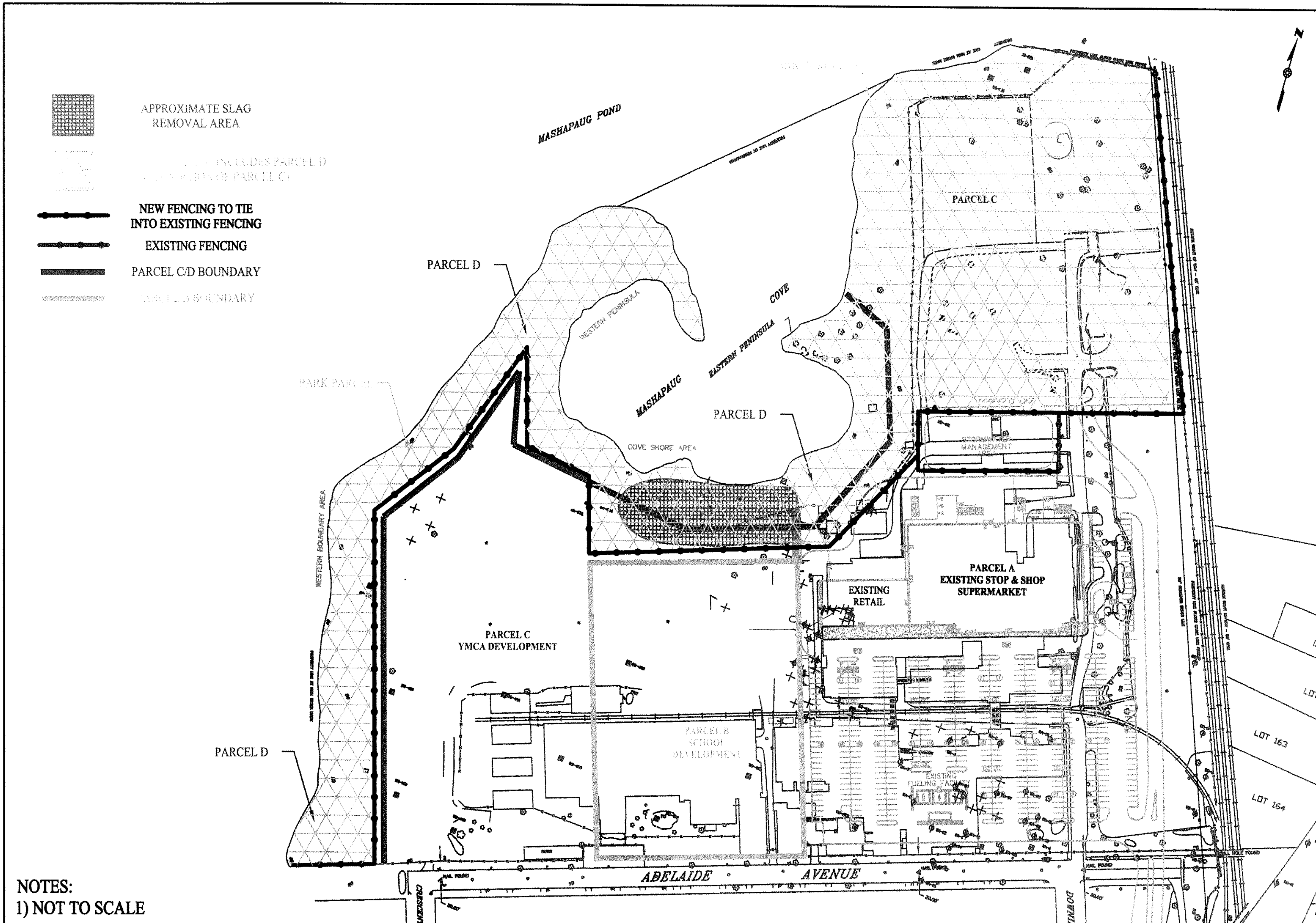
Part Number	150624
Inputs	16 universal inputs expandable to 64 in 16 (order part# 150573-48) input increments, Analog (0-5VDC or 0-20mA) or dry contact closures
Outputs - Digital *Contact Rating* *Outputs - Analog*	16 digital outputs expandable to 64 in 8 (order part# 150574-48) output increments 60VDC, 0.3 amps Optional 2 on-board, expandable to 10 analog outputs (order part# 150624A), 0-10VDC or 0-20/4-20mA
Card Access	Supports industry standard Wiegand format, proximity or swipe card readers Up to 999 cards can be programmed per site. Logs 500 most recent events
Power	±18 to 65VDC, 0.5 amps. Optional 110VAC/220VAC, 60Hz, 0.25 amps
Front Panel	Built-in programming panel with 8 keys and a 32-character backlit LCD Display
Modem	Supports industry standard Modems (V.90, V.34) with error correction and data compression with RJ11 connector
Serial Port	DB9, 9 pin RS232 port. Supports asynchronous communications. Programmable for speed, parity, and bit format
Network Interface (option) *LAN* *Protocols Supported*	 Ethernet 10baseT (order part# 300165) with RJ45 connector TCP/IP, Telnet, DHCP, HTTP (for setup)
Logging	Logs all inputs, outputs, and alarms, up to 16,000 points
Software	Supports any off-the-shelf terminal communication software (e.g. Procomm®, Hyperterminal®)
I/O Terminals	2 piece, pull-off terminals for power, inputs, outputs, and networking
Battery	Long life lithium: 10 year shelf life, 1.5 years under load
Temp/Humidity Sensor Accuracy	Temp: ±1°F (±-0.5°C), Humidity: ±2% of range. Temperature and Humidity sensors included
Ambient Operating Temp	-20 to 180°F (-29 to 82°C), 0-95% RH Non-condensing
Certification	UL, CE
Dimensions	9"W x 10"H x 2"D (229mmW x 254mmH x 51mmD)
Weight	2.5 lbs (1.1 kg)
Warranty	3 years

Specifications are subject to change without notice

QUEST Controls, Inc.
Monitoring & Control Solutions for Telecom
www.questcontrols.com
208 9th Street Drive West, Palmetto, FL 34221
Tel: (941) 729-4799 Fax: (941) 729-5480

Appendix F

Site Map for Proposed Fencing and Deterrent Vegetation



NOTES:
1) NOT TO SCALE

FORMER GORHAM MANUFACTURING FACILITY
PROVIDENCE, RHODE ISLAND
EXHIBIT A

Appendix G

Soil Gas Laboratory Analytical Report
5 October 2005

con-test®
ANALYTICAL LABORATORY
39 Spruce Street ° East Longmeadow, MA 01028 ° FAX 413/525-6405 ° TEL. 413/525-2332

REPORT DATE 10/12/2005

EA ENGINEERING SCIENCE & TECH. - RI
2350 POST ROAD
WARWICK, RI 02886
ATTN: PETER GRIVERS

CONTRACT NUMBER:
PURCHASE ORDER NUMBER: 2725

PROJECT NUMBER:

ANALYTICAL SUMMARY

LIMS BAT #: LIMS-92298
JOB NUMBER: 6196501-0011

The results of analyses performed on the following samples submitted to the CON-TEST Analytical Laboratory are found in this report.

PROJECT LOCATION: PROVIDENCE

FIELD SAMPLE #	LAB ID	MATRIX	SAMPLE DESCRIPTION	TEST
SV-07	05B39516	AIR	NOT SPECIFIED	air special test
SV-07	05B39516	AIR	NOT SPECIFIED	to-15 ppbv
SV-07	05B39516	AIR	NOT SPECIFIED	to-15 ug/m3
SV-08	05B39517	AIR	NOT SPECIFIED	air special test
SV-08	05B39517	AIR	NOT SPECIFIED	to-15 ppbv
SV-08	05B39517	AIR	NOT SPECIFIED	to-15 ug/m3
SV-09	05B39518	AIR	NOT SPECIFIED	air special test
SV-09	05B39518	AIR	NOT SPECIFIED	to-15 ppbv
SV-09	05B39518	AIR	NOT SPECIFIED	to-15 ug/m3
SV-10	05B39519	AIR	NOT SPECIFIED	air special test
SV-10	05B39519	AIR	NOT SPECIFIED	to-15 ppbv
SV-10	05B39519	AIR	NOT SPECIFIED	to-15 ug/m3
SV-11	05B39520	AIR	NOT SPECIFIED	air special test
SV-11	05B39520	AIR	NOT SPECIFIED	to-15 ppbv
SV-11	05B39520	AIR	NOT SPECIFIED	to-15 ug/m3

The CON-TEST Environmental Laboratory operates under the following certifications and accreditations :

AIHA 100033	AIHA ELLAP (LEAD) 100033	
MASSACHUSETTS MA0100	NEW HAMPSHIRE NELAP 2516	NEW JERSEY NELAP NJ MA007 (AIR)
CONNECTICUT PH-0567	VERMONT DOH (LEAD) No. LL015036	ARIZONA AZ0648
NEW YORK ELAP/NELAP 10899	RHODE ISLAND (LIC. No. 112)	ARIZONA AZ0654 (AIR)

