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TO Ms. Rui Feng

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DATE 12/14/06

PAGES (incl. cover)

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FROM Kris Almskog **EMAIL** krisa@pwgrosser.com

RE
NYSDEC Brownfields Cleanup Program
Final Remedial Work Plan
White Plains Courtyard Apartments Redevelopment Project
2040 White Plains Road
Bronx, NY

☒Attached ☐Under separate cover ☐ overnight ☐regular mail:

COMMENTS

Attached is the revised Remedial Work Plan for 2040 White Plains Road, Bronx, NY. Please contact me or Charles Sosik at 631.357.4297 with any questions or comments.

Thanks

NYSDEC
BROWNFIELDS CLEANUP PROGRAM

REMEDIAL WORK PLAN
DECEMBER 2006

SITE NO. C203031
White Plains Courtyard Apartments
Redevelopment Project
2040 White Plains Road
Bronx, NY

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P.W. GROSSER CONSULTING INC.
PROJECT No. ARK0401

NEW YORK STATE BROWNFIELDS CLEANUP PROGRAM
SITE No. C203031

REMEDIAL WORK PLAN

FORMER SHELL SERVICE STATION
2040 WHITE PLAINS ROAD
BRONX, NEW YORK

December, 2006

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1.0 INTRODUCTION

1.1 Project Background

This Remedial Work Plan (RWP) has been prepared by P.W. Grosser Consulting Inc.(PWGC), on behalf of Metro Management, Inc. (Metro) of Woodmere, New York, for a commercial property, located at 2040 White Plains Road, Bronx, New York (**Figure 1**). Redevelopment plans for the former retail gas station and automobile repair shop include the construction of a residential apartment complex with first floor retail space and associated grounds. Construction of the building began in November of 2005.

Prior to the purchase by Metro, the property had been in continual service as a gasoline service station for approximately fifty years. Previous environmental investigations identified petroleum impacted soil and groundwater beneath the site. Due to the historic use of the property and the confirmed presence of gasoline-related contaminants in soil, groundwater and soil gas, the site was formally accepted into New York State's Brownfield Clean-up Program (BCP) on May 9, 2005 (Site No. C203031).

A Remedial Investigation (RI) report has been prepared by PWGC to document the nature and extent of contaminants at the site. The RI report and this Remedial Action Plan are being submitted to DEC together and will be placed in the designated document repository for public access.

The Remedial Investigation concluded that significant levels of volatile organic compounds (VOCs) in groundwater remain in the vicinity of the former waste-oil UST and beneath the former service station building building and that VOCs in groundwater are above standards at several locations on the property. The proposed RWP includes the injection of a chemical oxidant solution into petroleum impacted groundwater areas north and beneath the former service station building building and the installation of a vapor barrier and a sub-slab venting system beneath the new building.

The field work portion of the RI was largely completed by PWGC from February 11 through August 29, 2005, in accordance with the protocols and methods as established by the New York State Department of Environmental Conservation (DEC) in Draft DER-10 Technical Guidance for Site Investigation and Remediation (12/25/02). Supplemental field work was also performed at the site in January, June and July of 2006.

1.2 Site Location and Description

The subject property is located at 2040 White Plains Road on the east side of White Plains Road between Bronxdale Avenue and Brady Avenue,Bronx, New York (**Figure 1**). The property, identified as Block 4284, Lot 5, consists of a single 25,000 square foot parcel (see **Figure 2** Site Plan). Until recently, the site was improved with a one-story 1,512 square foot masonry building, which was constructed in 1954. The building formerly a Shell Service Station, has since been demolished and construction of the new multi-use (retail, residential) building, is currently underway.

The property is located within a residential area of the Bronx. The general area is comprised of residential apartments and commercial buildings, such as restaurants, supermarkets and gas stations. A one-story strip-mall is located on the property north of the site. The strip-mall contains a restaurant, a martial arts studio and a parking garage. The property adjacent to the south is occupied by a specialty food market and a bingo hall. A Mobil gas station is located across White Plains Road to the west and a six story residential building is located east of the site.

1.3 Summary of Previous Investigations and Interim Remedial Measures

Numerous environmental investigations, remedial studies and remedial actions have been performed at the site and are documented in the NYSDEC file including the following:

- Limited Phase II Site Investigation, 2040 White Plains Road, Bronx, New York, EnviroTrac, Ltd., 1998
- Subsurface Investigation Report, Shell Service Station, 2040 White Plains Road, Bronx, New York, Phoenix Environmental Technology, Inc. July 2004
- Phase I Environmental Site Assessment, 2040 White Plains Road, Bronx, New York, PWGC, December 2004.
- Interim Remedial Measure Work Plan (*UST Closure*) for 2040 White Plains Road, Bronx, New York, PWGC, June, 2005.
- Interim Remedial Measure Report (*UST Closure*), 2040 White Plains Road, Bronx, New York, SAIC, October 2005.
- Interim Remedial Measure for Hot Spot Reduction (*Chemical Oxidant Injections*), 2040 White Plains Road, Bronx, New York, PWGC, October, 2005.
- Amendment Letter for Interim Remedial Measure for Hot Spot Reduction (*Chemical Oxidant Injections*), 2040 White Plains Road, Bronx, New York, PWGC, December, 2005.
- Remedial Investigation Report, 2040 White Plains Road, Bronx, New York, PWGC, September 2006

1.3.1 Limited Phase II Site Investigation

A limited Phase II Site Investigation was performed at the site in 1998 by EnviroTrac, Ltd, under contract to Motiva. The investigation included the installation of three groundwater monitoring wells, one in the vicinity of the former waste oil tank, one in the general vicinity of the gasoline USTs and a third near the southwest corner of the property. Initial sample results from the three monitoring wells, indicated that total BTEX compounds and MTBE were present at concentrations significantly above groundwater standards (total BTEX: 1,881 ug/L, MTBE: 2,280 ug/L). The results were reported to the NYSDEC, which responded by assigning spill file number 98-08824 to the site.

Following discussions with the NYSDEC Project Manager, Motiva implementing a quarterly sampling and analysis program to monitor conditions at the site. The program continued for approximately 2 years, during which a general declining trend was observed in VOC concentrations. In August 2000, Motiva requested closure of the spill file. After review, the NYSDEC responded by closing the spill file in November 2000.

1.3.2 Subsurface Investigation Report

In July 2004, Phoenix Environmental Technology, Inc. (Phoenix), under contract to Motiva, collected groundwater samples at the site to establish a baseline for VOCs in groundwater in preparation for divestment of the property. The focus of the sampling program was to determine if there had been a change in groundwater quality at the 3 locations monitored by EnviroTrac from 1998 to 2000. To complete this task, Phoenix used temporary probe equipment to collect groundwater samples from the three previously abandoned monitoring well locations. The results of the samples indicated that the concentrations of BTEX and MTBE had decreased since the final sampling event performed by Envirotrac in August 2000.

1.3.3 Phase I Environmental Site Assessment

A Phase I ESA was completed by PWGC, and documented in a report dated December 21, 2004. The ESA revealed that the property had been in continual service as a gas station since at least 1956 and, prior to that, was used as an open air car lot from at least 1949. At the time of the site inspection, the site consisted of a one-story masonry building, two dispenser islands with a canopy and a paved parking lot. The station, which was owned and operated by Motiva Enterprises (Motiva), had been closed for several months.

The records search performed for the ESA identified two NYSDEC petroleum spill files associated with the property, and one unregistered storage tank which had been previously removed. The site is listed on the Petroleum Bulk Storage (PBS) database under the name "Whitestone Shell". The registry (PBS No. 2-190780) lists five storage tanks at the site including:

- three 4,000 gallon gasoline underground storage tanks (USTs);
- one 550 gallon fuel oil UST, and;
- one 250 gallon above ground storage tank (AST) used for waste oil

The PBS record indicates that the tanks were installed in 1971, and are listed as "in-service".

The ESA noted that the site is listed on the NYSPILLS database. The database indicated that there were two spills associated with the site. The first spill (98-08824), which was opened as a result of a limited subsurface investigation performed in 1998, was closed in November 2000. The second spill (98-02162) was opened as a result of impacted soil identified during the removal of a waste oil UST in 1995. The tank was not previously registered with the NYSDEC, and this spill file remains open.

The site inspection performed as part of the ESA identified the storage of batteries and drums containing oily rags and used oil filters, around the building's exterior. The building interior was not

accessible for inspection, leaving the possibility of floor drains and hydraulic lift equipment as a potential concern.

The Phase I ESA Report recommended the following actions:

- register the waste oil UST removed in 1995 and excavate impacted soils to close the open Spill File (98-02162).
- perform a geophysical survey to determine if additional USTs are present at the site.
- remove and properly dispose of debris observed during the site inspection including used automobile batteries and drums containing oily rags and oil filters.
- inspect the building for floor drains and hydraulic lifts. If floor drains are identified it is recommended that the discharge location of these structures be identified. If it is determined that they discharge directly to the subsurface, it is recommended that the floor drains be sampled in order to determine if improper discharges have impacted the subsurface. If the building contains hydraulic lifts, they should be properly removed.

1.3.4 Interim Remedial Measure (UST Closure)

In July 2005, Science Applications International Corporation (SAIC) and Island Pump and Tank (IPT), under contract to Motiva, implemented an Interim Remedial Measure at the property. The IRM was implemented in accordance with the approved IRM Work Plan (PWGC, 5/05) and consisted of the removal of three gasoline USTs, one fuel-oil UST and all associated piping. During implementation of the IRM, impacted soil was encountered and removed from the former waste-oil UST area just north of the service station building. During the course of the gasoline UST removal and excavation of the former waste-oil UST area, approximately 227 tons of petroleum impacted soil were removed from the site and disposed of at a permitted facility.

Following the removal of the USTs, associated piping and impacted soil, nineteen confirmatory endpoint samples were collected. Two samples were collected from each sidewall and the bottom of the UST excavation, one from beneath each of the four former dispenser locations and five from beneath the piping. Although one or more SVOCs were detected at concentrations exceeding NYSDEC RSCOs in each of the nineteen endpoint samples collected, the site-wide distribution of the compounds and concentrations detected is consistent with that of "historic or urban" fill material, encountered throughout the five Boroughs. VOCs were detected at concentrations exceeding NYSDEC RSCOs in a single sample, PIPE-5, collected from beneath the piping along the western property boundary. During removal of the piping, a small amount of fuel remaining in the pipe was spilled in the vicinity of the PIPE-5 sample location. Soil was excavated to bedrock and two additional endpoint samples were collected. No VOC impact was detected in the additional endpoint samples.

Following the removal of impacted soil from the former waste-oil UST area, a total of five endpoint samples were collected, one from each of the four sidewalls and the bottom of the excavation. SVOCs were detected above NYSDEC RSCOs in each of the endpoint samples. However, the site-

wide distribution of the compounds and the concentrations detected are consistent with that of "historic or urban"fill materials, encountered throughout the five Boroughs, and is not representative of petroleum related impact from the site.

Four test pits were installed in former suspect UST and dispenser areas. No petroleum impacted soil was encountered in the test pits, and a total of five soil samples were collected. One sample was collected from the bottom of Test Pits 1, 2 and 3 and two were collected from Test Pit 4. Although SVOCs were detected at concentrations above the NYSDEC RSCOs in the test pit samples, the site-wide distribution of the compounds and concentrations detected were consistent with that of "historic or urban" fill materials, encountered throughout the five Boroughs, and is not representative of petroleum impact.

The Interim Remedial Measure was successful in removing all petroleum contaminated soil, and with the exception of the site-wide distribution of common urban fill parameters, the unrestricted soil cleanup objectives, as established in Draft 6NYCRR 375-6 have been met.

1.3.5 Interim Remedial Measure (Chemical Oxidant Injections)

In October, 2005, PWGC prepared an Interim Remedial Measure to address high concentration areas, or "hot spots" of VOCs in groundwater on the property (Interim Remedial Measure for Hot Spot Reduction, PWGC, 10/05). DEC formally approved the IRM in a letter dated December 20, 2005. The IRM specified the use of an activated chemical oxidant (sodium persulfate) to significantly reduce on-site concentrations of VOC contaminants in groundwater. The initial phase of the program was performed in January 2006 and included the injection of oxidant solution at 21 locations throughout the former waste oil tank area and station building area with Geoprobe equipment. A secondary injection was performed in February - March 2006 which included the same locations as the initial event plus 11 locations installed into bedrock in the vicinity of suspect dispenser areas located along White Plains Road and Bronxdale Avenue (**Figure 3**). Follow-up injections of 10 and 7 points respectively, were performed in July and September of 2006, in the primary hot spot areas, as shown in **Figure 4.**

The IRM program has been successful in achieving significant reductions in on-site VOC concentrations within the hot spot areas. Concentrations in the vicinity of the former waste oil tank area were reduced from 28,878 ug/L in January 2006 to 53 ug/L in June 2006. Concentrations within the former service station building area were reduced from 145,832 ug/L in January 2006 to 4,398 ug/L in September 2006. Off-site concentrations show a general decline during implementation of the IRM with an average total reduction from 8,843 ug/L to 6,086 ug/L. It must be noted that groundwater flow across the site, and from on-site to off-site is expected to be severely limited by the construction of the new building's foundation which extends below the water table and, with the exception of an 80 foot section in the south east corner of the site, extends to the bedrock surface. In addition, construction of the new building over the northern half of the site eliminates surface recharge through this formerly unpaved area.

1.4 Summary of the Remedial Investigation

The purpose of the field work portion of the RI completed by PWGC was to collect data of sufficient quality and quantity to supplement the previous investigations conducted at the site and to close gaps

in the data set necessary to adequately characterize the nature and extent of contamination at the site, evaluate contaminant migration, characterize the potential exposure to human health and the environment and select the most appropriate remedial technology.

This work was performed in accordance with the Draft DER-10 Technical Guidance for Site Investigation and Remediation, as released by the NYSDEC on 12/25/02. Details of the RI are provided in the *Remedial Investigation Report, 2040 White Plains Road* (PWGC 9/06).

1.4.1 Summary of the Nature and Extent of Contamination

The results of sampling performed during the RI, identified residual VOCs in soil above NYSDEC Recommended Soil Cleanup Objective (RSCO) concentrations in the vicinity of the former waste-oil UST. During the course of the UST removal and excavation of the former waste-oil UST area, approximately 227 tons of petroleum impacted soil was removed from the site and disposed of at a properly permitted facility. Endpoint verification sampling confirmed that the removal of affected soil was successful.

VOCs in groundwater were detected above NYSDEC Ambient Water Quality Standards (AWQS) at sampling locations throughout the site, with the highest concentrations occurring in the vicinity of and beneath the former service station building. A significant reduction in on-site groundwater concentrations (VOCs) was achieved in response to a series of chemical oxidant injections performed under an IRM program (1/06 to present).

Based on the proximity to the property line and the VOC concentrations in samples collected from MW-7, MW-12, HL-N and HL-S, the RI Report concluded that impacted groundwater may be migrating off-site from the former waste- oil UST area and from beneath the former service station building, in an easterly direction. However, an overall reduction in the average off-site concentrations has been observed following implementation of the chemical oxidant injection program. Groundwater flow from on-site to off-site is expected to be severely limited by the construction of the new building's foundation which extends below the water table and, with the exception of an 80 foot section in the south east corner of the site, extends to the bedrock surface. In addition, construction of the new building over the northern half of the site eliminates surface recharge through this formerly unpaved area.

Total VOC concentrations detected in soil-gas samples were fairly consistent throughout the site during the initial round of sampling on August 27, 2005, and did not appear to correlate well with groundwater impact areas during this round. Tetrachloroethene was also widely detected across the site. Tetrachloroethene is not generally associated with petroleum impact and it has not been identified as a site related contaminant.

During the second round of soil gas sampling on July 27, 2006, benzene was detected in SG2 and SG3. The fact that comparable benzene levels were detected in widely spaced samples suggests that it is not related to groundwater contamination. Tetrachloroethylene and trichloroethene were also detected across the site during this round.

1.4.2 Summary of the Exposure Assessment

The objective of the qualitative exposure assessment under the Brownfield Cleanup Program (BCP) is to identify potential receptors to the contaminants of concern (COC) that are present at, or migrating from, the 2040 White Plains Road site. The identification of exposure pathways describes the route that the COC takes to travel from the source to the receptor. An identified pathway indicates that the potential for exposure exists; it does not imply that exposures actually occur. An exposure pathway has five elements; a contaminant source, release and transport mechanisms, point of exposure, route of exposure and a receptor population.

The potential exposure pathways identified below, represent both current and future exposure scenarios.

Contaminant Source

The source of the VOCs detected at the site are generally related to the historic use of the property as a gasoline service station. Although a specific point of discharge is unknown, impacted soil and groundwater within the waste oil UST area and impacted groundwater beneath the former service station building are considered the sources for purposes of evaluating exposure.

Contaminant Release and Transport Mechanism

VOC compounds present in soil above the water table interface may transfer to the vapor phase through volatilization and migrate through interstitial pore spaces in response to pressure gradients. VOCs in the vapor phase would be expected to accumulate on-site beneath the asphalt cover and may migrate along higher permeability zones adjacent to utility conduits. This may allow VOCs in soil gas to migrate off-site.

Residual VOC compounds in soil which are in contact with the groundwater will transfer to the dissolved phase and migrate east to southeast with groundwater flow. VOCs in groundwater may also volatilize to air resulting in elevated VOC concentrations in soil gas both on-site and off-site.

An IRM was successfully completed which removed impacted soil from the site. Endpoint verification samples demonstrate that soil at the site has been remediated to Track 1 soil cleanup standards as set forth in Draft 6NYCRR Part 375-6. VOCs remain in groundwater, however, and will be addressed through the implementation of this Remedial Plan.

Point of Exposure, Route of Exposure and Potentially Exposed Populations

Potential On-Site Exposures: Remediation workers and construction workers engaged in the excavation of impacted and non-impacted soil at the site may be exposed to VOCs through several routes. Workers excavating impacted soil may be exposed to VOCs through inhalation, ingestion and dermal contact. It is unlikely that construction workers would be exposed to impacted soil since the IRM was successful in removing this material from the site. Workers excavating non-impacted soil may be exposed to VOCs in soil gas through inhalation. A site specific Health and Safety Plan has been developed to identify and minimize the potential hazards to on-site workers during the current construction activity.

Under a future scenario, commercial workers and residents within the proposed building could be exposed to vapor intrusion if remediation is not performed, or if preventive measures are not incorporated into the new building design (i.e. vapor barrier, sub-slab venting). Ingestion of affected

groundwater is not a concern since the water supply for the new building will be provided by the New York City Water System.

Potential Off-Site Exposures: The entire area is serviced by the New York City Water System which distributes water from the Croton Reservoir system. Since there are no public or private potable supply wells in the area, exposure from contact with tap water is not a concern. Off-site exposure is therefore limited to vapor intrusion from migrating soil gas and VOCs off-gassing from impacted groundwater leaving the site, if remedial activity to reduce VOC concentrations in groundwater are performed. The potentially exposed population would include residents in adjacent buildings and commercial workers in retail businesses.

Off-site exposure from VOCs in groundwater to indoor air, assumes that VOCs present in groundwater at the site are migrating off-site with minimal attenuation, transferring to the vapor phase and entering commercial or residential buildings through pores and cracks in the foundation to the breathing zoning.

Utility workers excavating conduits and service lines beneath the sidewalk and streets could also be potentially exposed to vapor migrating along the backfill trenches associated with the installation of these lines if remedial activity to reduce VOC concentrations in groundwater is not performed.

Potential Off-Site Environmental Impacts: Since VOCs in shallow groundwater may be leaving the site in an easterly direction, the groundwater to surface water discharge pathway was evaluated. Based on topographic maps of the area, there are no surface water bodies within 1 mile downgradient of the site. The nearest body of water downgradient of the site is Eastchester Bay which is approximately 14,000 feet to the east. The nearest body of water is the Bronx River, which is located approximately 1,600 feet west (upgradient) of the site. There are no expected impacts to surface water environments since there are no surface water bodies within 1 mile downgradient of the site.

2.0 REMEDY SELECTION

The goal of the remedy selection process under the BCP is to select a remedy that is protective of human health and the environment taking into consideration the current, intended and reasonably anticipated future use of the property. The remedy selection process begins by establishing remedial action objectives (RAOs) for media in which chemical constituents were found in exceedance of NYSDEC standards, criteria and guidance values (SCGs). A remedy is then developed based on the following nine criteria:

- Overall Protection of Public Health and the Environment;
- Compliance with Standards, Criteria and Guidance;
- Long-term Effectiveness and Permanence;
- Reduction in Toxicity, Mobility or Volume with Treatment;
- Short-term Effectiveness;
- Implementability;
- Cost, and;
- Community Acceptance

2.1 Remedial Action Objectives

2.1.1 Subsurface Soil

As part of the IRM, approximately 227 tons of petroleum impacted soil was removed from source areas in the vicinity of the former waste-oil and gasoline USTs and the former dispenser island areas. The IRM was successful in removing impacted soil from the identified source areas, as demonstrated by the verification (endpoint)sampling program. With the exception of the site-wide distribution of common urban fill parameters, subsurface soil at the site meets the unrestricted soil cleanup objectives, as established in 6NYCRR 375-6. Therefore, remedial action objectives for soil are unnecessary.

2.1.2 Groundwater

Although groundwater in the vicinity of the site is not used for any purpose, AWQS for Class GA (potable) groundwater is considered an SCG. VOCs were detected in groundwater above the NYSDEC AWQS at the site. Following implementation of a chemical oxidant injection program, performed under an IRM, the highest on-site concentrations currently remain beneath the former service station building footprint, in the vicinity of monitoring well TW2. Since the entire area is serviced by a municipal water supply, exposure is limited to vapor intrusion into the new building via off-gassing of VOCs from shallow groundwater.

RAOs for public health protection will include reducing VOCs in groundwater to prevent future commercial workers at the site from potentially inhaling VOCs off-gassing from groundwater. RAOs for environmental protection will include continued reduction of VOCs in groundwater to improve overall groundwater quality.

reduce VOCs

2.2 Alternatives Analysis

Since the proposed remedy will meet the unrestricted Tract 1 clean-up criteria and not follow a use-based approach, an Alternatives Analysis is not required.

2.3 Description of Selected Remedy

The Remedial Action recommended for the site consists of continued spot injections of a chemical oxidant solution in the vicinity of the former service station building footprint, and the installation of a vapor barrier and sub-slab venting system beneath the retail portion of new building's foundation as a preventative measure. Chemical oxidant injection is intended to continue to reduce the VOCs remaining in the former high concentration areas, and thereby accelerate the restoration of impacted groundwater through natural attenuation processes. The vapor barrier and sub-slab venting system for the retail portion of the building are designed as a preventative measure to prevent the potential infiltration of VOCs through the building's concrete slab foundation.

2.3.1 Chemical Oxidant Injection

To reduce the mass of dissolved BTEX and VOCs in groundwater beneath the site and prevent off-site contaminant migration, a chemical oxidant solution (sodium persulfate) will be injected into the groundwater beneath and north of the existing on-site building.

Persulfate is a stable, highly soluble, crystalline material, which upon activation generates the sulfate radical, a strong oxidant, capable of oxidizing a broad range of recalcitrant compounds. The persulfate anion itself is a strong oxidizer, providing an alternate mechanism for oxidation. Activation of persulfate to form the sulfate radical can be accomplished by heating or by catalysis with transition metals. For this application the pursulfate will be activated FeEDTA a chelated metal complex to destroy the compounds of interest

Activated persulfate will be applied through 12 semi-permanent PVC injection points, which will be installed throughout the former service station building area. The locations of the semi-permanent oxidant injection points are illustrated in **Figure 5**. Additional injection points will be installed as needed to assure adequate coverage of the area under treatment.

2.3.2 Vapor Barrier

To significantly reduce the potential for vapor intrusion, a vapor barrier and sub-slab ventilation piping have been installed as a preventative measure beneath the foundation of the retail section of the building which covers approximately two-thirds of the property. The remaining third of the building footprint is dedicated as parking garage with open air ventilation.

The vapor barrier will be installed beneath the base of the foundation, and will consist of 30 mil high density polyethylene (HDPE) sheeting. Upon project completion, the entire building will be underlain by an HDPE vapor barrier with the exception of the parking garage which will be continuously vented to the outside through large open areas in the east, west and south walls.

2.4 Remedy Evaluation Criteria

The remedial action selected to meet the medium-specific RAOs, was based on the following nine

criteria, as specified in DER-10, Section 4.1:

Overall Protection of Public Health and the Environment
The recommended remedial action achieves protection of the public health and the environment by remediating the high concentration of VOCs in groundwater and by taking steps to significantly reduce the potential for vapor intrusion in the new building while VOCs in groundwater continue to attenuate. The remedy will meet all of the RAOs established for soil and groundwater at the site.

Compliance with Standards, Criteria and Guidance
The recommended remedial action meets the objectives of the RAOs by removing the potential for human and environmental exposures to chemical constituents above SCGs in groundwater. The IRM implemented at the site effectively removed the source area s resulting in compliance with SCGs for soils. Removal of the source area and the chemical oxidation treatment program will result in significant improvement of groundwater quality with respect to SCGs.

Long-term Effectiveness and Permanence
Long-term risks have been mitigated by the removal of the remaining source area and the installation of a vapor barrier, and sub-slab venting system in the new building. Following the chemical oxidation treatment, monitoring of groundwater will continue to verify the improvement in groundwater quality.

Reduction of Toxicity, Mobility and Volume
The recommended action will reduce the toxicity, mobility and volume of the chemical constituents by removing the source area of contamination and effectively treating the high concentration areas of VOCs in groundwater..

Short-term Effectiveness
Potential short-term adverse impacts include exposure to VOCs and oxidants to remediation workers during the chemical oxidation program. A health and safety plan has been prepared (**Attachment A**) to protect on-site remediation workers from exposure during remedy implementation.

Implementability
The selected remedy is based on simple, commonly-used techniques and processes. No issues related to the design, availability or implementation of the selected remedy is anticipated.

Cost
The selected remedy is a cost-effective approach to meet the RAOs of the site and completes the remedial process as initiated by the volunteer under the IRM previously implemented at the site.

Community Acceptance
Public participation plays a large role in the BCP process. A fact sheet will be prepared and sent out to all interested parties as identified in the site contact list. This document will be placed in a local repository and made available for public review and comment for a period of 45 days. Since the removal of USTs and the excavation of impacted soil under the IRM did not encounter community opposition, issues with respect to community acceptance are not anticipated.

3.0 ENGINEERING SPECIFICATIONS AND CONTROLS

3.1 Engineering Specifications

3.1.1 *Chemical Oxidant Injection Program*

Sodium persulfate and a chelated iron activator will be delivered to the Site as a dry powder and mixed with water to produce a sodium persulfate solution. The activated sodium persulfate solution will be prepared by mixing 9 lbs of FeEDTA powder to each 55 lb bag of sodium persulfate powder and approximately 38 gallons of water to produce a 20 % sodium persulfate solution.

Field personnel will set up a mixing and distribution system consisting of a mixing tank, transfer pump and appropriate distribution hoses and fittings to connect to injection points. All equipment surfaces that come into contact with the sodium persulfate solution will be constructed of materials compatible with the sodium persulfate solution, as the solution may damage common materials like carbon steel.

Approximately 12 semi-permanent, 1 inch pvc, injection points will be installed in the parking garage area in and around the footprint of the former service station building. Proposed injection points are illustrated in **Figure 5**, though additional points may be added as needed to provide adequate coverage. Each injection well will be constructed with 10 feet of 0.020 slotted well screen and completed to a total depth of 20 ft below grade or bedrock. A standard No. 2 morie filter pack, or equivalent, will be placed in the borehole around the well to a minimum of 2 feet above the screened section. The borehole will then be grouted with a cement-bentonite slurry to grade.

Activated sodium persulfate solution will be injected into the 1 inch pvc injection points at a concentration of approximately 20 percent. After the initial application of oxidant, a groundwater sampling program will be implemented to monitor the progress of treatment and to determine if subsequent injections are warranted. This process will continue until remediation goals or asymptotic levels have been achieved.

3.1.2 *Sub-Slab Venting System Design and Installation*

A sub-slab venting system was specified for this site as a precautionary measure and installed prior to completion of the slab within the retail section of the building. The sub-slab venting system consists of four separate rings of 4-inch HDPE corrugated smooth interior pipe in a geotextile fabric. Installation was performed by laying the piping out in the specified configuration over a compacted base. Gravel was then placed around and over the pipe to bring the level to final grade. A 30 mil HDPE vapor barrier was then placed over the gravel before pouring the slab.