I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Edward Denson 10/12/05

SIGNATURE DATE

Tod Kopyscinski
Director of Operations

Sondra S. Kocot
Quality Control Coordinator

Edward Denson
Technical Director

con-test® ANALYTICAL LABORATORY

39 Spruce Street ° East Longmeadow, MA 01028 ° FAX 413/525-6405 ° TEL. 413/525-2332

PETER GRIVERS
EA ENGINEERING SCIENCE & TECH. - RI
2350 POST ROAD
WARWICK, RI 02886

10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005

Field Sample # : SV-07

Sample ID : 05B39516
Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			10/08/05	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : SV-08

Sample ID : 05B39517
Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			10/08/05	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : SV-09

Sample ID : 05B39518
Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			10/08/05	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : SV-10

Sample ID : 05B39519
Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			10/08/05	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-11
Sample ID : 05B39520
Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			10/08/05	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-07
Sample ID : 05B39516
Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Acetone	PPBv	4.2	10/07/05	TPH	0.5			
Benzene	PPBv	ND	10/07/05	TPH	0.5			
Benzyl Chloride	PPBv	ND	10/07/05	TPH	2.0			
Bromodichloromethane	PPBv	ND	10/07/05	TPH	0.5			
Bromomethane	PPBv	ND	10/07/05	TPH	0.5			
1,3-Butadiene	PPBv	ND	10/07/05	TPH	0.5			
2-Butanone (MEK)	PPBv	ND	10/07/05	TPH	0.5			
Carbon Disulfide	PPBv	ND	10/07/05	TPH	0.5			
Carbon Tetrachloride	PPBv	ND	10/07/05	TPH	0.5			
Chlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
Chlorodibromomethane	PPBv	ND	10/07/05	TPH	0.5			
Chloroethane	PPBv	ND	10/07/05	TPH	0.5			
Chloroform	PPBv	ND	10/07/05	TPH	0.5			
Chloromethane	PPBv	ND	10/07/05	TPH	0.5			
Cyclohexane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dibromoethane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
1,3-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
1,4-Dichlorobenzene	PPBv	1.1	10/07/05	TPH	0.5			
Dichlorodifluoromethane	PPBv	0.5	10/07/05	TPH	0.5			
1,1-Dichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,1-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
cis-1,2-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
t-1,2-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichloropropane	PPBv	ND	10/07/05	TPH	0.5			
cis-1,3-Dichloropropene	PPBv	ND	10/07/05	TPH	0.5			
trans-1,3-Dichloropropene	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichlorotetrafluoroethane (114)	PPBv	ND	10/07/05	TPH	0.5			
Ethanol	PPBv	14.	10/07/05	TPH	0.5			

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10/12/2005

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Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-07

Sample ID : 05B39516

Sampled : 10/5/2005
NOT SPECIFIED
Sample Medium : SUMMA

Sample Matrix: AIR

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Ethyl Acetate	PPBv	ND	10/07/05	TPH	0.5			
Ethylbenzene	PPBv	1.7	10/07/05	TPH	0.5			
4-Ethyl Toluene	PPBv	ND	10/07/05	TPH	0.5			
n-Heptane	PPBv	ND	10/07/05	TPH	0.5			
Hexachlorobutadiene	PPBv	ND	10/07/05	TPH	2.0			
Hexane	PPBv	ND	10/07/05	TPH	0.5			
2-Hexanone	PPBv	ND	10/07/05	TPH	0.5			
Isopropanol	PPBv	1.2	10/07/05	TPH	0.5			
Methyl tert-Butyl Ether (MTBE)	PPBv	0.5	10/07/05	TPH	0.5			
Methylene Chloride	PPBv	0.8	10/07/05	TPH	0.5			
4-Methyl-2-Pentanone (MIBK)	PPBv	ND	10/07/05	TPH	0.5			
Propene	PPBv	0.9	10/07/05	TPH	0.5			
Styrene	PPBv	ND	10/07/05	TPH	0.5			
1,1,2,2-Tetrachloroethane	PPBv	ND	10/07/05	TPH	0.5			
Tetrachloroethylene	PPBv	ND	10/07/05	TPH	0.5			
Tetrahydrofuran	PPBv	ND	10/07/05	TPH	0.5			
Toluene	PPBv	1.1	10/07/05	TPH	0.5			
1,2,4-Trichlorobenzene	PPBv	ND	10/07/05	TPH	5.0			
1,1,1-Trichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,1,2-Trichloroethane	PPBv	ND	10/07/05	TPH	0.5			
Trichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
Trichlorofluoromethane (Freon 11)	PPBv	ND	10/07/05	TPH	0.5			
1,1,2-Trichloro-1,2,2-Trifluoroethane	PPBv	ND	10/07/05	TPH	0.5			
1,2,4-Trimethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
1,3,5-Trimethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
Vinyl Acetate	PPBv	ND	10/07/05	TPH	0.5			
Vinyl Chloride	PPBv	ND	10/07/05	TPH	0.5			
m/p-Xylene	PPBv	6.8	10/07/05	TPH	1.0			
o-Xylene	PPBv	2.2	10/07/05	TPH	0.5			

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-07

Analytical Method:
EPA TO-15
SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

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10/12/2005

Purchase Order No.: 2725

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-08

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Sample ID : 05B39517

Sampled : 10/5/2005
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Acetone	PPBv	12.	10/07/05	TPH	0.5			
Benzene	PPBv	ND	10/07/05	TPH	0.5			
Benzyl Chloride	PPBv	ND	10/07/05	TPH	2.0			
Bromodichloromethane	PPBv	ND	10/07/05	TPH	0.5			
Bromomethane	PPBv	ND	10/07/05	TPH	0.5			
1,3-Butadiene	PPBv	ND	10/07/05	TPH	0.5			
2-Butanone (MEK)	PPBv	2.0	10/07/05	TPH	0.5			
Carbon Disulfide	PPBv	2.7	10/07/05	TPH	0.5			
Carbon Tetrachloride	PPBv	ND	10/07/05	TPH	0.5			
Chlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
Chlorodibromomethane	PPBv	ND	10/07/05	TPH	0.5			
Chloroethane	PPBv	ND	10/07/05	TPH	0.5			
Chloroform	PPBv	ND	10/07/05	TPH	0.5			
Chloromethane	PPBv	ND	10/07/05	TPH	0.5			
Cyclohexane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dibromoethane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
1,3-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
1,4-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
Dichlorodifluoromethane	PPBv	ND	10/07/05	TPH	0.5			
1,1-Dichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,1-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
cis-1,2-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
t-1,2-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichloropropane	PPBv	ND	10/07/05	TPH	0.5			
cis-1,3-Dichloropropene	PPBv	ND	10/07/05	TPH	0.5			
trans-1,3-Dichloropropene	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichlorotetrafluoroethane (114)	PPBv	ND	10/07/05	TPH	0.5			
Ethanol	PPBv	9.5	10/07/05	TPH	0.5			

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-08
Sample ID : 05B39517
Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Ethyl Acetate	PPBv	ND	10/07/05	TPH	0.5			
Ethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
4-Ethyl Toluene	PPBv	ND	10/07/05	TPH	0.5			
n-Heptane	PPBv	ND	10/07/05	TPH	0.5			
Hexachlorobutadiene	PPBv	ND	10/07/05	TPH	2.0			
Hexane	PPBv	ND	10/07/05	TPH	0.5			
2-Hexanone	PPBv	ND	10/07/05	TPH	0.5			
Isopropanol	PPBv	1.5	10/07/05	TPH	0.5			
Methyl tert-Butyl Ether (MTBE)	PPBv	ND	10/07/05	TPH	0.5			
Methylene Chloride	PPBv	ND	10/07/05	TPH	0.5			
4-Methyl-2-Pentanone (MIBK)	PPBv	ND	10/07/05	TPH	0.5			
Propene	PPBv	ND	10/07/05	TPH	0.5			
Styrene	PPBv	ND	10/07/05	TPH	0.5			
1,1,2,2-Tetrachloroethane	PPBv	ND	10/07/05	TPH	0.5			
Tetrachloroethylene	PPBv	ND	10/07/05	TPH	0.5			
Tetrahydrofuran	PPBv	ND	10/07/05	TPH	0.5			
Toluene	PPBv	ND	10/07/05	TPH	0.5			
1,2,4-Trichlorobenzene	PPBv	ND	10/07/05	TPH	5.0			
1,1,1-Trichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,1,2-Trichloroethane	PPBv	ND	10/07/05	TPH	0.5			
Trichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
Trichlorofluoromethane (Freon 11)	PPBv	ND	10/07/05	TPH	0.5			
1,1,2-Trichloro-1,2,2-Trifluoroethane	PPBv	ND	10/07/05	TPH	0.5			
1,2,4-Trimethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
1,3,5-Trimethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
Vinyl Acetate	PPBv	ND	10/07/05	TPH	0.5			
Vinyl Chloride	PPBv	ND	10/07/05	TPH	0.5			
m/p-Xylene	PPBv	ND	10/07/05	TPH	1.0			
o-Xylene	PPBv	ND	10/07/05	TPH	0.5			

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10/12/2005

Purchase Order No.: 2725

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-08

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Analytical Method:
EPA TO-15
SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-09
Sample ID : 05B39518
Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Acetone	PPBv	7.6	10/07/05	TPH	0.5			
Benzene	PPBv	ND	10/07/05	TPH	0.5			
Benzyl Chloride	PPBv	ND	10/07/05	TPH	2.0			
Bromodichloromethane	PPBv	ND	10/07/05	TPH	0.5			
Bromomethane	PPBv	ND	10/07/05	TPH	0.5			
1,3-Butadiene	PPBv	ND	10/07/05	TPH	0.5			
2-Butanone (MEK)	PPBv	4.2	10/07/05	TPH	0.5			
Carbon Disulfide	PPBv	ND	10/07/05	TPH	0.5			
Carbon Tetrachloride	PPBv	ND	10/07/05	TPH	0.5			
Chlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
Chlorodibromomethane	PPBv	ND	10/07/05	TPH	0.5			
Chloroethane	PPBv	ND	10/07/05	TPH	0.5			
Chloroform	PPBv	ND	10/07/05	TPH	0.5			
Chloromethane	PPBv	ND	10/07/05	TPH	0.5			
Cyclohexane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dibromoethane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
1,3-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
1,4-Dichlorobenzene	PPBv	0.7	10/07/05	TPH	0.5			
Dichlorodifluoromethane	PPBv	ND	10/07/05	TPH	0.5			
1,1-Dichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,1-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
cis-1,2-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
t-1,2-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichloropropane	PPBv	ND	10/07/05	TPH	0.5			
cis-1,3-Dichloropropene	PPBv	ND	10/07/05	TPH	0.5			
trans-1,3-Dichloropropene	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichlorotetrafluoroethane (114)	PPBv	ND	10/07/05	TPH	0.5			
Ethanol	PPBv	3.9	10/07/05	TPH	0.5			

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Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-09
Sample ID : 05B39518
Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Ethyl Acetate	PPBv	ND	10/07/05	TPH	0.5			
Ethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
4-Ethyl Toluene	PPBv	ND	10/07/05	TPH	0.5			
n-Heptane	PPBv	ND	10/07/05	TPH	0.5			
Hexachlorobutadiene	PPBv	ND	10/07/05	TPH	2.0			
Hexane	PPBv	ND	10/07/05	TPH	0.5			
2-Hexanone	PPBv	0.8	10/07/05	TPH	0.5			
Isopropanol	PPBv	ND	10/07/05	TPH	0.5			
Methyl tert-Butyl Ether (MTBE)	PPBv	0.6	10/07/05	TPH	0.5			
Methylene Chloride	PPBv	0.6	10/07/05	TPH	0.5			
4-Methyl-2-Pentanone (MIBK)	PPBv	ND	10/07/05	TPH	0.5			
Propene	PPBv	1.3	10/07/05	TPH	0.5			
Styrene	PPBv	ND	10/07/05	TPH	0.5			
1,1,2,2-Tetrachloroethane	PPBv	ND	10/07/05	TPH	0.5			
Tetrachloroethylene	PPBv	ND	10/07/05	TPH	0.5			
Tetrahydrofuran	PPBv	ND	10/07/05	TPH	0.5			
Toluene	PPBv	1.3	10/07/05	TPH	0.5			
1,2,4-Trichlorobenzene	PPBv	ND	10/07/05	TPH	5.0			
1,1,1-Trichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,1,2-Trichloroethane	PPBv	ND	10/07/05	TPH	0.5			
Trichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
Trichlorofluoromethane (Freon 11)	PPBv	ND	10/07/05	TPH	0.5			
1,1,2-Trichloro-1,2,2-Trifluoroethane	PPBv	ND	10/07/05	TPH	0.5			
1,2,4-Trimethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
1,3,5-Trimethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
Vinyl Acetate	PPBv	ND	10/07/05	TPH	0.5			
Vinyl Chloride	PPBv	ND	10/07/05	TPH	0.5			
m/p-Xylene	PPBv	ND	10/07/05	TPH	1.0			
o-Xylene	PPBv	ND	10/07/05	TPH	0.5			

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NM = Not Measured
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SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

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EA ENGINEERING SCIENCE & TECH. - RI
2350 POST ROAD
WARWICK, RI 02886

10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-09

Analytical Method:
EPA TO-15
SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

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ND = Not Detected at or above the Reporting Limit

NM = Not Measured

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-10
Sample ID : 05B39519

Sampled : 10/5/2005
NOT SPECIFIED
Sample Medium : SUMMA

Sample Matrix: AIR

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Acetone	PPBv	10.	10/07/05	TPH	0.5			
Benzene	PPBv	ND	10/07/05	TPH	0.5			
Benzyl Chloride	PPBv	ND	10/07/05	TPH	2.0			
Bromodichloromethane	PPBv	ND	10/07/05	TPH	0.5			
Bromomethane	PPBv	ND	10/07/05	TPH	0.5			
1,3-Butadiene	PPBv	ND	10/07/05	TPH	0.5			
2-Butanone (MEK)	PPBv	1.5	10/07/05	TPH	0.5			
Carbon Disulfide	PPBv	ND	10/07/05	TPH	0.5			
Carbon Tetrachloride	PPBv	ND	10/07/05	TPH	0.5			
Chlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
Chlorodibromomethane	PPBv	ND	10/07/05	TPH	0.5			
Chloroethane	PPBv	ND	10/07/05	TPH	0.5			
Chloroform	PPBv	ND	10/07/05	TPH	0.5			
Chloromethane	PPBv	ND	10/07/05	TPH	0.5			
Cyclohexane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dibromoethane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
1,3-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
1,4-Dichlorobenzene	PPBv	0.6	10/07/05	TPH	0.5			
Dichlorodifluoromethane	PPBv	0.5	10/07/05	TPH	0.5			
1,1-Dichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,1-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
cis-1,2-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
t-1,2-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichloropropane	PPBv	ND	10/07/05	TPH	0.5			
cis-1,3-Dichloropropene	PPBv	ND	10/07/05	TPH	0.5			
trans-1,3-Dichloropropene	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichlorotetrafluoroethane (114)	PPBv	ND	10/07/05	TPH	0.5			
Ethanol	PPBv	ND	10/07/05	TPH	0.5			

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-10
Sample ID : 05B39519

Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Ethyl Acetate	PPBv	ND	10/07/05	TPH	0.5			
Ethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
4-Ethyl Toluene	PPBv	ND	10/07/05	TPH	0.5			
n-Heptane	PPBv	ND	10/07/05	TPH	0.5			
Hexachlorobutadiene	PPBv	ND	10/07/05	TPH	2.0			
Hexane	PPBv	0.5	10/07/05	TPH	0.5			
2-Hexanone	PPBv	ND	10/07/05	TPH	0.5			
Isopropanol	PPBv	ND	10/07/05	TPH	0.5			
Methyl tert-Butyl Ether (MTBE)	PPBv	0.6	10/07/05	TPH	0.5			
Methylene Chloride	PPBv	2.2	10/07/05	TPH	0.5			
4-Methyl-2-Pentanone (MIBK)	PPBv	ND	10/07/05	TPH	0.5			
Propene	PPBv	1.3	10/07/05	TPH	0.5			
Styrene	PPBv	ND	10/07/05	TPH	0.5			
1,1,2,2-Tetrachloroethane	PPBv	ND	10/07/05	TPH	0.5			
Tetrachloroethylene	PPBv	ND	10/07/05	TPH	0.5			
Tetrahydrofuran	PPBv	ND	10/07/05	TPH	0.5			
Toluene	PPBv	1.1	10/07/05	TPH	0.5			
1,2,4-Trichlorobenzene	PPBv	ND	10/07/05	TPH	5.0			
1,1,1-Trichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,1,2-Trichloroethane	PPBv	ND	10/07/05	TPH	0.5			
Trichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
Trichlorofluoromethane (Freon 11)	PPBv	0.9	10/07/05	TPH	0.5			
1,1,2-Trichloro-1,2,2-Trifluoroethane	PPBv	ND	10/07/05	TPH	0.5			
1,2,4-Trimethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
1,3,5-Trimethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
Vinyl Acetate	PPBv	ND	10/07/05	TPH	0.5			
Vinyl Chloride	PPBv	ND	10/07/05	TPH	0.5			
m/p-Xylene	PPBv	ND	10/07/05	TPH	1.0			
o-Xylene	PPBv	ND	10/07/05	TPH	0.5			

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-10

Analytical Method:
EPA TO-15
SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-11
Sample ID : 05B39520