Each vent system ring was tied to a 6 inch "tee" connection, at the eastern wall A 6 inch pvc extension run from the tee to the surface along the eastern wall of the building, and temporarily capped. Exhaust piping from the 6 inch pvc extension will run up the eastern wall to the first floor roof. Exhaust piping at the roof will be completed with a Radonway high-flow, in-line fan model RP265 or the equivalent. The fan will be equipped with a vacuum monitor which will be mounted in an appropriate location such as a mechanical room or security office. Detailed specifications of

the sub-slab venting system are shown in the engineering plans provided in **Attachment B**. A PWGC field inspector under the direct supervision of a professional engineer, inspected the sub-slab piping at several critical stages before during and after the installation was complete to assure compliance with design specifications. The engineer's certification letter is presented in **Attachment B**. Final testing and demonstration of the sub-slab vent system's performance will be made in coordination with and under the direction of the NYSDOH.

The sub-slab venting system was designed and installed as a precautionary measure. Operation will only be initiated if needed to prevent vapor intrusion into the building.

3.1.3 *Vapor Barrier Design and Installation*

A vapor barrier was recommended for this project and previously installed as a preventative measure. This section includes the specifications and guidelines which were provided to the construction management company and followed for installation of a below concrete slab sheet vapor barrier at the site. The vapor barrier extends throughout the area occupied by the commercial section of the new building currently under construction at the site. A PWGC field inspector under the direct supervision of a professional engineer, inspected the vapor barrier at several critical stages before during and after the installation was complete, to assure compliance with design specifications.

The specifications provided to the construction management company for the vapor barrier were as follows:

Vapor barrier seams, penetrations, and repairs will be sealed either by the tape method or weld method, according to the manufacturer's recommendations and instructions.

A vapor retarder or barrier, by definition, is a material or assembly of materials that resists vapor diffusion through it. For this project the sheet material will consist of a black high-density polyethylene (HDPE) film, 30 mil thick.

ASTM references for vapor barriers include the following:

- ASTM E 1745-97 "Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs."
- ASTM E 1643-98 "Standard Practice for Vapor Barriers."

Materials
The minimum values for the HDPE film will meet the following:

Property	Test Method	Minimum Values
Thickness, mil (mm)	ASTM D 5199	30 (0.75)
Density, g/cm3	ASTM D 1505	0.94
Carbon Black Content, %	ASTM D 1603, mod.	2.0

Tensile Properties (each direction) Strength at Yield, lb/in. (kN/m) Strength at Break, lb/in. (kN/m) Elongation at Yield, % Elongation at Break, %	ASTM D 6693 (1.3" gauge length) (2.0" gauge length)	 63 (11) 122 (21) 13 700
Tear Resistance, lb (N)	ASTM D 1004	21 (93)
Puncture Resistance, lb (N)	ASTM D 4833	59 (263)
Notched Constant Tensile Load, hours	ASTM D 5397, app.	400
Oxidative Induction Time, min.	ASTM D 3895	100

Manufacturers of products meeting the above specifications include:

- IN-LINE PLASTICS, LC - Herculine Geomembranes Line
- GSE LINING TECHNOLOGY, INC. - Smooth Black-Surfaced HDPE Geomembrane

Substitutions shall be permitted only after receiving written approval from the Engineer.

All joints in the HDPE sheeting will be sealed with either a tape seal or a weld seal. The tape seal consists of a polyethylene self-adhering tape, 2 inch (50 mm) wide, compatible with sheet material and a liquid membrane, compatible with the sheet material.

The weld seal consists of an extrudate rod or bead, compatible with sheet material.

Preparation for the installation of the vapor barrier membrane is as follows:

- Do not install vapor retarder/barrier until items penetrating it are in place.
- Rake, trim, and tamp surfaces over which membrane is to be installed.
- Substrates must be regular and smooth with no gaps or voids greater than 0.5 inches (12 mm)
- The substrate must be free of loose aggregate and sharp protrusions.
- The substrate does not need to be dry, but standing water must be removed.

Membrane Installation
Place the membrane HDPE film side to the substrate with printed coating side up facing towards the concrete pour. Lay membrane with seams perpendicular to and lapped in direction of concrete pour. End laps should be staggered to avoid a build-up of layers. Accurately position succeeding sheets to overlap the previous sheet 3 inches (75 mm). Ensure that the underside of the succeeding sheet is clean, dry, and free from contamination before attempting to overlap.

If manufacturer recommends sealing overlaps with tape, proceed with the following steps:

- Secure overlaps to the bottom sheet with tape.

- Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller. During cold or damp conditions, the tape adhesive can be gently warmed using a hot air gun or similar to remove moisture or condensation and improve initial adhesion.

- If manufacturer recommends sealing overlaps by welding, weld overlap seams according to manufacturer's instructions.
- Penetrations through the membrane such as utility conduits, can be sealed either using the tape and liquid membrane method or the extrusion weld method.

Procedures for sealing penetrations using the tape and seal method include the following:

- Scribe membrane tight to the penetration.
- If the membrane is not within 0.5 inches (12 mm) of the penetration, apply tape to cover the gap.
- Wrap the penetration with tape by positioning the tape 0.5 inches (12 mm) above the membrane.
- Mix and apply Liquid Membrane around the penetrations using a fillet to provide a watertight seal between the membrane and tape.

Procedures for sealing penetrations using the extrusion weld method include the following:

Scribe membrane tight to the penetration.

- Perform extrusion weld techniques according to manufacturer's instructions.

Protection
Protect membrane from damage until permanent covering is in place.
Membrane Repair
The membrane can be repaired using either the tape method or the weld method.

The procedure to repair the membrane using the tape method is as follows:

- Repair punctures and tears in membrane using patches of the material and overlapping the puncture or tear a minimum of 12 inches.

- Seal with tape.

The procedure to repair the membrane using the weld method is as follows:

- Repair punctures and tears in membrane using patches of the material and overlapping the puncture or tear a minimum of 6 inches. Seal with extrusion weld.

Inspection
Upon completion of the installation of the membrane, the Contractor shall coordinate an inspection with the Engineer or its designated representative. The membrane shall not be covered until the Contractor receives written approval from the Engineer.

Pouring of Concrete
It is recommended that concrete be poured within 56 days of application of the membrane. Concrete must be placed and compacted carefully to avoid damage to the membrane. Never use a sharp object to consolidate the concrete.

4.0 MONITORING AND MAINTENANCE

4.1 Remediation Phase Groundwater Monitoring

Periodic groundwater sampling will be performed to monitor the progress of the chemical oxidant treatment program. Samples will be collected from temporary wells TW2, TW5, and from proposed temporary well TW6, and from long term monitoring wells PWG2, PWG3 and PWG4 (**Figure 6**), two weeks following the initial injection application. Samples will be submitted to a NYSDOH certified laboratory for analysis of VOCs, persulfate and Fe^{2+}. Following the receipt of the laboratory results, a decision will be made to:

- perform a subsequent injection application (either full or partial); or
- based on high persulfate/Fe2+ content, wait 2 weeks and sample again; or
- terminate the injection program.

4.2 Post-Remediation Groundwater Monitoring

Following the completion of the chemical oxidant treatment program, groundwater quality will be monitored at the six off-site monitoring well locations (PW1-PW6) as shown in **Figure 6**. Groundwater samples will be collected on a quarterly basis and submitted for analysis of VOCs, for a minimum of four quarters to monitor overall improvements to groundwater quality.

4.3 Performance Monitoring - Sub-Slab Venting System

If operation of the sub-slab venting system is required, performance monitoring will be conducted to verify the effectiveness of the system. Performance monitoring will consist of sub-slab pressure readings to demonstrate negative pressure beneath the slab.

Sub-slab vapor probes will be constructed with polyethylene or Teflon® tubing of laboratory or food grade quality; and will not extend further than two inches into the sub-slab material. Porous backfill material (i.e., coarse sand or glass beads) will be added to cover about one inch of the probe tip and the vapor probe will be sealed to the surface with permagum grout, melted beeswax, putty or other non-VOC-containing and non-shrinking product.

The number and location of the vapor probes will be determined through consultation with the NYSDOH and NYSDEC project managers. Vapor probe locations will be limited to mechanical rooms and store room areas within the building.

The need for additional performance monitoring (i.e. indoor air testing, soil gas sampling) will be made in consultation with the NYSDEC and the NYSDOH. If, additional testing is necessary, it will be performed in accordance with the methods and procedures as specified in the *Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH, 10/06).*

4.4 Laboratory Analysis

Collected groundwater samples will be placed in pre-cleaned laboratory supplied glassware, and placed in a cooler packed with ice for transport to the laboratory. Sample analysis will be provided by American Analytical Laboratories, Inc., of Farmingdale, New York, a New York State certified environmental laboratory (NYSDOH ID #11418) and consist of the following:

- Volatile organic Compounds (VOCs) by EPA Method 8260;

Samples will be submitted to the laboratory for a standard turnaround time, which is estimated to be one to two weeks.

4.5 Quality Assurance / Quality Control

The fundamental QA objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the QC acceptance of the analytical protocol. The accuracy, precision and completeness requirements will be addressed by the laboratory for all data generated.

Collected samples will be appropriately packaged, placed in coolers and shipped via overnight courier or delivered directly to the analytical laboratory by field personnel. Samples will be containerized in appropriate laboratory provided glassware and shipped in plastic coolers. Samples will be preserved through the use of ice or "cold-paks" to maintain a temperature of 4°C.

If dedicated disposable materials are used to collect groundwater samples (polyethylene tubing, dedicated samplers), field equipment (rinsate) blanks will not be part of the QA/QC program. Trip blanks will accompany samples each time they are transported to the laboratory.

In accordance with DER-10, the final round of confirmatory (post remediation) samples will include Category B laboratory data deliverables as defined in the analytical services protocol (ASP). In addition, a Data Usability Summary Report will be prepared by a party independent from the laboratory performing the analysis.

5.0 HEALTH AND SAFETY PLAN

The Health and Safety Plan (HASP) takes into account the specific hazards inherent to the site and presents the minimum requirements which are to be met by the remediation contractor and its subcontractors, P.W. Grosser Consulting Inc. (PWGC) and its subcontractors, and other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. The HASP which was previously prepared for the IRM excavation work, has been revised to include health and safety issues relative to chemical oxidation injection. The revised HASP is provided in **Attachment A.**

Contractors and subcontractors will have the option of adopting this HASP or developing their own site-specific document. If a contractor or subcontractor chooses to prepare their own HASP, it must meet the minimum requirements as detailed in the site HASP prepared by PWGC and must be made available to PWGC and the NYSDEC.

Activities performed under the HASP will comply with applicable parts of OSHA Regulations, primarily 29 CFR Parts 1910 and 1926, and the PWGC Corporate Environmental Health and Safety policy. Modifications to the HASP may be made with the approval of the PWGC Health and Safety Manager (HSM) and/or Project Manager (PM).

6.0 SCHEDULE

The estimated duration of the chemical oxidation injection program is two months. The installation of the sub-slab piping and vapor barrier, have been completed and inspected. Completion of the exhaust section of the sub-slab venting lines, fans and controls will take place during the months of December 2006 and January 2007 in conjunction with completion of the retail space in the building.

The chemical oxidant injection program and monitoring program will be performed in accordance with the following schedule:

- Within 2 weeks of approval of the RWP, perform groundwater sampling in accordance with Section 4.1 of this document.
- Within 2 weeks of receipt of the laboratory data from Item 1 above, perform chemical oxidant injections, resample, or terminate the program as specified in Section 4.1 of this document.
- Within 2 weeks of the decision to terminate the chemical oxidant treatment program, begin the post remedial monitoring program

7.0 REFERENCES

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P. W. Grosser Consulting, October, 2006. *Remedial Investigation Report. 2040 White Plains Road, Bronx, NY.*

USEPA Office of Solid Waste and Emergency Response, Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance).

FIGURES

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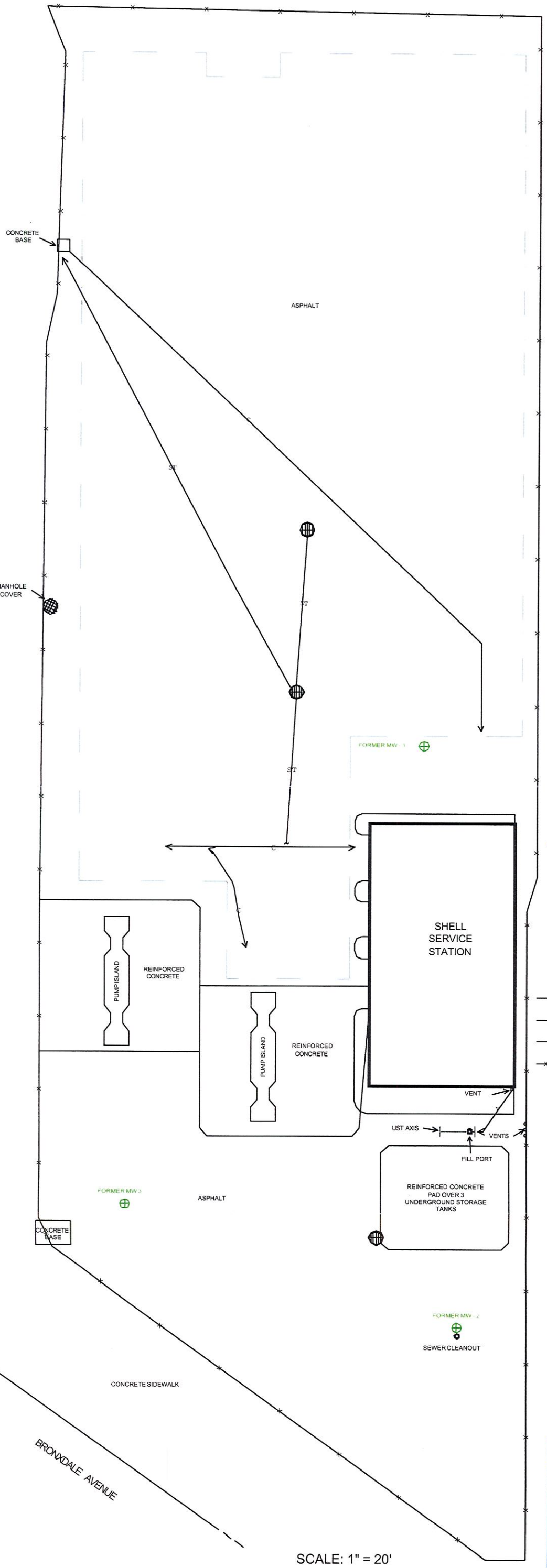
SITE LOCATION MAP
2040 WHITE PLAINS ROAD
BRONX, NY

Project No.	ARK0401
Designed By	ZY
Approved By	PWG
Drawn By	TC\TEB
Figure No.	1
Date	05/03/05



LEGEND

- C — CONDUIT OF UNKNOWN USE
- ST — STORM DRAIN
- V — VENT
- CHAIN LINK FENCE
- MANHOLE
- FORMER GROUNDWATER WEL

SITE PLAN

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Project:	Designed By:	Figure No:
ARK0401	CBS	2
CADD Operator:	Approved By:	Date:
TEB	PWG	05/06/05