Sampled : 10/5/2005
NOT SPECIFIED
Sample Medium : SUMMA

Sample Matrix: AIR

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Acetone	PPBv	16.	10/07/05	TPH	0.5			
Benzene	PPBv	ND	10/07/05	TPH	0.5			
Benzyl Chloride	PPBv	ND	10/07/05	TPH	2.0			
Bromodichloromethane	PPBv	ND	10/07/05	TPH	0.5			
Bromomethane	PPBv	ND	10/07/05	TPH	0.5			
1,3-Butadiene	PPBv	ND	10/07/05	TPH	0.5			
2-Butanone (MEK)	PPBv	2.3	10/07/05	TPH	0.5			
Carbon Disulfide	PPBv	ND	10/07/05	TPH	0.5			
Carbon Tetrachloride	PPBv	ND	10/07/05	TPH	0.5			
Chlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
Chlorodibromomethane	PPBv	ND	10/07/05	TPH	0.5			
Chloroethane	PPBv	ND	10/07/05	TPH	0.5			
Chloroform	PPBv	ND	10/07/05	TPH	0.5			
Chloromethane	PPBv	ND	10/07/05	TPH	0.5			
Cyclohexane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dibromoethane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
1,3-Dichlorobenzene	PPBv	ND	10/07/05	TPH	0.5			
1,4-Dichlorobenzene	PPBv	0.9	10/07/05	TPH	0.5			
Dichlorodifluoromethane	PPBv	ND	10/07/05	TPH	0.5			
1,1-Dichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,1-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
cis-1,2-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
t-1,2-Dichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichloropropane	PPBv	ND	10/07/05	TPH	0.5			
cis-1,3-Dichloropropene	PPBv	ND	10/07/05	TPH	0.5			
trans-1,3-Dichloropropene	PPBv	ND	10/07/05	TPH	0.5			
1,2-Dichlorotetrafluoroethane (114)	PPBv	ND	10/07/05	TPH	0.5			
Ethanol	PPBv	30.	10/07/05	TPH	0.5			

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-11
Sample ID : 05B39520

Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Ethyl Acetate	PPBv	ND	10/07/05	TPH	0.5			
Ethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
4-Ethyl Toluene	PPBv	ND	10/07/05	TPH	0.5			
n-Heptane	PPBv	ND	10/07/05	TPH	0.5			
Hexachlorobutadiene	PPBv	ND	10/07/05	TPH	2.0			
Hexane	PPBv	0.6	10/07/05	TPH	0.5			
2-Hexanone	PPBv	ND	10/07/05	TPH	0.5			
Isopropanol	PPBv	ND	10/07/05	TPH	0.5			
Methyl tert-Butyl Ether (MTBE)	PPBv	0.9	10/07/05	TPH	0.5			
Methylene Chloride	PPBv	2.1	10/07/05	TPH	0.5			
4-Methyl-2-Pentanone (MIBK)	PPBv	ND	10/07/05	TPH	0.5			
Propene	PPBv	1.5	10/07/05	TPH	0.5			
Styrene	PPBv	ND	10/07/05	TPH	0.5			
1,1,2,2-Tetrachloroethane	PPBv	ND	10/07/05	TPH	0.5			
Tetrachloroethylene	PPBv	ND	10/07/05	TPH	0.5			
Tetrahydrofuran	PPBv	ND	10/07/05	TPH	0.5			
Toluene	PPBv	1.3	10/07/05	TPH	0.5			
1,2,4-Trichlorobenzene	PPBv	ND	10/07/05	TPH	5.0			
1,1,1-Trichloroethane	PPBv	ND	10/07/05	TPH	0.5			
1,1,2-Trichloroethane	PPBv	ND	10/07/05	TPH	0.5			
Trichloroethylene	PPBv	ND	10/07/05	TPH	0.5			
Trichlorofluoromethane (Freon 11)	PPBv	0.6	10/07/05	TPH	0.5			
1,1,2-Trichloro-1,2,2-Trifluoroethane	PPBv	ND	10/07/05	TPH	0.5			
1,2,4-Trimethylbenzene	PPBv	0.9	10/07/05	TPH	0.5			
1,3,5-Trimethylbenzene	PPBv	ND	10/07/05	TPH	0.5			
Vinyl Acetate	PPBv	ND	10/07/05	TPH	0.5			
Vinyl Chloride	PPBv	ND	10/07/05	TPH	0.5			
m/p-Xylene	PPBv	ND	10/07/05	TPH	1.0			
o-Xylene	PPBv	ND	10/07/05	TPH	0.5			

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-11

Analytical Method:
EPA TO-15
SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

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10/12/2005

Purchase Order No.: 2725

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-07
Sample ID : 05B39516

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Acetone	ug/m3	9.9	10/07/05	TPH	1.2			
Benzene	ug/m3	ND	10/07/05	TPH	1.6			
Benzyl Chloride	ug/m3	ND	10/07/05	TPH	11.			
Bromodichloromethane	ug/m3	ND	10/07/05	TPH	3.4			
Bromomethane	ug/m3	ND	10/07/05	TPH	2.0			
1,3-Butadiene	ug/m3	ND	10/07/05	TPH	1.1			
2-Butanone (MEK)	ug/m3	ND	10/07/05	TPH	1.5			
Carbon Disulfide	ug/m3	ND	10/07/05	TPH	1.6			
Carbon Tetrachloride	ug/m3	ND	10/07/05	TPH	3.1			
Chlorobenzene	ug/m3	ND	10/07/05	TPH	2.3			
Chlorodibromomethane	ug/m3	ND	10/07/05	TPH	4.3			
Chloroethane	ug/m3	ND	10/07/05	TPH	1.4			
Chloroform	ug/m3	ND	10/07/05	TPH	2.5			
Chloromethane	ug/m3	ND	10/07/05	TPH	1.1			
Cyclohexane	ug/m3	ND	10/07/05	TPH	1.7			
1,2-Dibromoethane	ug/m3	ND	10/07/05	TPH	3.9			
1,2-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
1,3-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
1,4-Dichlorobenzene	ug/m3	6.4	10/07/05	TPH	3.0			
Dichlorodifluoromethane	ug/m3	2.6	10/07/05	TPH	2.5			
1,1-Dichloroethane	ug/m3	ND	10/07/05	TPH	2.1			
1,2-Dichloroethane	ug/m3	ND	10/07/05	TPH	2.1			
1,1-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
cis-1,2-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
t-1,2-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
1,2-Dichloropropane	ug/m3	ND	10/07/05	TPH	2.4			
cis-1,3-Dichloropropene	ug/m3	ND	10/07/05	TPH	2.3			
trans-1,3-Dichloropropene	ug/m3	ND	10/07/05	TPH	2.3			
1,2-Dichlorotetrafluoroethane (114)	ug/m3	ND	10/07/05	TPH	3.5			
Ethanol	ug/m3	27.	10/07/05	TPH	0.9			

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-07

Sample ID : 05B39516

Sampled : 10/5/2005
NOT SPECIFIED
Sample Medium : SUMMA

Sample Matrix: AIR

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Ethyl Acetate	ug/m3	ND	10/07/05	TPH	1.8			
Ethylbenzene	ug/m3	7.4	10/07/05	TPH	2.2			
4-Ethyl Toluene	ug/m3	ND	10/07/05	TPH	2.5			
n-Heptane	ug/m3	ND	10/07/05	TPH	2.0			
Hexachlorobutadiene	ug/m3	ND	10/07/05	TPH	22.			
Hexane	ug/m3	ND	10/07/05	TPH	1.8			
2-Hexanone	ug/m3	ND	10/07/05	TPH	2.0			
Isopropanol	ug/m3	3.1	10/07/05	TPH	1.2			
Methyl tert-Butyl Ether (MTBE)	ug/m3	1.8	10/07/05	TPH	1.8			
Methylene Chloride	ug/m3	2.7	10/07/05	TPH	1.7			
4-Methyl-2-Pentanone (MIBK)	ug/m3	ND	10/07/05	TPH	2.0			
Propene	ug/m3	1.6	10/07/05	TPH	0.9			
Styrene	ug/m3	ND	10/07/05	TPH	2.2			
1,1,2,2-Tetrachloroethane	ug/m3	ND	10/07/05	TPH	3.5			
Tetrachloroethylene	ug/m3	ND	10/07/05	TPH	3.4			
Tetrahydrofuran	ug/m3	ND	10/07/05	TPH	1.5			
Toluene	ug/m3	4.0	10/07/05	TPH	1.9			
1,2,4-Trichlorobenzene	ug/m3	ND	10/07/05	TPH	38.			
1,1,1-Trichloroethane	ug/m3	ND	10/07/05	TPH	2.8			
1,1,2-Trichloroethane	ug/m3	ND	10/07/05	TPH	2.8			
Trichloroethylene	ug/m3	ND	10/07/05	TPH	2.7			
Trichlorofluoromethane	ug/m3	ND	10/07/05	TPH	2.9			
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/m3	ND	10/07/05	TPH	3.9			
1,2,4-Trimethylbenzene	ug/m3	ND	10/07/05	TPH	2.5			
1,3,5-Trimethylbenzene	ug/m3	ND	10/07/05	TPH	2.5			
Vinyl Acetate	ug/m3	ND	10/07/05	TPH	1.8			
Vinyl Chloride	ug/m3	ND	10/07/05	TPH	1.3			
m/p-Xylene	ug/m3	30.	10/07/05	TPH	4.3			
o-Xylene	ug/m3	9.6	10/07/05	TPH	2.2			