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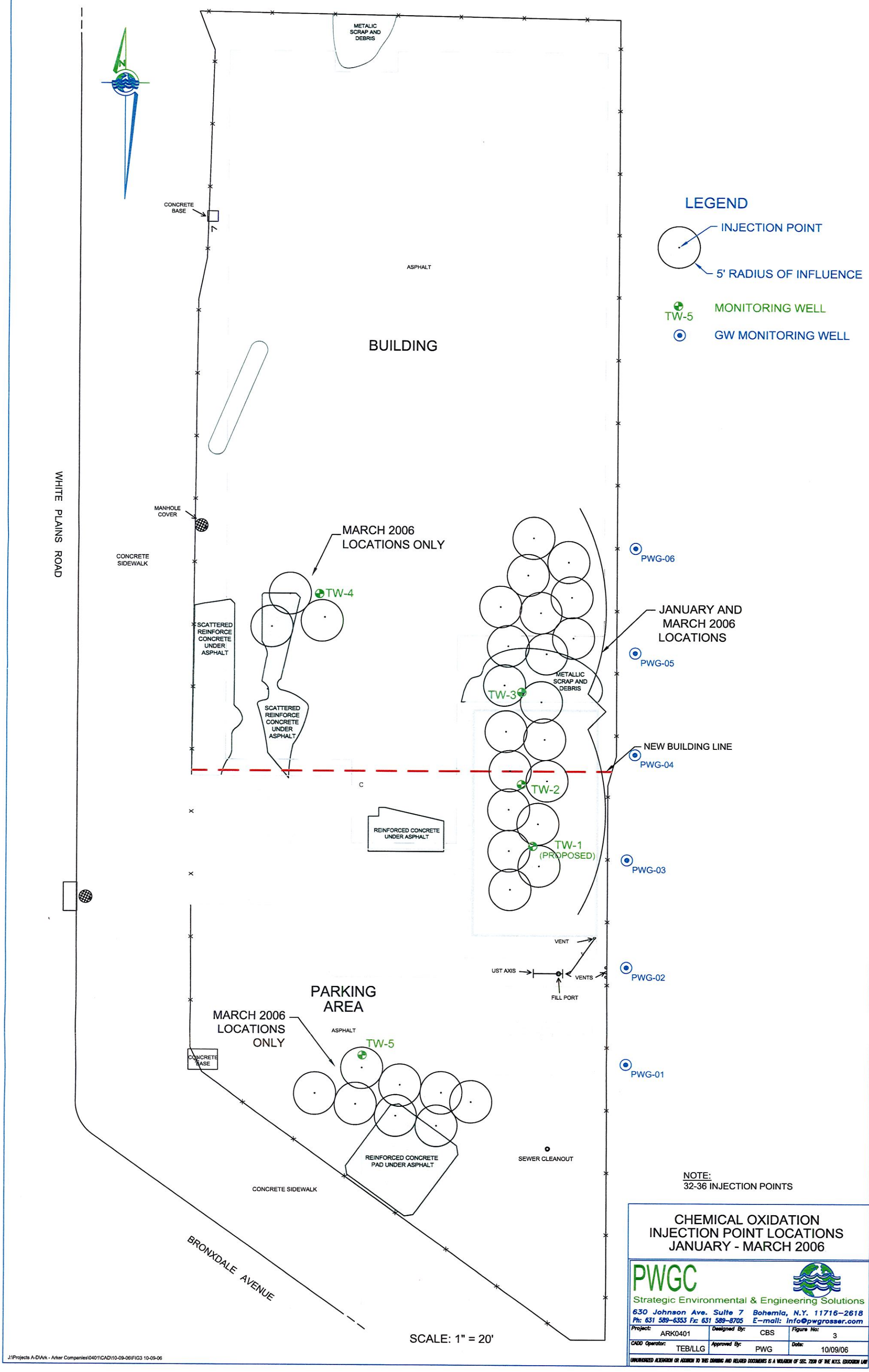

NOTE:
32-36 INJECTION POINTS

CHEMICAL OXIDATION INJECTION POINT LOCATIONS JANUARY - MARCH 2006

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Project:	Designed By:	Figure No:
ARK0401	CBS	3
CADD Operator: TEB/LLG	Approved By: PWG	Date: 10/09/06

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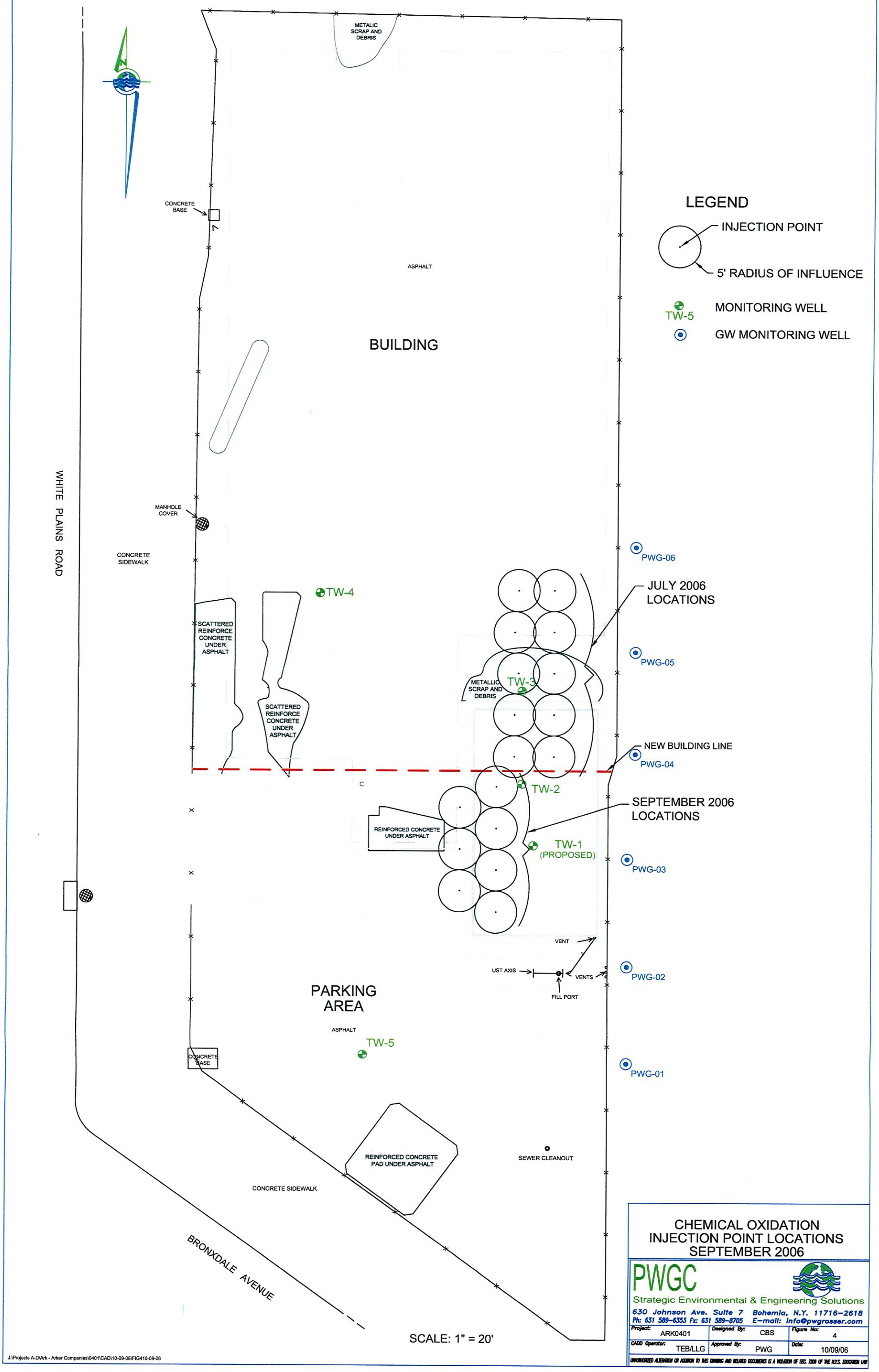

CHEMICAL OXIDATION INJECTION POINT LOCATIONS SEPTEMBER 2006

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Project:	Designed By:	Figure No:
ARK0401	CBS	4
CADD Operator:	Approved By:	Date:
TEB/LLG	PWG	10/09/06

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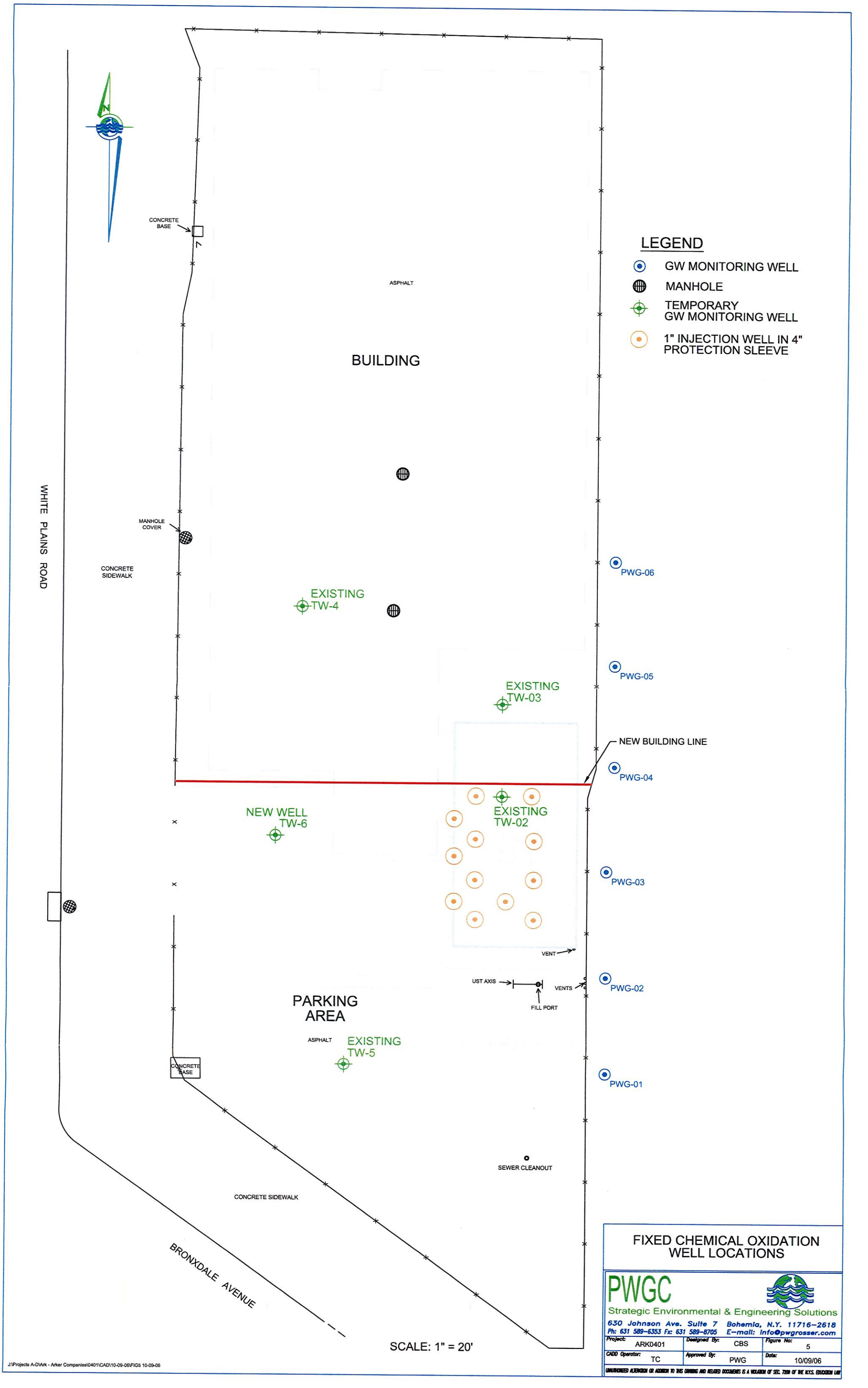

LEGEND

- GW MONITORING WELL
- MANHOLE
- TEMPORARY GW MONITORING WELL
- 1" INJECTION WELL IN 4" PROTECTION SLEEVE

FIXED CHEMICAL OXIDATION WELL LOCATIONS

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Project:	Designed By:	Figure No:
ARK0401	CBS	5
CADD Operator: TC	Approved By: PWG	Date: 10/09/06

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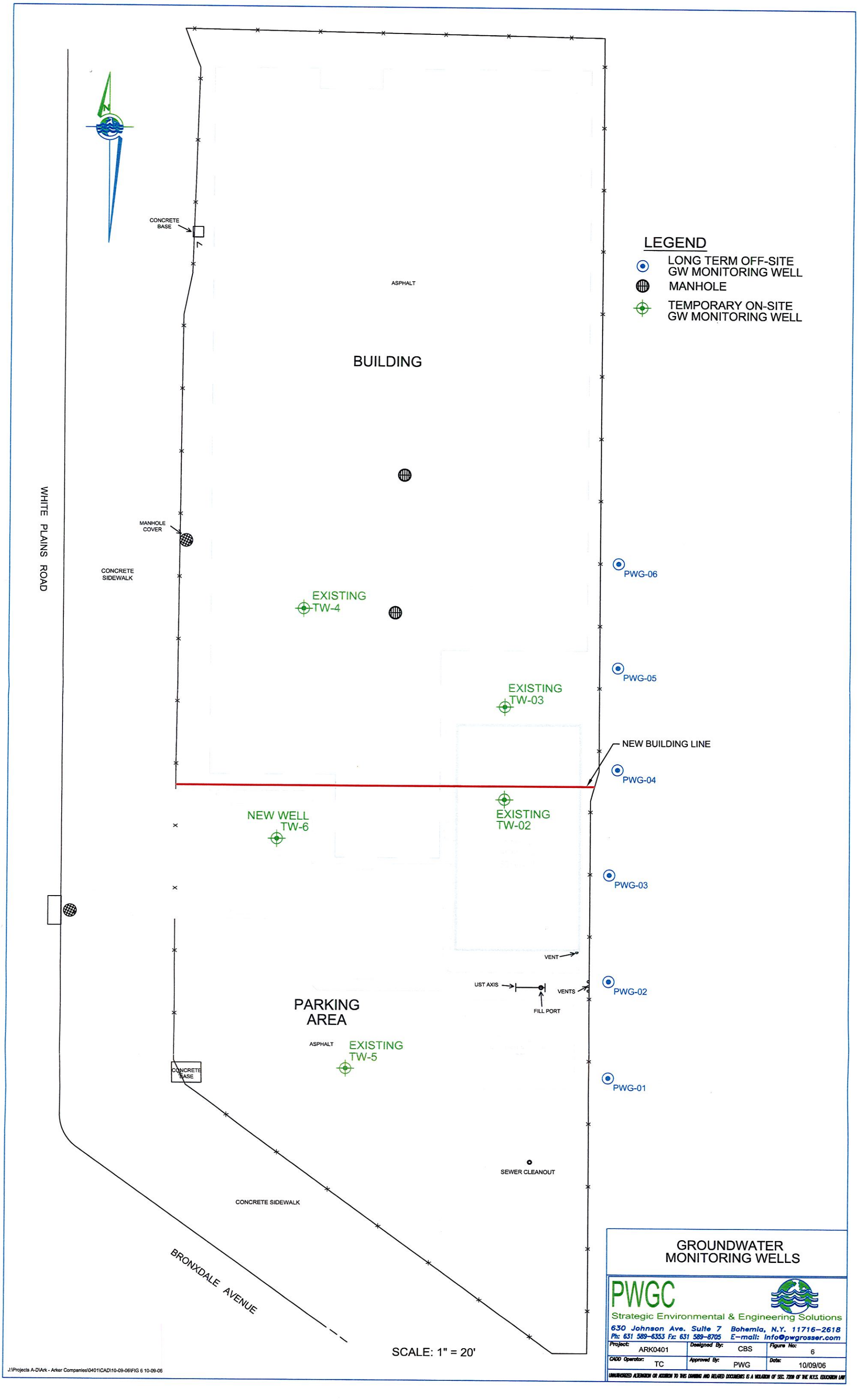