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample

SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

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EA ENGINEERING SCIENCE & TECH. - RI
2350 POST ROAD
WARWICK, RI 02886

10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-07

Analytical Method:
EPA TO-15
SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

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SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-08
Sample ID : 05B39517

Sampled : 10/5/2005
NOT SPECIFIED
Sample Medium : SUMMA

Sample Matrix: AIR

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Acetone	ug/m3	30.	10/07/05	TPH	1.2			
Benzene	ug/m3	ND	10/07/05	TPH	1.6			
Benzyl Chloride	ug/m3	ND	10/07/05	TPH	11.			
Bromodichloromethane	ug/m3	ND	10/07/05	TPH	3.4			
Bromomethane	ug/m3	ND	10/07/05	TPH	2.0			
1,3-Butadiene	ug/m3	ND	10/07/05	TPH	1.1			
2-Butanone (MEK)	ug/m3	5.8	10/07/05	TPH	1.5			
Carbon Disulfide	ug/m3	8.4	10/07/05	TPH	1.6			
Carbon Tetrachloride	ug/m3	ND	10/07/05	TPH	3.1			
Chlorobenzene	ug/m3	ND	10/07/05	TPH	2.3			
Chlorodibromomethane	ug/m3	ND	10/07/05	TPH	4.3			
Chloroethane	ug/m3	ND	10/07/05	TPH	1.4			
Chloroform	ug/m3	ND	10/07/05	TPH	2.5			
Chloromethane	ug/m3	ND	10/07/05	TPH	1.1			
Cyclohexane	ug/m3	ND	10/07/05	TPH	1.7			
1,2-Dibromoethane	ug/m3	ND	10/07/05	TPH	3.9			
1,2-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
1,3-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
1,4-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
Dichlorodifluoromethane	ug/m3	ND	10/07/05	TPH	2.5			
1,1-Dichloroethane	ug/m3	ND	10/07/05	TPH	2.1			
1,2-Dichloroethane	ug/m3	ND	10/07/05	TPH	2.1			
1,1-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
cis-1,2-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
t-1,2-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
1,2-Dichloropropane	ug/m3	ND	10/07/05	TPH	2.4			
cis-1,3-Dichloropropene	ug/m3	ND	10/07/05	TPH	2.3			
trans-1,3-Dichloropropene	ug/m3	ND	10/07/05	TPH	2.3			
1,2-Dichlorotetrafluoroethane (114)	ug/m3	ND	10/07/05	TPH	3.5			
Ethanol	ug/m3	18.	10/07/05	TPH	0.9			

RL = Reporting Limit

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-08
Sample ID : 05B39517
Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Ethyl Acetate	ug/m3	ND	10/07/05	TPH	1.8			
Ethylbenzene	ug/m3	ND	10/07/05	TPH	2.2			
4-Ethyl Toluene	ug/m3	ND	10/07/05	TPH	2.5			
n-Heptane	ug/m3	ND	10/07/05	TPH	2.0			
Hexachlorobutadiene	ug/m3	ND	10/07/05	TPH	22.			
Hexane	ug/m3	ND	10/07/05	TPH	1.8			
2-Hexanone	ug/m3	ND	10/07/05	TPH	2.0			
Isopropanol	ug/m3	3.6	10/07/05	TPH	1.2			
Methyl tert-Butyl Ether (MTBE)	ug/m3	ND	10/07/05	TPH	1.8			
Methylene Chloride	ug/m3	ND	10/07/05	TPH	1.8			
4-Methyl-2-Pentanone (MIBK)	ug/m3	ND	10/07/05	TPH	2.0			
Propene	ug/m3	ND	10/07/05	TPH	0.9			
Styrene	ug/m3	ND	10/07/05	TPH	2.2			
1,1,2,2-Tetrachloroethane	ug/m3	ND	10/07/05	TPH	3.5			
Tetrachloroethylene	ug/m3	ND	10/07/05	TPH	3.4			
Tetrahydrofuran	ug/m3	ND	10/07/05	TPH	1.5			
Toluene	ug/m3	ND	10/07/05	TPH	1.9			
1,2,4-Trichlorobenzene	ug/m3	ND	10/07/05	TPH	38.			
1,1,1-Trichloroethane	ug/m3	ND	10/07/05	TPH	2.8			
1,1,2-Trichloroethane	ug/m3	ND	10/07/05	TPH	2.8			
Trichloroethylene	ug/m3	ND	10/07/05	TPH	2.7			
Trichlorofluoromethane	ug/m3	ND	10/07/05	TPH	2.9			
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/m3	ND	10/07/05	TPH	3.9			
1,2,4-Trimethylbenzene	ug/m3	ND	10/07/05	TPH	2.5			
1,3,5-Trimethylbenzene	ug/m3	ND	10/07/05	TPH	2.5			
Vinyl Acetate	ug/m3	ND	10/07/05	TPH	1.8			
Vinyl Chloride	ug/m3	ND	10/07/05	TPH	1.3			
m/p-Xylene	ug/m3	ND	10/07/05	TPH	4.4			
o-Xylene	ug/m3	ND	10/07/05	TPH	2.2			

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-08

Analytical Method:
EPA TO-15
SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

RL = Reporting Limit

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-09
Sample ID : 05B39518

Sampled : 10/5/2005
NOT SPECIFIED

Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Acetone	ug/m3	18.	10/07/05	TPH	1.2			
Benzene	ug/m3	ND	10/07/05	TPH	1.6			
Benzyl Chloride	ug/m3	ND	10/07/05	TPH	11.			
Bromodichloromethane	ug/m3	ND	10/07/05	TPH	3.4			
Bromomethane	ug/m3	ND	10/07/05	TPH	2.0			
1,3-Butadiene	ug/m3	ND	10/07/05	TPH	1.1			
2-Butanone (MEK)	ug/m3	12.	10/07/05	TPH	1.5			
Carbon Disulfide	ug/m3	ND	10/07/05	TPH	1.6			
Carbon Tetrachloride	ug/m3	ND	10/07/05	TPH	3.1			
Chlorobenzene	ug/m3	ND	10/07/05	TPH	2.3			
Chlorodibromomethane	ug/m3	ND	10/07/05	TPH	4.3			
Chloroethane	ug/m3	ND	10/07/05	TPH	1.4			
Chloroform	ug/m3	ND	10/07/05	TPH	2.5			
Chloromethane	ug/m3	ND	10/07/05	TPH	1.1			
Cyclohexane	ug/m3	ND	10/07/05	TPH	1.7			
1,2-Dibromoethane	ug/m3	ND	10/07/05	TPH	3.9			
1,2-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
1,3-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
1,4-Dichlorobenzene	ug/m3	4.1	10/07/05	TPH	3.0			
Dichlorodifluoromethane	ug/m3	ND	10/07/05	TPH	2.5			
1,1-Dichloroethane	ug/m3	ND	10/07/05	TPH	2.1			
1,2-Dichloroethane	ug/m3	ND	10/07/05	TPH	2.1			
1,1-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
cis-1,2-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
t-1,2-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
1,2-Dichloropropane	ug/m3	ND	10/07/05	TPH	2.4			
cis-1,3-Dichloropropene	ug/m3	ND	10/07/05	TPH	2.3			
trans-1,3-Dichloropropene	ug/m3	ND	10/07/05	TPH	2.3			
1,2-Dichlorotetrafluoroethane (114)	ug/m3	ND	10/07/05	TPH	3.5			
Ethanol	ug/m3	7.3	10/07/05	TPH	0.9			