GROUNDWATER MONITORING WELLS

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Project:	Designed By:	Figure No:
ARK0401	CBS	6
CADD Operator: TC	Approved By: PWG	Date: 10/09/06

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LIST OF TABLES

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LIST OF APPENDICES

1.0 INTRODUCTION

1.1 Purpose

This Health and Safety Plan (HASP) addresses the minimum health and safety practices that will be employed by site workers participating in remedial activities at the project site located at a former Shell Service Station at 2040 White Plains Road in Bronx, New York. Redevelopment plans for the site (currently underway) include a residential apartment complex with first flow retail space and associated grounds, named the White Plains Courtyard Apartments. The site has been approved for participation in New York State's Brownfield Cleanup Program (BCP).

The HASP takes into account the specific hazards inherent to the site and presents the minimum requirements which are to be met by P.W. Grosser Consulting, Inc. (PWGC), its' subcontractors, and other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. PWGC sub-contractors will have the option of adopting this HASP or developing their own site-specific document. If a subcontractor chooses to prepare their own HASP, it must meet the minimum requirements as detailed in this HASP and must be made available to PWGC.

Activities performed under this HASP will comply with applicable parts of OSHA Regulations, primarily 29 CFR Parts 1910 and 1926, and the PWGC Corporate Environmental Health and Safety policy. Modifications to the HASP may be made with the approval of the PWGC Health and Safety Manager (HSM) and/or Project Manager (PM).

Refusal to comply with the HASP or violation of any safety procedures by field personnel may result in their immediate removal from the site following consultation with the HSM and the Project Manager.

1.2 Scope

This HASP addresses the potential hazards related to the Remedial Work Plan prepared for the site by PWGC in October 2006. The primary remedial activities under this work plan include the following:

- Installation of monitoring wells / chemical injection wells;
- Chemical Oxidant Injection, and;
- Groundwater Sampling.

The potential hazards associated with this scope are listed below and are discussed in more detail in this HASP after the project organization and responsibilities section.

- Chemical Hazards
- Biological Hazards
- Physical Hazards

1.3 Application

The HASP applies to all personnel involved in the above tasks who wish to gain access to active work areas, including but not limited to:

- PWGC employees and subcontractors;
- Client representatives; and
- Federal, state or local representatives.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This section specifies the project organization and responsibilities.

2.1 Project Manager

- Participates in major incident investigations;
- Ensures that the HASP has all of the required approvals before site work is conducted; and
- Has the overall project responsibility for project health and safety.

2.2 Field Operations Lead (FOL)/ Health and Safety Officer (HSO)

- Ensures that the HASP is implemented in conjunction with the Health and Safety Manager (HSM);
- Ensures that field work is scheduled with adequate equipment to complete the job safely;
- Enforces site health and safety rules;
- Ensures that proper personal protective equipment is utilized;
- Ensures that the HSM is informed of project changes which require modifications to the HASP;
- Ensures that the procedure modifications are implemented;
- Investigates incidents;
- Conducts the site safety briefing;
- Reports to HSM to provide summaries of field operations and progress; and
- Acts as Emergency Coordinator.

2.3 Health and Safety Manager

- Provides for the development of the HASP;
- Serves as the primary contact to review health and safety matters that may arise;
- Approves individuals who are assigned HSO responsibilities;
- Coordinates revisions of this HASP with field personnel; and
- Assists in the investigation of major accidents.

2.4 Site Personnel

- Report any unsafe or potentially hazardous conditions to the FOL/HSO;
- Maintain knowledge of the information, instructions and emergency response actions contained in this HASP; and
- Comply with rules, regulations and procedures as set forth in this HASP and any revisions.

3.0 SITE HISTORY AND PROJECT DESCRIPTION

3.1 Project Background

This Health and Safety Plan (HASP) has been prepared by PWGC, on behalf of Metro Management Inc. (Metro) of Woodmere, NY, for the implementation of planned remedial action at a commercial property located at 2040 White Plains Road, Bronx, New York. Redevelopment plans for the property, formerly a Shell Service Station, include a residential apartment complex with first floor retail space and associated grounds.

Gasoline related compounds above guidance levels and/or standards were identified in soil and groundwater during the Remedial Investigation performed at the site. The gasoline related contaminants were believed to have been released sometime during the operation of the site as a service station beginning in 1956.

The field work portion of the RI was largely completed by PWGC from February 11 through August 29, 2005, in accordance with the protocols and methods as established by the New York State Department of Environmental Conservation (DEC) in Draft DER-10 Technical Guidance for Site Investigation and Remediation (12/25/02). Supplemental field work was also performed at the site in January, June and July of 2006.

A Remedial Investigation (RI) report has been prepared by PWGC to document the nature and extent of contaminants at the site. The RI report and this Remedial Action Plan are being submitted to DEC together and will be placed in the designated document repository for public access.

The Remedial Investigation concluded that significant levels of volatile organic compounds (VOCs) in groundwater remain in the vicinity of the former waste-oil UST and beneath the existing building and that VOCs in groundwater are above standards at many locations on the property. The proposed RWP includes the injection of a chemical oxidant solution into petroleum impacted groundwater areas north and beneath the existing building and the installation of a vapor barrier beneath the new building.

3.2 Site Location and Description

The subject property is located at 2040 White Plains Road on the east side of White Plains Road between Bronxdale Avenue and Brady Avenue,Bronx, New York. The property, identified as Block 4284, Lot 5, consists of a single 25,000 square foot parcel. The site was improved with a one-story 1,512 square foot masonry building, which was constructed in 1954. The building formerly a Shell Service Stations, has since been demolished and construction of the new multi-use building, is currently underway.

The property is located within a residential area of the Bronx. The general area is comprised of residential apartments and commercial buildings, such as restaurants, supermarkets and gas stations. A one-story strip-mall is located on the property north of the site. The strip-mall contains a restaurant, a martial arts studio and a parking garage. The property adjacent to the south is occupied by a specialty food market and a bingo hall. A Mobil gas station is located across White Plains Road to the west and a six story residential building is located east of the site.

4.0 POTENTIAL HAZARDS OF THE SITE

This section presents an assessment of the chemical, biological, and physical hazards that may be encountered during the tasks specified under Section 1.0. Additional information can be found in Appendix A - Material Safety Data Sheets or in Appendix B - Activity Hazard Analyses.

4.1 Chemical Hazards

Review of historical information from the site indicates that the soil and groundwater are contaminated primarily with volatile organic compounds (VOCs) especially ethylbenzene, xylene, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene which are present at ppm levels in soil and groundwater. Other petroleum related VOCs are present at lower levels in the groundwater and/or soil. These compounds may present an occupational exposure hazard during site operations.

The VOCs identified above generally have a depressant effect on the central nervous system, may affect the respiratory system and may cause chronic liver and kidney damage. Acute exposure may include headache, dizziness, nausea, and skin and eye irritation. Specific information on these compounds can be found in Table 4-1 as well as on the Material Safety Data Sheets found in Appendix A.

4.2 Biological Hazards

Although unlikely given the urban nature of the area, during the course of the project, there may be some potential for workers to come into contact with biological hazards such as animals, insects and plants. The Activity Hazard Analyses found in Appendix B will include specific hazards and control measures for each task, if applicable.

4.2.1 Animals

It is not expected that workers will encounter animals as the Site is located in a predominantly urban area though it is possible that dogs, cats, rats and mice may be present. Workers shall use discretion and avoid all contact with animals. If these animals present a problem, efforts will be made to remove these animals from the Site by contacting a licensed pest control technician.

4.2.2 Insects

Insects, such as mosquitoes, ticks, bees and wasps may be present during certain times of the year. Workers will be encouraged to wear repellents when working in areas where insects are expected to be present. If insects are prevalent, efforts will be made to remove them from the site by contacting a licensed pest control technician.

4.2 Physical Hazards

Most safety hazards are discussed in the Activity Hazard Analyses (AHA) in Appendix B for the different phases of the project. In addition to the AHAs, general work rules and other safety procedures are described in Section 10 of this HASP.

4.2.1 Temperature Extremes

Heat Stress
Heat stress is a significant potential hazard, which is greatly exacerbated with the use of PPE in hot environments. The potential hazards of working in hot environments include dehydration, cramps, heat rash, heat exhaustion, and heat stroke.

Cold Stress
At certain times of the year, workers may be exposed to the hazards of working in cold environments. Potential hazards in cold environments include frostbite, trench foot or immersion foot, hypothermia as well as slippery surfaces, brittle equipment, and poor judgment.

4.2.2 Steam, Heat and Splashing

Exposure to steam/heat/splashing hazards can occur during steam cleaning activities. Splashing can also occur during recovery well development, product extraction events and sampling activities. Exposure to steam/heat/splashing can result in scalding/burns, eye injury, and puncture wounds.

4.2.3 Noise

Noise is a potential hazard associated with the operation of heavy equipment, drill rigs, sheet piling, pumps and engines. Workers will wear hearing protection while in the work zone when machinery such as heavy equipment, drill rigs, or generators are operating.

Table 4-1
Chemical Data

COMPOUND	CAS#	NIOSH REL	OSHA PEL	ROUTES OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Ethylbenzene	100-41-4	TWA 100 ppm, ST 125 ppm	TWA 100 ppm	Inhalation, ingestion, skin/eye contact	Irritates eyes, skin, mucous membranes; headache; dermatitis; narcosis; coma	Eyes, skin, resp. system, CNS	VP= 7 mm Hg, Colorless liquid with an aromatic odor IP= 8.76 eV
Xylene-o Xylene-m Xylene-p	95-47-6 108-38-3	TWA 100 ppm, ST 150 ppm	TWA 100 ppm	Inhalation, ingestion, skin absorption, skin/eye contact	Irritation to eyes, dizziness, excitement, drowsiness, incoordination, corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, resp. system, CNS, gastrointestinal tract, blood, liver and kidneys	VP= 9 mm Hg, Colorless liquid with an aromatic odor IP= 8.44 eV
1,2,4-Trimethyl-benzene 1,3,5-Trimethyl-benzene	95-63-6 108-67-8	TWA 25 ppm	None	Inhalation, ingestion	Irritation to eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia, headache, drowsiness, fatigue, dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis	Eyes, skin, resp. system, CNS, blood	VP= 1 mm Hg, Clear, colorless liquid with distinctive aromatic odor IP= 8.27 eV IP=8.39 eV
Benzene	71-43-2	TWA 0.1 ppm, ST 1 ppm	TWA 1 ppm, ST 5 ppm	Inhalation, ingestion, skin/eye contact	Irritation to eyes, skin, nose, respiratory system; dizziness, headache, nausea, staggering gait; anorexia; lassitude dermatitis, bone marrow depression (potential occupational carcinogen)	Eyes, skin, resp. system, CNS, blood, bone marrow	VP= 75 mm Hg, Colorless to light yellow liquid with an aromatic odor IP= 9.240 eV

COMPOUND	CAS#	NIOSH REL	OSHA PEL	ROUTES OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Diisopropyl Ehter	108-20-3	TWA 500 ppm	TWA 200 ppm	Inhalation, ingestion, skin/eye contact	Irritates eyes, skin, nose, respiratory discomfort, dermatitus	Eyes, skin, CNS, resp. system	VP= 119 mm Hg, Colorless liquid with sharp, sweet, ether like odor
Isopropylbenzene	98-82-8	TWA 50 ppm	TWA 50 ppm	Inhalation, ingestion, skin/eye contact	Irritation to eyes, skin, mucous membrane, headache, dermatitis, narcosis, coma	Eyes, skin, CNS, resp. system	VP= 8 mm Hg, Colorless liquid with a sharp, penetrating aromatic odor IP= 8.75 eV
Naphthalene	91-20-3	TWA 10 ppm, ST 15 ppm	TWA 10 ppm	Inhalation, Ingestion, Skin/eye contact	Irritation to eyes, headache, confusion, excitement, malaise, nausea, vomiting, abdominal pain, irritation bladder, profuse sweating, jaundice, hematuria, renal shutdown, dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, CNS	VP= 0.08 mm Hg, Colorless liquid with a sharp, penetrating aromatic odor IP= 8.12 eV
Toluene	108-88-3	TWA 100 ppm, ST 150 ppm	TWA 200 ppm, C 300 ppm, 500 ppm 10 min avg.	Inhalation, Ingestion, Skin/eye contact	Irritation to eyes, nose, lassitude, confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, anxiety, muscle fatigue, insomnia, paresthesia, dermatitis, liver, kidney damage	Eyes, skin, resp. system, liver, kidneys, CNS	VP= 21 mm Hg, Colorless liquid with a sweet, pungent, benzene-like odor IP= 8.82 eV

COMPOUND	CAS#	NIOSH REL	OSHA PEL	ROUTES OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Trichloroethylene	79-01-6	TWA 50 ppm, ST 100 ppm	TWA 100 ppm	Inhalation, Ingestion, Skin contact	Irritates eyes, throat; redness, tearing, blurred vision, vertigo, dizziness, incoordination, irregular heart beat, potential human carcinogen	Heart, nervous system, liver and kidneys	VP= 60 mm Hg, Irritating odor at high concentrations IP= 9.45 eV
Tetrachloroethylene	127-18-4	TWA 25 ppm, ST 100 ppm	TWA 100 ppm	Inhalation, skin absorption, skin contact, ingestion	Irritates eyes, nose, throat; nausea; flushed face & neck; vertigo, dizziness, incoordination, headache, somnolence; skin erythema; potential human carcinogen	Eyes, skin, resp. system, CNS, liver, kidneys	VP= 14 mm Hg, Chloroform like odor, IP= 9.32 eV

Abbreviations

C = Ceiling limit, not to be exceeded
CNS = Central Nervous System
CVS = Cardiovascular System
eV = Electron volt
IP = Ionization Potential
OSHA = Occupational Safety and Health Administration
ppm = parts per million
ST = Short-term exposure limit (15 minutes)
TWA = Time-weighted average (8 hours)
VP = vapor pressure at approximately 68°F in mm Hg (mercury)

The NIOSH guide did not contain information on the following chemicals present at the site: 1,2,4,5-Tetramethylbenzene, 4-Isopropyltoluene, MTBE, n-butylbenzene, n-propylbenzene, p-diethylbenzene, p-ethyltoluene, sec-butylbenzene

4.2.4 Fire and Explosion

When conducting excavation or drilling activities, the opportunity of encountering fire and explosion hazards may exist from underground utilities and gases. Additionally, the use of a diesel engine equipment drill rig, could present the possibility of encountering fire and explosion hazards.