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-09
Sample ID : 05B39518

Sampled : 10/5/2005
NOT SPECIFIED
Sample Medium : SUMMA

Sample Matrix: AIR

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Ethyl Acetate	ug/m3	ND	10/07/05	TPH	1.8			
Ethylbenzene	ug/m3	ND	10/07/05	TPH	2.2			
4-Ethyl Toluene	ug/m3	ND	10/07/05	TPH	2.5			
n-Heptane	ug/m3	ND	10/07/05	TPH	2.0			
Hexachlorobutadiene	ug/m3	ND	10/07/05	TPH	22.			
Hexane	ug/m3	ND	10/07/05	TPH	1.8			
2-Hexanone	ug/m3	3.4	10/07/05	TPH	2.0			
Isopropanol	ug/m3	ND	10/07/05	TPH	1.2			
Methyl tert-Butyl Ether (MTBE)	ug/m3	2.2	10/07/05	TPH	1.8			
Methylene Chloride	ug/m3	2.2	10/07/05	TPH	1.7			
4-Methyl-2-Pentanone (MIBK)	ug/m3	ND	10/07/05	TPH	2.0			
Propene	ug/m3	2.3	10/07/05	TPH	0.9			
Styrene	ug/m3	ND	10/07/05	TPH	2.2			
1,1,2,2-Tetrachloroethane	ug/m3	ND	10/07/05	TPH	3.5			
Tetrachloroethylene	ug/m3	ND	10/07/05	TPH	3.4			
Tetrahydrofuran	ug/m3	ND	10/07/05	TPH	1.5			
Toluene	ug/m3	5.0	10/07/05	TPH	1.9			
1,2,4-Trichlorobenzene	ug/m3	ND	10/07/05	TPH	38.			
1,1,1-Trichloroethane	ug/m3	ND	10/07/05	TPH	2.8			
1,1,2-Trichloroethane	ug/m3	ND	10/07/05	TPH	2.8			
Trichloroethylene	ug/m3	ND	10/07/05	TPH	2.7			
Trichlorofluoromethane	ug/m3	ND	10/07/05	TPH	2.9			
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/m3	ND	10/07/05	TPH	3.9			
1,2,4-Trimethylbenzene	ug/m3	ND	10/07/05	TPH	2.5			
1,3,5-Trimethylbenzene	ug/m3	ND	10/07/05	TPH	2.5			
Vinyl Acetate	ug/m3	ND	10/07/05	TPH	1.8			
Vinyl Chloride	ug/m3	ND	10/07/05	TPH	1.3			
m/p-Xylene	ug/m3	ND	10/07/05	TPH	4.4			
o-Xylene	ug/m3	ND	10/07/05	TPH	2.2			

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-09

Analytical Method:
EPA TO-15
SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

RL = Reporting Limit

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-10
Sample ID : 05B39519

Sampled : 10/5/2005
NOT SPECIFIED
Sample Medium : SUMMA

Sample Matrix: AIR

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Acetone	ug/m3	25.	10/07/05	TPH	1.2			
Benzene	ug/m3	ND	10/07/05	TPH	1.6			
Benzyl Chloride	ug/m3	ND	10/07/05	TPH	11.			
Bromodichloromethane	ug/m3	ND	10/07/05	TPH	3.4			
Bromomethane	ug/m3	ND	10/07/05	TPH	2.0			
1,3-Butadiene	ug/m3	ND	10/07/05	TPH	1.1			
2-Butanone (MEK)	ug/m3	4.5	10/07/05	TPH	1.5			
Carbon Disulfide	ug/m3	ND	10/07/05	TPH	1.6			
Carbon Tetrachloride	ug/m3	ND	10/07/05	TPH	3.1			
Chlorobenzene	ug/m3	ND	10/07/05	TPH	2.3			
Chlorodibromomethane	ug/m3	ND	10/07/05	TPH	4.3			
Chloroethane	ug/m3	ND	10/07/05	TPH	1.4			
Chloroform	ug/m3	ND	10/07/05	TPH	2.5			
Chloromethane	ug/m3	ND	10/07/05	TPH	1.1			
Cyclohexane	ug/m3	ND	10/07/05	TPH	1.7			
1,2-Dibromoethane	ug/m3	ND	10/07/05	TPH	3.9			
1,2-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
1,3-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
1,4-Dichlorobenzene	ug/m3	3.9	10/07/05	TPH	3.0			
Dichlorodifluoromethane	ug/m3	2.5	10/07/05	TPH	2.5			
1,1-Dichloroethane	ug/m3	ND	10/07/05	TPH	2.1			
1,2-Dichloroethane	ug/m3	ND	10/07/05	TPH	2.1			
1,1-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
cis-1,2-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
t-1,2-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
1,2-Dichloropropane	ug/m3	ND	10/07/05	TPH	2.4			
cis-1,3-Dichloropropene	ug/m3	ND	10/07/05	TPH	2.3			
trans-1,3-Dichloropropene	ug/m3	ND	10/07/05	TPH	2.3			
1,2-Dichlorotetrafluoroethane (114)	ug/m3	ND	10/07/05	TPH	3.5			
Ethanol	ug/m3	ND	10/07/05	TPH	0.9			

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample

SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-10
Sample ID : 05B39519

Sampled : 10/5/2005
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Ethyl Acetate	ug/m3	ND	10/07/05	TPH	1.8			
Ethylbenzene	ug/m3	ND	10/07/05	TPH	2.2			
4-Ethyl Toluene	ug/m3	ND	10/07/05	TPH	2.5			
n-Heptane	ug/m3	ND	10/07/05	TPH	2.0			
Hexachlorobutadiene	ug/m3	ND	10/07/05	TPH	22.			
Hexane	ug/m3	1.8	10/07/05	TPH	1.8			
2-Hexanone	ug/m3	ND	10/07/05	TPH	2.0			
Isopropanol	ug/m3	ND	10/07/05	TPH	1.2			
Methyl tert-Butyl Ether (MTBE)	ug/m3	2.1	10/07/05	TPH	1.8			
Methylene Chloride	ug/m3	7.8	10/07/05	TPH	1.7			
4-Methyl-2-Pentanone (MIBK)	ug/m3	ND	10/07/05	TPH	2.0			
Propene	ug/m3	2.3	10/07/05	TPH	0.9			
Styrene	ug/m3	ND	10/07/05	TPH	2.2			
1,1,2,2-Tetrachloroethane	ug/m3	ND	10/07/05	TPH	3.5			
Tetrachloroethylene	ug/m3	ND	10/07/05	TPH	3.4			
Tetrahydrofuran	ug/m3	ND	10/07/05	TPH	1.5			
Toluene	ug/m3	4.3	10/07/05	TPH	1.9			
1,2,4-Trichlorobenzene	ug/m3	ND	10/07/05	TPH	38.			
1,1,1-Trichloroethane	ug/m3	ND	10/07/05	TPH	2.8			
1,1,2-Trichloroethane	ug/m3	ND	10/07/05	TPH	2.8			
Trichloroethylene	ug/m3	ND	10/07/05	TPH	2.7			
Trichlorofluoromethane	ug/m3	4.9	10/07/05	TPH	2.8			
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/m3	ND	10/07/05	TPH	3.9			
1,2,4-Trimethylbenzene	ug/m3	ND	10/07/05	TPH	2.5			
1,3,5-Trimethylbenzene	ug/m3	ND	10/07/05	TPH	2.5			
Vinyl Acetate	ug/m3	ND	10/07/05	TPH	1.8			
Vinyl Chloride	ug/m3	ND	10/07/05	TPH	1.3			
m/p-Xylene	ug/m3	ND	10/07/05	TPH	4.4			
o-Xylene	ug/m3	ND	10/07/05	TPH	2.2			

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample

SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

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2350 POST ROAD
WARWICK, RI 02886

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-10

Analytical Method:
EPA TO-15
SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample

SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

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10/12/2005

Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-11
Sample ID : 05B39520

Sampled : 10/5/2005
NOT SPECIFIED
Sample Medium : SUMMA

Sample Matrix: AIR

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/F
Acetone	ug/m3	39.	10/07/05	TPH	1.2			
Benzene	ug/m3	ND	10/07/05	TPH	1.6			
Benzyl Chloride	ug/m3	ND	10/07/05	TPH	11.			
Bromodichloromethane	ug/m3	ND	10/07/05	TPH	3.4			
Bromomethane	ug/m3	ND	10/07/05	TPH	2.0			
1,3-Butadiene	ug/m3	ND	10/07/05	TPH	1.1			
2-Butanone (MEK)	ug/m3	6.8	10/07/05	TPH	1.5			
Carbon Disulfide	ug/m3	ND	10/07/05	TPH	1.6			
Carbon Tetrachloride	ug/m3	ND	10/07/05	TPH	3.1			
Chlorobenzene	ug/m3	ND	10/07/05	TPH	2.3			
Chlorodibromomethane	ug/m3	ND	10/07/05	TPH	4.3			
Chloroethane	ug/m3	ND	10/07/05	TPH	1.4			
Chloroform	ug/m3	ND	10/07/05	TPH	2.5			
Chloromethane	ug/m3	ND	10/07/05	TPH	1.1			
Cyclohexane	ug/m3	ND	10/07/05	TPH	1.7			
1,2-Dibromoethane	ug/m3	ND	10/07/05	TPH	3.9			
1,2-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
1,3-Dichlorobenzene	ug/m3	ND	10/07/05	TPH	3.1			
1,4-Dichlorobenzene	ug/m3	5.6	10/07/05	TPH	3.0			
Dichlorodifluoromethane	ug/m3	ND	10/07/05	TPH	2.5			
1,1-Dichloroethane	ug/m3	ND	10/07/05	TPH	2.1			
1,2-Dichloroethane	ug/m3	ND	10/07/05	TPH	2.1			
1,1-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
cis-1,2-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
t-1,2-Dichloroethylene	ug/m3	ND	10/07/05	TPH	2.0			
1,2-Dichloropropane	ug/m3	ND	10/07/05	TPH	2.4			
cis-1,3-Dichloropropene	ug/m3	ND	10/07/05	TPH	2.3			
trans-1,3-Dichloropropene	ug/m3	ND	10/07/05	TPH	2.3			
1,2-Dichlorotetrafluoroethane (114)	ug/m3	ND	10/07/05	TPH	3.5			
Ethanol	ug/m3	57.	10/07/05	TPH	0.9			

RL = Reporting Limit

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-11
Sample ID : 05B39520

Sampled : 10/5/2005
NOT SPECIFIED
Sample Medium : SUMMA

Sample Matrix: AIR

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
Ethyl Acetate	ug/m3	ND	10/07/05	TPH	1.8			
Ethylbenzene	ug/m3	ND	10/07/05	TPH	2.2			
4-Ethyl Toluene	ug/m3	ND	10/07/05	TPH	2.5			
n-Heptane	ug/m3	ND	10/07/05	TPH	2.0			
Hexachlorobutadiene	ug/m3	ND	10/07/05	TPH	22.			
Hexane	ug/m3	2.1	10/07/05	TPH	1.8			
2-Hexanone	ug/m3	ND	10/07/05	TPH	2.0			
Isopropanol	ug/m3	ND	10/07/05	TPH	1.2			
Methyl tert-Butyl Ether (MTBE)	ug/m3	3.4	10/07/05	TPH	1.8			
Methylene Chloride	ug/m3	7.4	10/07/05	TPH	1.7			
4-Methyl-2-Pentanone (MIBK)	ug/m3	ND	10/07/05	TPH	2.0			
Propene	ug/m3	2.6	10/07/05	TPH	0.9			
Styrene	ug/m3	ND	10/07/05	TPH	2.2			
1,1,2,2-Tetrachloroethane	ug/m3	ND	10/07/05	TPH	3.5			
Tetrachloroethylene	ug/m3	ND	10/07/05	TPH	3.4			
Tetrahydrofuran	ug/m3	ND	10/07/05	TPH	1.5			
Toluene	ug/m3	5.0	10/07/05	TPH	1.9			
1,2,4-Trichlorobenzene	ug/m3	ND	10/07/05	TPH	38.			
1,1,1-Trichloroethane	ug/m3	ND	10/07/05	TPH	2.8			
1,1,2-Trichloroethane	ug/m3	ND	10/07/05	TPH	2.8			
Trichloroethylene	ug/m3	ND	10/07/05	TPH	2.7			
Trichlorofluoromethane	ug/m3	3.1	10/07/05	TPH	2.8			
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/m3	ND	10/07/05	TPH	3.9			
1,2,4-Trimethylbenzene	ug/m3	4.3	10/07/05	TPH	2.5			
1,3,5-Trimethylbenzene	ug/m3	ND	10/07/05	TPH	2.5			
Vinyl Acetate	ug/m3	ND	10/07/05	TPH	1.8			
Vinyl Chloride	ug/m3	ND	10/07/05	TPH	1.3			
m/p-Xylene	ug/m3	ND	10/07/05	TPH	4.4			
o-Xylene	ug/m3	ND	10/07/05	TPH	2.2			

RL = Reporting Limit

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SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005
Field Sample # : SV-11

Analytical Method:
EPA TO-15
SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

RL = Reporting Limit
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Purchase Order No.: 2725

LIMS-BAT #: LIMS-92298
Job Number: 6196501-0011

Project Location: PROVIDENCE
Date Received: 10/5/2005

** END OF REPORT **

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

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SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

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QC SUMMARY REPORT

SAMPLE QC: Sample Results with Duplicates
Sample Matrix Spikes and Matrix Spike Duplicates

BATCH QC: Lab fortified Blanks and Duplicates
Standard Reference Materials and Duplicates
Method Blanks

Report Date: 10/12/2005 Lims Bat # : LIMS-92298

QC Batch Number: BATCH-9902

Sample Id	Analysis	QC Analysis	Values	Units	Limits
05B39516					
	4-Bromofluorobenzene	Surrogate Recovery	97.0	%	70-130
05B39517					
	4-Bromofluorobenzene	Surrogate Recovery	88.8	%	70-130
05B39518					
	4-Bromofluorobenzene	Surrogate Recovery	90.8	%	70-130
05B39519					
	4-Bromofluorobenzene	Surrogate Recovery	90.9	%	70-130
05B39520					
	4-Bromofluorobenzene	Surrogate Recovery	91.4	%	70-130
BLANK-79569					
	Acetone	Blank	<1.2	ug/m3	
	Benzene	Blank	<1.6	ug/m3	
	Carbon Tetrachloride	Blank	<3.1	ug/m3	
	Chloroform	Blank	<2.5	ug/m3	
	1,2-Dichloroethane	Blank	<2.1	ug/m3	
	1,4-Dichlorobenzene	Blank	<3.1	ug/m3	
	Ethyl Acetate	Blank	<1.8	ug/m3	
	Ethylbenzene	Blank	<2.2	ug/m3	
	Hexane	Blank	<1.8	ug/m3	
	Isopropanol	Blank	<1.2	ug/m3	
	2-Butanone (MEK)	Blank	<1.5	ug/m3	
	4-Methyl-2-Pentanone (MIBK)	Blank	<2.0	ug/m3	
	Styrene	Blank	<2.2	ug/m3	
	Tetrachloroethylene	Blank	<3.4	ug/m3	
	Toluene	Blank	<1.9	ug/m3	
	1,1,1-Trichloroethane	Blank	<2.8	ug/m3	
	Trichloroethylene	Blank	<2.7	ug/m3	
	1,1,2-Trichloro-1,2,2-Trifluoroethane	Blank	<3.9	ug/m3	
	Trichlorofluoromethane	Blank	<2.9	ug/m3	
	o-Xylene	Blank	<2.2	ug/m3	
	m/p-Xylene	Blank	<4.4	ug/m3	
	1,2-Dichlorobenzene	Blank	<3.1	ug/m3	
	1,3-Dichlorobenzene	Blank	<3.1	ug/m3	
	1,1-Dichloroethane	Blank	<2.1	ug/m3	
	1,1-Dichloroethylene	Blank	<2.0	ug/m3	
	Ethanol	Blank	<0.9	ug/m3	
	4-Ethyl Toluene	Blank	<2.5	ug/m3	
	Methyl tert-Butyl Ether (MTBE)	Blank	<1.8	ug/m3	
	t-1,2-Dichloroethylene	Blank	<2.0	ug/m3	
	Vinyl Chloride	Blank	<1.3	ug/m3	
	Methylene Chloride	Blank	<1.8	ug/m3	
	Chlorobenzene	Blank	<2.3	ug/m3	
	Chloromethane	Blank	<1.1	ug/m3	

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QC SUMMARY REPORT

SAMPLE QC: Sample Results with Duplicates
Sample Matrix Spikes and Matrix Spike Duplicates

BATCH QC: Lab fortified Blanks and Duplicates
Standard Reference Materials and Duplicates
Method Blanks

Report Date: 10/12/2005 Lims Bat # : LIMS-92298

QC Batch Number: BATCH-9902

Sample Id	Analysis	QC Analysis	Values	Units	Limits
BLANK-79569					
	Bromomethane	Blank	<2.0	ug/m3	
	Chloroethane	Blank	<1.4	ug/m3	
	cis-1,3-Dichloropropene	Blank	<2.3	ug/m3	
	trans-1,3-Dichloropropene	Blank	<2.3	ug/m3	
	Chlorodibromomethane	Blank	<4.3	ug/m3	
	1,1,2-Trichloroethane	Blank	<2.8	ug/m3	
	1,1,2,2-Tetrachloroethane	Blank	<3.5	ug/m3	
	Hexachlorobutadiene	Blank	<22.	ug/m3	
	1,2,4-Trichlorobenzene	Blank	<38.	ug/m3	
	1,2,4-Trimethylbenzene	Blank	<2.5	ug/m3	
	1,3,5-Trimethylbenzene	Blank	<2.5	ug/m3	
	Cyclohexane	Blank	<1.7	ug/m3	
	cis-1,2-Dichloroethylene	Blank	<2.0	ug/m3	
	1,2-Dichloropropane	Blank	<2.4	ug/m3	
	Dichlorodifluoromethane	Blank	<2.5	ug/m3	
	Benzyl Chloride	Blank	<11.	ug/m3	
	Carbon Disulfide	Blank	<1.6	ug/m3	
	Vinyl Acetate	Blank	<1.8	ug/m3	
	2-Hexanone	Blank	<2.0	ug/m3	
	Bromodichloromethane	Blank	<3.4	ug/m3	
	1,2-Dibromoethane	Blank	<3.9	ug/m3	
	n-Heptane	Blank	<2.0	ug/m3	
	1,2-Dichlorotetrafluoroethane (114)	Blank	<3.5	ug/m3	
	Tetrahydrofuran	Blank	<1.5	ug/m3	
	Propene	Blank	<0.9	ug/m3	
	1,3-Butadiene	Blank	<1.1	ug/m3	

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QC SUMMARY REPORT

SAMPLE QC: Sample Results with Duplicates
Sample Matrix Spikes and Matrix Spike Duplicates

BATCH QC: Lab fortified Blanks and Duplicates
Standard Reference Materials and Duplicates
Method Blanks