4.2.5 Manual Lifting/Material Handling

Manual lifting of heavy objects may be required. Failure to follow proper lifting technique can result in back injuries and strains. Back injuries are a serious concern as they are the most common work place injury, often resulting in lost or restricted work time, and long treatment and recovery periods.

4.2.6 Slips, Trips and Falls

Working in and around the site will pose slip, trip and fall hazards due to slippery surfaces that may be oil covered, or from surfaces that are steep inclines or are wet from rain or ice. Falls may result in twisted ankles, broken bones, head trauma or back injuries.

4.2.7 Heavy Equipment Operation

A backhoe excavator and/or clamshell excavator will be used to excavate the contaminated soil, and a drill rig will be used to install recovery wells. Working with or near heavy equipment poses many potential hazards, including electrocution, fire/explosion, being struck by or against, or pinched/caught/crushed by, and can result in serious physical harm.

4.2.8 Electrocution

Encountering underground utilities may pose electrical hazards to workers. Additionally, overhead electrical lines can be a concern during drilling operations. Potential adverse effects of electrical hazards include burns and electrocution, which could result in death.

5.0 ACTIVITY HAZARD ANALYSES

The Activity Hazard Analysis (AHA) is a systematic way of identifying the potential health and safety hazards associated with major phases of work on the project and the methods to avoid, control and mitigate those hazards. The AHAs will be used to train work crews in proper safety procedures during phase preparatory meetings.

AHAs have been developed by PWGC for the following phases of work:

1. Monitoring well, chemical oxidant injection well installation;
2. Chemical Oxidant Injection, and;
3. Groundwater Sampling.

Copies of these AHAs are included in Appendix B of this HASP.

6.0 PERSONAL PROTECTIVE EQUIPMENT

The personal protective equipment (PPE) specified in Table 6-1 represents the hazard analysis and PPE selection required by 29 CFR 1910.132. Specific information on known potential hazards can be found under Section 4.0 and Appendix B - Activity Hazard Analyses. For the purposes of PPE selection, the HSM and FOL/HSO are considered competent persons. The signatures on the approval page of the HASP constitute certification of the hazard assessment. For activities not covered by Table 6-1, the FOL/HSO will conduct the hazard assessment, select the PPE, and ndocument changes in the appropriate field logs. PPE selection will be made in consultation with the HSM.

Modifications for initial PPE selection may also be made by the FOL/HSO in consultation with the HSM and changes documented accordingly. If major modifications occur, the HSM will notify the PM.

6.1 PPE Abbreviations

HEAD PROTECTION
HH = Hard Hat

HEARING PROTECTION
EP = ear plugs
EM = ear muffs

HAND PROTECTION
Cot = cotton
But = Butyl
LWG = Leather Work Gloves
Neo = Neoprene
Nit = Nitrile
Sur = Surgical

EYE/FACE PROTECTION
APR = Full Face Air Purifying Respirator
MFS = Mesh Face shield
PFS =Plastic Face shield
SG = ANSI approved safety glasses with side shields

BODY PROTECTION
WC = work clothes
Cot Cov = Cotton Coveralls
Poly = Polyethylene coated Tyvek® coveralls
Saran = Saranex coated coveralls

FOOT PROTECTION
Neo = Neoprene
OB = Overboot
Poly = polyethylene coated boot
Rub = rubber slush boots
STB = Leather work boots with steel toe

RESPIRATORY PROTECTION
APR = Full-face air purifying respirator with organic vapor cartridges
ASR = Full face air supplied respirator with escape bottle
DR = NIOSH/MSA approved dust respirator
SCBA = Self-contained breathing apparatus

6.2 Hazard Assessment for Selection of Personal Protective Equipment

The initial selection of personal protective equipment for each task was done by performing a hazard assessment taking into consideration the following:

- Potential chemical and physical present;
- Work operations to be performed;

- Potential routes of exposure;
- Concentrations of contaminants present; and
- Characteristics, capabilities and limitations of PPE and any hazard that the PPE presents or magnifies.

A review of the analytical data from previous sampling events indicates that gasoline related volatile organic compounds identified in Table 4-1 are the primary contaminants of concern. The maximum concentration for total VOCs detected in soil was 237 parts per million (ppm). The primary concern is inhalation; skin contact and ingestion are secondary routes of exposure. Chemical protective gloves will be required for all activities that involve sample handling and the likelihood for skin contact. Additionally, the type of respiratory protection will be dependent on real-time air monitoring results. The use of organic vapor cartridges, along with the air monitoring program, will provide adequate respiratory protection to minimize potential exposure via inhalation. The proper use of PPE and strict adherence to decontamination and personal hygiene procedures will effectively minimize skin contact and ingestion as potential routes of exposure.

Table 6-1
Personal Protective Equipment Selection

TASK	HEAD	EYE/FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR
Monitoring well/injection well installation	HH	SG	STB	WG	WC	None	None
Mixing Chemical Oxidant Solution	HH	SG	STB	WG, Nit & Neo as needed	WC, Tyvek® as needed	None	DR
Chemical Oxidant Injection	HH	SG	STB	WG, Nit & Neo as needed	WC, Tyvek® as needed	EP/EM as needed	None
Decontamination	HH	SG	STB	Nit + Sur	WC, Tyvek® as needed	None	None

6.3 Respirator Cartridge Change-Out Schedule

A respirator cartridge change-out schedule has been developed in order to comply with 29 CFR 1910.134. If the use of respirators is necessary, the respirator cartridge change-out schedule for this project will be as follows:

1. Cartridges shall be removed and disposed of at the end of each shift, when cartridges become wet or wearer experiences breakthrough, whichever occurs first; and
2. If the humidity exceeds 85%, then cartridges shall be removed and disposed of after 4 hours of use.
3. Respirators shall not be stored at the end of the shift with contaminated cartridges left on. Cartridges shall not be worn on the second day, no matter how short of time period they were used the day before.

The schedule was developed based on the following scientific information and assumptions:

- Analytical data that is available regarding site contaminants;
- Using the Rule of Thumb provided by the AIHA;
- All of the chemicals have boiling points greater than 70 C;
- Total airborne concentration of contaminants is anticipated to be less than 200 ppm;
- The humidity is expected to be less than 85%; and
- Desorption of the contaminants (including those with poor warning properties) after partial use of the chemical cartridge can occur after a short period (hours) without use (eg, overnight) and result in a non-use exposure.

The following is a partial list of factors that may affect the usable cartridge service life and/or the degree of respiratory protection attainable under actual workplace conditions. These factors have been considered when developing the cartridge change-out schedule.

- Type of contaminant(s);
- Contaminant concentration;
- Relative humidity;
- Breathing rate; Temperature; Changes in contaminant concentration, humidity, breathing rate and temperature;
- Mixtures of contaminants;
- Accuracy in the determination of the conditions;
- The contaminant concentration in the workplace can vary greatly. Consideration must be given to the quality of the estimate of the workplace concentration;
- Storage conditions between multiple uses of the same respirator cartridges. It is recommended that the chemical cartridges be replaced after each work shift. Contaminants adsorbed on a cartridge can migrate through the carbon bed without airflow;
- Age of the cartridge;
- Condition of the cartridge and respirator;

- Respirator and cartridge selection respirator fit;
- Respirator assembly, operation, and maintenance;
- User training, experience and medical fitness;
- Warning properties of the contaminant; and
- The quality of the warning properties should be considered when establishing the chemical cartridge change schedule. Good warning properties may provide a secondary or back-up indication for cartridge change-out.

7.0 AIR MONITORING

It is not anticipated that remedial activities at the site will result in airborne contaminant releases, and air monitoring will not be required.

8.0 ZONES, PROTECTION AND COMMUNICATION

8.1 Site Control

Site zones are intended to control the potential spread of contamination throughout the site and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It shall include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones shall be established on the work site when operations begin. All maps will be posted at the site and used during initial site-specific training.

This project is a hazardous waste remediation project, and any person working in an area where the potential for exposure to site contaminants exists, will only be allowed access after providing the FOL/HSO with proper training and medical documentation.

The zones are based upon current knowledge of proposed site activities. It is possible that the zone configurations may be altered due to work plan revisions. Should this occur, the work zone will be adjusted accordingly, and documented through use of a field-change request form? The following shall be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone - The SZ is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

Contamination Reduction Zone - The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides for an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for EZ entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities, which may involve exposure to site contaminants, hazardous materials and/or conditions, should be considered an EZ. This zone will be clearly delineated by cones, tapes or other means. The FOL/HSO may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the site HSO allowing adequate space for the activity to be completed, field members and emergency equipment.

8.2 Contamination Control

Decontamination areas will be established for the following activities.

- Chemical Oxidant Injection
- Groundwater Sampling

8.2.1 Personnel Decontamination Station

All personnel and portable equipment used in the EZ shall be subject to a thorough decontamination process, as deemed necessary by the FOL/HSO. Sampling equipment shall be decontaminated. As necessary, all boots and gloves will be decontaminated using soap and water solution and scrub brushes or simple removal and disposal. All used respiratory protective equipment will be decontaminated daily and sanitized with appropriate sanitizer solution.

All drums generated as a result of sampling and decontamination activities will be marked and stored at a designated area at the site until the materials can be property disposed of off-site.
All non-expendable sampling equipment will be decontaminated. This usually entails the use of Alconox, solvent and distilled/deionized water rinses to eliminate contaminants.

8.3 Communication

- Each team member will have a Nextel cell phone/radio for communication with the PM, HSO and other team members during field activities.
- Hand Signals - Hand signals shall be used by field teams, along with the buddy system. The entire field team shall know them before operations commence and their use covered during site-specific training. Typical hand signals are the following:

SIGNAL	MEANING
Hand gripping throat	Out of air, can't breathe
Grip on a partner's wrist or placement of both hands around a partner's waist	Leave the area immediately, no debate
Hands on top of head	Need assistance
Thumbs up	Okay, I'm all right, I understand
Thumbs down	No, negative

9.0 MEDICAL SURVEILLANCE PROCEDURES

All contractor and subcontractor personnel performing field work where potential exposure to contaminants exists at the site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120(f).

9.1 Medical Surveillance Requirements

A physician's medical release for work will be confirmed by the HSM before an employee can work in the exclusion zone. The examination will be taken annually at a minimum and upon termination of hazardous waste site work if the last examination was not taken within the previous six months. Additional medical testing may be required by the HSM in consultation with the Corporate Medical Consultant and the FOL/HSO if an over-exposure or accident occurs, if an employee exhibits symptoms of exposure, or if other site conditions warrant further medical surveillance.

9.2 Medical Data Sheet

A medical data sheet is provided in Appendix C. This medical data sheet is voluntary and should be completed by all on-site personnel and will be maintained at the site. Where possible, this medical data sheet will accompany the personnel needing medical assistance. The medical data sheet will be maintained in a secure location, treated as confidential, and used only on a need-to-know basis.

10.0 SAFETY CONSIDERATIONS

10.1 General Health and Safety Work Practices

A list of general health and safety work practices is included as an included in Appendix D. The work rules will be posted in a conspicuous location at the site.

10.2 The Buddy System

At a minimum, employees shall work in groups of two in such a manner that they can observe each other and maintain line-of-sight for each employee within the work group. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

10.3 Sample Handling

Personnel responsible for the handling of samples should wear the prescribed level of protection. Samples should be identified as to their hazard and packaged as to prevent spillage or breakage. Sample containers shall be decontaminated in the CRZ or EZ before entering a clean Support Zone area. Any unusual sample conditions, odors, or real-time readings should be noted. Laboratory personnel should be advised of sample hazard level and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or including a written statement with the samples reviewing lab safety procedures in handling, in order to assure that the practices are appropriate for the suspected contaminants in the sample.

10.4 Drill Rigs

When conducting drilling activities, the opportunity of encountering fire and explosion hazards exists from underground utilities and gases. The locations of underground utilities will be verified prior to performing any intrusive activities. Additionally, because of the inherently hazardous nature of drilling operations, safety and accident prevention are crucial when drilling operations are performed. Most drilling accidents occur as a direct result of lack of training and supervision, improper handling of equipment, and unsafe work practices. Hazards include: assembling and disassembling rigs, rotary and auger drilling, and grouting. The drilling contractor shall perform drilling in accordance with its own Health & Safety Program for Drill Rig Safety.

10.4.1 Safety During Drilling Operations

- Safety requires the attention and cooperation of every worker and site visitor.
- Do not drive the drill rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast (derrick), look up to check for overhead obstructions.
- Maintain a minimum of 15 feet clearance from all overhead electric lines.
- Before raising the mast (derrick), all drill rig personnel (with the exception of the operator) and visitors shall be cleared from the areas immediately to the rear and the sides

of the mast. All drill rig personnel and visitors shall be informed that the mast is being raised prior to raising it.

- Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. Lower the mast (derrick) only when the leveling jacks are down and do not raise the leveling jack pads until the mast (derrick) is lowered completely.
- The operator of a drill rig shall only operate a drill rig from the position of the controls.
- Throwing or dropping tools shall not be permitted. All tools shall be carefully passed by hand between personnel or a hoist line shall be used.
- Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a drill rig or while on the job.
- All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors, or animals form stepping or falling into the hole.
- Terminate drilling operations during an electrical storm and move the entire crew away from the drill rig.

10.5 Excavation and Trenching

Excavation will be conducted in accordance with the excavation contractor's Health & Safety Program for Excavation and Trenching and with the requirements contained in 29 CFR 1926, Subpart P-Excavations. It provides for the designation of a "Competent Person" and general requirements for safe excavating practices. The program also incorporates company standards for the monitoring of potentially hazardous atmospheres; protection from water hazards; analyzing and maintaining the stability of adjacent structures; daily competent person inspections; soil classification; sloping and benching; protective systems; and training.

The Competent Person will be the Field Operations Lead or other designee with appropriate training and experience. The Competent Person will be assisted in his/her duties by other technical personnel such as the HSM, geologists, structural engineers and soils engineers.

Excavations and trenches 4 feet or greater in depth will require atmospheric monitoring and ladders for safe entry/egress. The Competent Person will determine the need for cave-in protection. If trenches exceed 5 feet in depth and personnel will enter, cave-in protection will be implemented in accordance with 29 CFR 1926, Subpart P.

11.0 DISPOSAL PROCEDURES

All discarded materials, waste materials or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard or causing litter to be left on site.

All potentially contaminated materials, e.g., clothing, gloves, etc., will be bagged or drummed as necessary, labeled and segregated for disposal. All non-contaminated materials will be collected and bagged for appropriate disposal as non-hazardous solid waste. Additional waste disposal procedures may be developed as applicable.

12.0 EMERGENCY RESPONSE PLAN

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff is essential. Specific elements of emergency support procedures which are addressed in the following subsections include communications, local emergency support units, preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures.

12.1 Responsibilities

12.1.1 Health and Safety Manager (HSM)

The HSM oversees and approves the Emergency Response/Contingency Plan and performs audits to determine that the plan is in effect and that all pre-emergency requirements are met. The HSM acts as a liaison to applicable regulatory agencies and notifies OSHA of reportable accidents.

12.1.2 Field Operations Lead/Health and Safety Officer (FOL/HSO)

The FOL/HSO is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The FOL/HSO is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the HSM can ensure that OSHA is notified within the required time frame. The HSM will be notified of all OSHA recordable injuries, fires, spills, releases or equipment damage in excess of $500 within 24 hours.

12.1.3 Emergency Coordinator

The Emergency Coordinator for the project is the FOL/HSO.

The Emergency Coordinator shall make contact with Local Emergency Response personnel prior to beginning work on site. In these contacts the emergency coordinator will inform interested parties about the nature and duration of work expected on the site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants. The emergency coordinator will locate emergency phone numbers and identify hospital routes prior to beginning work on site. The emergency coordinator shall make necessary arrangements to be prepared for any emergencies that could occur.

The Emergency Coordinator will implement the Emergency Response/Contingency Plan whenever conditions at the site warrant such action.

12.1.4 Site Personnel

Site personnel are responsible for knowing the Emergency Response/Contingency Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency.

12.2 Communication

A variety of communication systems may be utilized during emergency situations. These are discussed in the following sections.

12.2.1 Hand Signals

Downrange field teams will employ hand signals where necessary for communication during emergency situations. Hand signals are found in Section 8.3.

12.2.2 Field Radios and Cell Phones

PWGC field personnel are provided Nextel cellular phones with telephone and two-way radio capabilities for site communication and emergency use.

12.3 Local Emergency Support Units

A route map from the site to the nearest hospital can be found in Appendix E. This map will be placed with the above emergency telephone numbers in all on-site vehicles.

12.4 Pre-Emergency Planning

PWGC will communicate directly with administrative personnel from the emergency room at the hospital to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from exposure to any of the contaminants expected to be found on the site. Instructions for finding the hospital will be posted conspicuously in the site office and in each site vehicle.

Before the field activities begin, the local emergency response personnel will be notified of the schedule for field activities and about the materials that are thought to exist on the site so that they will be able to respond quickly and effectively in the event of a fire, explosion, or other emergency. Before fieldwork on the site commences, each person who will be working there or observing the operations will complete a medical data sheet (Appendix C). These data sheets will be filled out during site-specific training and will be kept on the site.

In the event of an incident where a team member becomes exposed or suffers from an acute symptom of exposure to site materials and has to be taken to a hospital, a copy of his/her medical data sheet will be presented to the attending physician.

Table 12-1
Emergency Telephone Numbers

Contact	Firm or Agency	Telephone Number
Police		911
Fire		911
Hospital	Beth Abraham Hospital	(718) 519-0152
Ambulance		911
Project Manager	Charles Sosik PWGC	(631) 589-6353
Health & Safety Mngr.	Brian DeVaux PWGC	(631) 589-6353
NYSDEC Site Contact	Kerry Foley NYSDEC	(718) 482-4977
Poison Control Center		(800) 962-1253
Chemtrec		(800) 424-9300

12.5 Emergency Medical Treatment

The procedures and rules in this HASP are designed to prevent employee injury. However, should an injury occur, no matter how slight, it will be reported to the FOL/HSO immediately. First aid equipment will be available on site at the following locations:

First Aid Kit: Support Zone (or designated by FOL/HSO upon arrival)
Emergency Eye Wash: Support Zone (or designated by FOL/HSO upon arrival)

During site-specific training, project personnel will be informed of the location of the first aid station(s) that has been set up. Unless they are in immediate danger, severely injured persons will not be moved until paramedics can attend to them. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person can be transported to the hospital, will be followed closely.

There will be at least two people with current First Aid and CPR certification on each active work shift. When personnel are transported to the hospital, the FOL/HSO will provide a copy of the Medical Data Sheet to the paramedics and treating physician.

Only in non-emergency situations will an injured person be transported to the hospital by means other than an ambulance. A map and directions to the hospital can be found in Appendix E.

12.6 Emergency Site Evacuation Routes and Procedures

In order to mobilize the manpower resources and equipment necessary to cope with a fire or other emergency, a clear chain of authority will be established. The EC will take charge of all emergency response activities and dictate the procedures that will be followed for the duration of the emergency. The EC will report immediately to the scene of the emergency, assess the seriousness of the situation, and direct whatever efforts are necessary until the emergency response units arrive. At his/her discretion, the EC also may order the closure of the site for an indefinite period.

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs, including but not limited to fire, explosion or significant release of toxic gas into the atmosphere, an air horn will be sounded on the site. The horn will sound continuously for one blast, signaling that immediate evacuation of all personnel is necessary due to an immediate or impending danger. All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at the evacuation meeting point, which will be determined upon arrival at the site by the FOL/HSO, prior to work beginning. This will then be conveyed to all crew members during the site-specific briefing.

The EC will give directions for implementing whatever actions are necessary. Any project team member may be assigned to be in charge of emergency communications during an emergency. He/she will attend the site telephone specified by the EC from the time the alarm sounds until the emergency has ended.

After sounding the alarm and initiating emergency response procedures, the EC will check and verify that access roads are not obstructed. If traffic control is necessary, as in the event of a fire or explosion, a project team member, who has been trained in these procedures and designated at the site safety meeting, will take over these duties until local police and fire fighters arrive.

The EC will remain at the site to provide any assistance requested by emergency-response squads as they arrive to deal with the situation. A map showing evacuation routes, meeting places, and location of emergency equipment will be posted in all trailers and used during site-specific training.

12.7 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site (air horn will sound for a single continuous blast), and notification of local fire and police departments. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

12.7.1 Fire Prevention

Adhering to the following precautions will prevent fires:

- Good housekeeping and storage of materials;
- Storage of flammable liquids and gases away from oxidizers;
- No smoking in the exclusion zone or any work area;
- No hot work without a properly executed hot work permit;
- Shutting off engines to refuel;
- Grounding and bonding metal containers during transfer of flammable liquids;
- Use of UL approved flammable storage cans;
- Fire extinguishers rated at least 10 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities; and
- Monthly inspections of all fire extinguishers.

12.8 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet or recommended by the Corporate Medical Consultant will be followed, when necessary.

SKIN AND EYE CONTACT: Use copious amounts of soap and water. Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination. Skin should also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs.

INHALATION: Move to fresh air. Decontaminate and transport to hospital or local medical provider.

INGESTION: Decontaminate and transport to emergency medical facility.

PUNCTURE WOUND OR LACERATION: Decontaminate and transport to emergency medical facility.

12.9 Decontamination During Medical Emergencies

If emergency life-saving first aid and/or medica treatment is required, normal decontamination procedures may need to be abbreviated or postponed. The FOL/HSO or designee will accompany contaminated victims to the medical facility to advise on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed on-site, a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the

individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed.

12.10 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

- Health and Safety Manager;
- Project Manager; and
- The employer of any injured worker who is not a PWGC employee.

Written confirmation of verbal reports are to be completed by the FOL/HSO using the Incident Report Form and submitted within 24 hours. The incident report and investigation form is found in Appendix F. If the employee involved is not a employee, his employer will receive a copy of the report.

12.11 Adverse Weather Conditions

In the event of adverse weather conditions, the FOL/HSO will determine if work can continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries;
- Potential for cold stress and cold-related injuries;
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds);
- Limited visibility (fog);
- Potential for electrical storms;
- Earthquakes; and
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The FOL/HSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

12.12 Spill Control and Response

All small hazardous spills/environmental releases shall be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining the best means of containment and cleanup. For small spills, sorbent materials such as sand, sawdust or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. Drains or drainage areas should be blocked. All spill containment materials will be properly

disposed. An exclusion zone of 50 to 100 feet around the spill area should be established depending on the size of the spill. The following seven steps should be taken by the Emergency Coordinator:

- Determine the nature, identity and amounts of major spill components;
- Make sure all unnecessary persons are removed from the spill area;
- Notify appropriate response teams and authorities;
- Use proper PPE in consultation with the FOL/HSO;
- If a flammable liquid, gas or vapor is involved, remove all ignition sources and use nonsparking and/or explosive proof equipment to contain or clean up the spill (diesel only vehicles, air operated pumps, etc.);
- If possible, try to stop the leak with appropriate material; and,
- Remove all surrounding materials that can react or compound with the spill.

12.13 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on-site:

- Industrial first aid kit;
- Burn kit portable eye washes (one per field team);
- 15-minute continuous flow eyewash;
- Fire extinguishers (one per work area); and
- Absorbent material/spill kit.

12.14 Postings

The following information will be posted at various, conspicuous locations throughout the site and notices are contained in this HASP:

- Emergency telephone numbers (Table 12-1);
- Work Practices (Appendix D);
- Evacuation Routes (Appendix E); and
- OSHA Poster.

12.15 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Refilling fire extinguishers;
- Refilling medical supplies;
- Recharging eye washes and/or showers; and
- Replenishing spill control supplies.

13.0 TRAINING

13.1 General Health and Safety Training

In accordance with PWGC corporate policy, and pursuant to 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations unless otherwise noted in the above reference. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical).

13.1.1 Three Day Supervised On the Job Training

In addition to the required initial hazardous waste operations training, each employee shall have received three days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

13.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 1910.120 requirements and related company programs and procedures.

13.3 Site-Specific Training

Prior to commencement of field activities, all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards and emergency services at the site, and will highlight all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

13.4 On-Site Safety Briefings

Project personnel and visitors will be given on-site health and safety briefings daily by the FOL/HSO to assist site personnel in safely conducting their work activities. A copy of the Daily Briefing Sign-In Sheet is contained in Appendix G. The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. The meetings will also be an opportunity to periodically update the crews on monitoring results. Prior to starting any new activity, a training session using the Activity Hazard Analysis will be held for crew members involved in the activity.

13.5 First Aid and CPR

The HSM will identify those individuals requiring first aid and CPR training to ensure that emergency medical treatment is available during field activities. It is anticipated that a minimum of one field person on-site at any one time will have first aid and CPR training. The training will be consistent with the requirements of the American Red Cross Association or American Heart Association. If none are available on-site, then the HSM shall be notified.

13.6 Hazard Communication

Hazard communication training will be provided in accordance with PWGC's corporate policy.

13.7 Supervisory Training

Supervisors and health and safety personnel shall have completed an additional eight hours of specialized training in accordance with 29 CFR 1910.120.

14.0 LOGS, REPORTS AND RECORDKEEPING

Changes to the HASP will be documented in the Health and Safety log book and as appropriate, the HSM and/or PM will be notified. Daily tailgate meetings will be documented in the H&S log book as well as personnel on-site.

14.1 Medical and Training Records

Copies or verification of training (40-hour, 8-hour, supervisor, site-specific training and documentation of three day OJT) and medical clearance for hazardous waste site work and respirator use will be maintained on-site. Records for all subcontractor employees will also be kept on-site.

14.2 Incident Report and Investigation Form

The incident report and investigation form is to be completed for all accidents and incidents, including near misses. The form can be found in Appendix F.

14.3 Health and Safety Logbooks

The FOL/HSO will maintain a logbook during site work. The daily site conditions, personnel, monitoring results and significant events will be recorded. The original logbooks will become part of the exposure records file.

14.4 Hazard Communication Program/MSDS

Material Safety Data Sheets (MSDS) will be obtained for applicable substances and included in the site hazard communication file. The hazard communication program will be maintained on-site in accordance with 29 CFR 1910.1200.

15.0 FIELD PERSONNEL REVIEW

This form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of the HASP. It is maintained on site by the FOL/HSO as a project record. Each field team member shall sign this section after site-specific training is completed and before being permitted to work on site.

I have read, or have been informed of, the Health and Safety Plan and understand the information presented. I will comply with the provisions contained therein.

Name (Print and Sign)	Date

ETHYLBENZENE	ICSC: 0268

Date of Peer Review: March 1995

Ethylbenzol
Phenylethane
EB

CAS #	100-41-4	C_8H_{10} / C_6H_5-C_2H_5
RTECS #	DA0700000	Molecular mass: 106.2
UN #	1175	
EC Index #	601-023-00-4	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**PREVENT GENERATION OF MISTS!**	
Inhalation	Cough. Dizziness. Drowsiness. Headache.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain. Blurred vision.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	(Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Refer for

			medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Ventilation. Collect leaking liquid in covered containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Personal protection: Afilter respirator for organic gases and vapours.	**EU Classification** Symbol: F, Xn R: 11-20 S: (2)-16-24/25-29 **UN Classification** UN Hazard Class: 3 UN Pack Group: II
EMERGENCY RESPONSE	**STORAGE**
Transport Emergency Card: TEC (R)-30S1175 or 30GF1-I+II NFPA Code: H2; F3; R0	Fireproof. Separated from strong oxidants.