Report Date: 10/12/2005 Lims Bat # : LIMS-92298

QUALITY CONTROL DEFINITIONS AND ABBREVIATIONS

QC BATCH NUMBER	This is the number assigned to all samples analyzed together that would be subject to comparison with a particular set of Quality Control Data.
LIMITS	Upper and Lower Control Limits for the QC ANALYSIS Reported. All values normally would fall within these statistically determined limits, unless there is an unusual circumstance that would be documented in a NOTE appearing on the last page of the QC SUMMARY REPORT. Not all QC results will have Limits defined.
Sample Amount	Amount of analyte found in a sample.
Blank	Method Blank that has been taken though all the steps of the analysis.
LFBLANK	Laboratory Fortified Blank (a control sample)
STDADD	Standard Added (a laboratory control sample)
Matrix Spk Amt Added	Amount of analyte spiked into a sample
MS Amt Measured	Amount of analyte found including amount that was spiked
Matrix Spike % Rec.	% Recovery of spiked amount in sample.
Duplicate Value	The result from the Duplicate analysis of the sample.
Duplicate RPD	The Relative Percent Difference between two Duplicate Analyses.
Surrogate Recovery	The % Recovery for non-environmental compounds (surrogates) spiked into samples to determine the performance of the analytical methods.
Sur. Recovery (ELCD)	Surrogate Recovery on the Electrolytic Conductivity Detector.
Sur. Recovery (PID)	Surrogate Recovery on the Photoionization Detector.
Standard Measured	Amount measured for a laboratory control sample
Standard Amt Added	Known value for a laboratory control sample
Standard % Recovery	% recovered for a laboratory control sample with a known value.
Lab Fort Blank Amt	Laboratory Fortified Blank Amount Added
Lab Fort Blk. Found	Laboratory Fortified Blank Amount Found
Lab Fort Blk % Rec	Laboratory Fortified Blank % Recovered
Dup Lab Fort Bl Amt	Duplicate Laboratory Fortified Blank Amount Added
Dup Lab Fort Bl Fnd	Duplicate Laboratory Fortified Blank Amount Found
Dup Lab Fort Bl % Rec	Duplicate Laboratory Fortified Blank % Recovery
Lab Fort Blank Range	Laboratory Fortified Blank Range (Absolute value of difference between recoveries for Lab Fortified Blank and Lab Fortified Blank Duplicate).
Lab Fort Bl. Av. Rec.	Laboratory Fortified Blank Average Recovery
Duplicate Sample Amt	Sample Value for Duplicate used with Matrix Spike Duplicate
MSD Amount Added	Matrix Spike Duplicate Amount Added (Spiked)
MSD Amt Measured	Matrix Spike Duplicate Amount Measured
MSD % Recovery	Matrix Spike Duplicate % Recovery
MSD Range	Absolute difference between Matrix Spike and Matrix Spike Duplicate Recoveries

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RESULTS FOR METHOD 3C

Lab ID Number: 05B39516
Client ID Number: SV-7

LIMS Number: 92298
Analyst: TPH
Date Analyzed: 10/8/05

Analyte:	**Sample Results %**	MDL %
Methane	ND	0.10

Gases sample analyzed by GC/TCD, method 3C(modified).
ND = Not Detected
MDL = Minimum Detectable Limit

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RESULTS FOR METHOD 3C

Lab ID Number: 05B39517
Client ID Number: SV-8

LIMS Number: 92298
Analyst: TPH
Date Analyzed: 10/8/05

Analyte:	**Sample Results %**	MDL %
Methane	ND	0.10

Gases sample analyzed by GC/TCD, method 3C(modified).
ND = Not Detected
MDL = Minimum Detectable Limit

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RESULTS FOR METHOD 3C

Lab ID Number: 05B39518
Client ID Number: SV-9

LIMS Number: 92298
Analyst: TPH
Date Analyzed: 10/8/05

Analyte:	Sample Results %	MDL %
Methane	ND	0.10

Gases sample analyzed by GC/TCD, method 3C(modified).
ND = Not Detected
MDL = Minimum Detectable Limit

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RESULTS FOR METHOD 3C

Lab ID Number: 05B39519
Client ID Number: SV-10

LIMS Number: 92298
Analyst: TPH
Date Analyzed: 10/8/05

Analyte:	**Sample Results** %	MDL %
Methane	ND	0.10

Gases sample analyzed by GC/TCD, method 3C(modified).
ND = Not Detected
MDL = Minimum Detectable Limit

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RESULTS FOR METHOD 3C

Lab ID Number: 05B39520
Client ID Number: SV-11

LIMS Number: 92298
Analyst: TPH
Date Analyzed: 10/8/05

Analyte:	**Sample Results %**	MDL %
Methane	ND	0.10

Gases sample analyzed by GC/TCD, method 3C(modified).
ND = Not Detected
MDL = Minimum Detectable Limit

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Email: info@contestlabs.com
www.contestlabs.com
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CHAIN OF CUSTODY RECORD

lims #92298

Company Name: EA Engineering, Science, and Technology
Address: 2350 Post Rd. Warwick, RI
Attention: Peter Grivers
Project Location: Providence
Sampled By: Peter Grivers

Telephone: (401) 736-3440
Project # 6196501-0011
Client PO #

DATA DELIVERY (check one): ☐FAX ☑EMAIL ☐WEBSITE CLIENT
Fax #:
Email: pgrivers@eaest.com
Format: ☐ EXCEL ☑ PDF ☐ GIS KEY ☐ OTHER

Proposal Provided? (For Billing purposes) ☑ yes 9/16/05 #0905-21 proposal date
State Form Required? ☐ yes ☒ no

ANALYSIS REQUESTED

Field ID	Sample Description	Lab # 05B	Start Date/Time	Stop Date/Time	Composite	Grab	*Matrix Code	TO-15	Methane
# of containers								1	1
**Preservation								–	–
~Cont.Code								S	S
SV-7	CT-1820	39516	10-5-05 0750	10-5-05 0750		✓	A	X	X
SV-8	CT-4028	39517	0805	0805		↓	↓	↓	↓
SV-9	CT-1720	39518	0812	0812		↓	↓	↓	↓
SV-10	CT-1392	39519	0825	0825		↓	↓	↓	↓
SV-11	CT-1335	39520	0830	0830		↓	↓	↓	↓
~~SV-12~~	~~CT-3386~~		~~0837~~	~~0837~~					

~Cont. Code: A=amber glass, G=glass, P=plastic, ST=sterile, V= vial, S=summa can, T=tedlar bag, O=Other

Client Comments: Do not analyze CT-3386. No vacuum in summa. PG 10-5-05

Laboratory Comments: ~~Do not A~~

	Date/Time
Relinquished by: (signature) [signature]	1320 10-5-05
Received by: (signature) [signature]	1320 10-5-05
Relinquished by: (signature) [signature]	4:45 pm 10-5-05
Received by: (signature) [signature]	10/5/05 1645

Turnaround **
☐ 7-Day
☐ 10-Day
☒ Other 5-Day
RUSH *
☐ *24-Hr ☐ *48-Hr
☐ *72-Hr ☐ *4-Day
* Require lab approval

Detection Limit Requirements
Regulations? CTDEP TAC
Data Enhancement Project/RCP? ☐ Y ☒ N
Special Requirements or DL's: Please set MDLs ≤ CTDEP TAC

***Matrix Code:**
GW= groundwater
WW= wastewater
DW= drinking water
(A) = air
S = soil/solid
SL = sludge
O = other

****Preservation Codes:**
I = Iced
H = HCL
M = Methanol
N = Nitric Acid
S = Sulfuric Acid
B = Sodium bisulfate
O = Other
X = Na hydroxide
T = Na thiosulfate

**Turnaround time begins at 9:00 a.m. the day after sample receipt (unless received before 2:00 p.m.)

SAMPLE RECEIPT CHECKLIST

CLIENT NAME: EA Engineering

RECIEVED BY: JS

DATE: 10/5/05

con-test ANALYTICAL LABORATORY

Was chain of custody relinquished and signed?		(yes)	no	Explain:
Does Chain agree with samples?		(yes)	no	Explain:
All samples in good condition?		(yes)	no	
Were samples received in compliance with temperaure 0-6 degrees C?	NA	yes	no	______ degrees C
Are there any on-hold samples?		yes	(no)	
Laboratory analysts notified?	(n/a)	yes	no	Who______ Time:______ Initials:______
Location where samples are stored: air lab				

CONTAINERS RECEIVED AT CON-TEST	# of containers			COMMENTS
1 liter amber				
500 ml amber				
250 ml amber (8oz amber)				
1 liter plastic				
500 ml plastic				
250 ml plastic				
40 ml vial				
colisure bottle				
flashpoint bottle				
dissolved oxygen bottle				
1 liter clear jar				
8 oz clear jar				
4 oz clear jar				
2 oz clear jar				
plastic bag				
air cassette				
encore sample				
brass sleeves				
tubes				
summa cans	6			
other				

Laboratory Comments:
do not analyze CT-3386

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