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SEE IMPORTANT INFORMATION ON BACK

ETHYLBENZENE

ICSC: 0268

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH AROMATIC ODOUR.

PHYSICAL DANGERS:
The vapour mixes well with air, explosive mixtures are easily formed.

CHEMICAL DANGERS:
Reacts with strong oxidants. Attacks plastic and rubber.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 100 ppm as TWA, 125 ppm as STEL; A3 (confirmed animal carcinogen with unknown relevance to humans); (ACGIH 2004).
MAK: skin absorption (H); Carcinogen category: 3A; (DFG 2004).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure far above the OEL could cause lowering of consciousness.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis.

PHYSICAL PROPERTIES

Boiling point: 136°C
Melting point: -95°C
Relative density (water = 1): 0.9
Solubility in water, g/100 ml at 20°C: 0.015
Vapour pressure, kPa at 20°C: 0.9
Relative vapour density (air = 1): 3.7

Relative density of the vapour/air-mixture at 20°C (air = 1): 1.02
Flash point: 18°C c.c.
Auto-ignition temperature: 432°C
Explosive limits, vol% in air: 1.0-6.7
Octanol/water partition coefficient as log Pow: 3.2

ENVIRONMENTAL DATA

The substance is harmful to aquatic organisms.

NOTES

The odour warning when the exposure limit value is exceeded is insufficient. Card has been partly updated in October 2005. See sections Occupational Exposure Limits, Emergency Response.

ADDITIONAL INFORMATION

o-XYLENE	ICSC: 0084

Date of peer-review: March 2002

ortho-Xylene
1,2-Dimethylbenzene
o-Xylol

CAS #	95-47-6	$C_6H_4(CH_3)_2$ / C_8H_{10}
RTECS #	ZE2450000	Molecular mass: 106.2
UN #	1307	
EC #	601-022-00-9	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 32°C explosive vapour/air mixtures may be formed.	Above 32°C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	
Inhalation	Dizziness. Drowsiness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Burning sensation. Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Ventilation. Remove all ignition sources. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. (Extra personal protection: filter respirator for organic gases and vapours.)	**EU Classification** Symbol: Xn R: 10-20/21-38 S: (2-)25 Note: C **UN Classification** UN Hazard Class: 3 UN Pack Group: III
EMERGENCY RESPONSE	**STORAGE**
Transport Emergency Card: TEC (R)-30S1307-III NFPA Code: H 2; F 3; R 0;	Fireproof. Separated from strong oxidants and strong acids.

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o-XYLENE

ICSC: 0084

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
Reacts with strong acids and strong oxidants.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 100 ppm as TWA; 150 ppm as STEL A4 (ACGIH 2001). BEI specified by (ACGIH 2001). EU OEL: 50 ppm as TWA; 100 ppm as STEL (skin) (EU 2000).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes and the skin. The substance may cause effects on the central nervous system. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin. The substance may have effects on the central nervous system. Exposure to the substance may enhance

hearing damage caused by exposure to noise. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 144°C
Melting point: -25°C
Relative density (water = 1): 0.88
Solubility in water: none
Vapour pressure, kPa at 20°C: 0.7
Relative vapour density (air = 1): 3.7

Relative density of the vapour/air-mixture at 20°C (air = 1): 1.02
Flash point: 32°C c.c.
Auto-ignition temperature: 463°C
Explosive limits, vol% in air: 0.9-6.7
Octanol/water partition coefficient as log Pow: 3.12

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. The recommendations on this Card also apply to technical xylene. See ICSC 0086 p-Xylene and 0085 m-Xylene.

ADDITIONAL INFORMATION

m-XYLENE	ICSC: 0085

Date of Peer Review: March 2002

meta-Xylene
1,3-Dimethylbenzene
m-Xylol

CAS #	108-38-3	$C_6H_4(CH_3)_2$ / C_8H_{10}
RTECS #	ZE2275000	Molecular mass: 106.2
UN #	1307	
EC #	601-022-00-9	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 27°C explosive vapour/air mixtures may be formed.	Above 27°C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**STRICT HYGIENE!**	
Inhalation	Dizziness. Drowsiness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Burning sensation. Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING

Ventilation. Remove all ignition sources. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. (Extra personal protection: filter respirator for organic gases and vapours.)	**EU Classification** Symbol: Xn R: 10-20/21-38 S: (2)-25 Note: [C] **UN Classification** UN Hazard Class: 3 UN Pack Group: III
EMERGENCY RESPONSE	**STORAGE**
NFPA Code: H 2; F 3; R 0; Transport Emergency Card: TEC (R)-30S1307-III	Fireproof. Separated from strong oxidants and strong acids.

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m-XYLENE

ICSC: 0085

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
Reacts with strong acids and strong oxidants.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 100 ppm as TWA; 150 ppm as STEL A4 (ACGIH 2001).
BEI specified by (ACGIH 2001).
EU OEL: 50 ppm as TWA; 100 ppm as STEL (skin) (EU 2000).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes and the skin. The substance may cause effects on the central nervous system. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin. The substance may have effects on the central nervous system. Exposure to the substance may enhance hearing damage caused by exposure to noise.

Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 139°C
Melting point: -48°C
Relative density (water = 1): 0.86
Solubility in water: none
Vapour pressure, kPa at 20°C: 0.8
Relative vapour density (air = 1): 3.7

Relative density of the vapour/air-mixture at 20°C (air = 1): 1.02
Flash point: 27°C c.c.
Auto-ignition temperature: 527°C
Explosive limits, vol% in air: 1.1-7.0
Octanol/water partition coefficient as log Pow: 3.20

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. The recommendations on this Card also apply to technical xylene. See ICSC 0084 o-Xylene and 0086 p-Xylene.

ADDITIONAL INFORMATION

p-XYLENE	ICSC: 0086

Date of peer-review: March 2002

para-Xylene
1,4-Dimethylbenzene
p-Xylol

CAS #	106-42-3	$C_6H_4(CH_3)_2$ / C_8H_{10}
RTECS #	ZE2625000	Molecular mass: 106.2
UN #	1307	
EC #	601-022-00-9	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 27°C explosive vapour/air mixtures may be formed.	Above 27°C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	
Inhalation	Dizziness. Drowsiness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Burning sensation. Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Ventilation. Remove all ignition sources. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. (Extra personal protection: filter respirator for organic gases and vapours.)	**EU Classification** Symbol: Xn R: 10-20/21-38 S: (2-)25 Note: C **UN Classification** UN Hazard Class: 3 UN Pack Group: III
EMERGENCY RESPONSE	**STORAGE**
Transport Emergency Card: TEC (R)-30S1307-III NFPA Code: H 2; F 3; R 0;	Fireproof. Separated from strong oxidants, and strong acids.

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p-XYLENE

ICSC: 0086

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
Reacts with strong acids and strong oxidants.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 100 ppm as TWA; 150 ppm as STEL A4 (ACGIH 2001). BEI specified by (ACGIH 2001). EU OEL: 50 ppm as TWA; 100 ppm as STEL (skin) (EU 2000).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes and the skin. The substance may cause effects on the central nervous system. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin. The substance may have effects on the central nervous system. Exposure to the substance may enhance

hearing damage caused by exposure to noise. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 138°C
Melting point: 13°C
Relative density (water = 1): 0.86
Solubility in water: none
Vapour pressure, kPa at 20°C: 0.9
Relative vapour density (air = 1): 3.7

Relative density of the vapour/air-mixture at 20°C (air = 1): 1.02
Flash point: 27°C c.c.
Auto-ignition temperature: 528°C
Explosive limits, vol% in air: 1.1-7.0
Octanol/water partition coefficient as log Pow: 3.15

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. The recommendations on this Card also apply to technical xylene. See ICSC 0084 o-Xylene and 0085 m-Xylene.

ADDITIONAL INFORMATION

1,2,4-TRIMETHYLBENZENE

ICSC: 1433

Date of Peer Review: March 2002

Pseudocumene

CAS #	95-63-6	C_9H_{12}
RTECS #	DC3325000	Molecular mass: 120,2
UN #	1993	
EC Index #	601-043-00-3	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Alcohol-resistant foam, dry powder, carbon dioxide.
EXPLOSION	Above 44°C explosive vapour/air mixtures may be formed.	Above 44°C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**PREVENT GENERATION OF MISTS!**	
Inhalation	Confusion. Cough. Dizziness. Drowsiness. Headache. Sore throat. Vomiting.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Redness. Dry skin.	Protective gloves.	Rinse skin with plenty of water or shower.
Eyes	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	(See Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING

Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Personal protection: filter respirator for organic gases and vapours.	**EU Classification** Symbol: Xn, N R: 10-20-36/37/38-51/53 S: (2-)23-61 **UN Classification** UN Hazard Class: 3 UN Pack Group: III
EMERGENCY RESPONSE	**STORAGE**
Transport Emergency Card: TEC (R)-30GF1-III NFPA Code: H0; F2; R0;	Fireproof. Separated from strong oxidants. Well closed. Keep in a well-ventilated room.

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SEE IMPORTANT INFORMATION ON BACK

1,2,4-TRIMETHYLBENZENE

ICSC: 1433

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

CHEMICAL DANGERS:
The substance decomposes on burning producing toxic and irritating fumes. Reacts violently with strong oxidants causing fire and explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: (as mixed isomers) 25 ppm as TWA; (ACGIH 2004).
MAK: (as mixed isomers) 20 ppm, 100 mg/m³; Peak limitation category: II(2); Pregnancy risk group: C; (DFG 2004).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C; on spraying or dispersing, however, much faster.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes the skin and the respiratory tract. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. The substance may cause effects on the central nervous system.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin. Lungs may be affected by repeated or prolonged exposure, resulting in chronic bronchitis. The substance may have effects on the central nervous system and blood. See Notes.

PHYSICAL PROPERTIES

Boiling point: 169°C	Relative density of the vapour/air-mixture at

Melting point: -44°C
Relative density (water = 1): 0.88
Solubility in water: very poor
Relative vapour density (air = 1): 4.1

20°C (air = 1): 1.01
Flash point: 44°C c.c.
Auto-ignition temperature: 500°C
Explosive limits, vol% in air: 0.9-6.4
Octanol/water partition coefficient as log Pow: 3.8

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms. Bioaccumulation of this chemical may occur in fish.

NOTES

Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is suggested. See also ICSC 1155 1,3,5-Trimethylbenzene (Mesitylene), ICSC 1362 1,2,3-Trimethylbenzene (Hemimellitene), ICSC 1389 Trimethyl benzene (mixed isomers). 1,3,5-Trimethylbenzene (Mesitylene) is classified as a marine pollutant. Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

1,3,5-TRIMETHYLBENZENE

ICSC: 1155

Date of Peer Review: March 2002

Mesitylene

CAS #	108-67-8	C_9H_{12}
RTECS #	OX6825000	Molecular mass: 120.2
UN #	2325	
EC #	601-025-00-5	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Alcohol-resistant foam, dry powder, carbon dioxide.
EXPLOSION	Above 50°C explosive vapour/air mixtures may be formed.	Above 50°C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**PREVENT GENERATION OF MISTS!**	
Inhalation	Confusion. Cough. Dizziness. Drowsiness. Headache. Sore throat. Vomiting.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Redness. Dry skin.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
Eyes	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	(See Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Personal protection: filter respirator for organic gases and vapours.	Marine pollutant. **EU Classification** Symbol: Xn, N R: 10-37-51/53 S: (2-)61 **UN Classification** UN Hazard Class: 3 UN Pack Group: III
EMERGENCY RESPONSE	**SAFE STORAGE**
Transport Emergency Card: TEC (R)-30S2325 NFPA Code: H0; F2; R0	Fireproof. Separated from strong oxidants. Well closed. Keep in a well-ventilated room.

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SEE IMPORTANT INFORMATION ON BACK

1,3,5-TRIMETHYLBENZENE

ICSC: 1155

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

CHEMICAL DANGERS:
The substance decomposes on burning producing toxic and irritating fumes. Reacts violently with strong oxidants causing fire and explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 25 ppm as TWA; (ACGIH 2004).
MAK: (all isomers) 20 ppm, 100 mg/m³; Peak limitation category: II(2); Pregnancy risk group: C; (DFG 2004).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C; on spraying or dispersing, however, much faster.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes, the skin and the respiratory tract. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. The substance may cause effects on the central nervous system.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin. Lungs may be affected by repeated or prolonged exposure, resulting in chronic bronchitis. The substance

may have effects on the central nervous system and blood. See Notes.

PHYSICAL PROPERTIES

Boiling point: 165°C
Melting point: -45°C
Relative density (water = 1): 0.86
Solubility in water: very poor
Vapour pressure, kPa at 20°C: 0.25
Relative vapour density (air = 1): 4.1
Relative density of the vapour/air-mixture at 20°C (air = 1): 1.01
Flash point: 50°C (c.c.)
Auto-ignition temperature: 550°C
Octanol/water partition coefficient as log Pow: 3.42

ENVIRONMENTAL DATA

The substance is harmful to aquatic organisms. Bioaccumulation of this chemical may occur in fish.

NOTES

Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is suggested. See ICSC 1433 1,2,4-Trimethylbenzene (Pseudocumene), ICSC 1362 1,2,3-Trimethylbenzene (Hemimellitene), ICSC 1389 Trimethyl benzene (mixed isomers).
Card has been partly updated in April 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

BENZENE	ICSC: 0015

Date of Peer Review: May 2003

Cyclohexatriene
Benzol

CAS #	71-43-2	C_6H_6
RTECS #	CY1400000	Molecular mass: 78.1
UN #	1114	
EC #	601-020-00-8	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive. Risk of fire and explosion: see Chemical Dangers.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling. Use non-sparking handtools. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**AVOID ALL CONTACT!**	
Inhalation	Dizziness. Drowsiness. Headache. Nausea. Shortness of breath. Convulsions. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	MAY BE ABSORBED! Dry skin. Redness. Pain. (Further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
Eyes	Redness. Pain.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to

			a doctor.
Ingestion	Abdominal pain. Sore throat. Vomiting. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Remove all ignition sources. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Personal protection: complete protective clothing including self-contained breathing apparatus.	Do not transport with food and feedstuffs. **EU Classification** Symbol: F, T R: 45-46-11-36/38-48/23/24/25-65 S: 53-45 Note: [E] **UN Classification** UN Hazard Class: 3 UN Pack Group: II
EMERGENCY RESPONSE	**SAFE STORAGE**
Transport Emergency Card: TEC (R)-30S1114 / 30GF1-II NFPA Code: H2; F3; R0	Fireproof. Separated from food and feedstuffs oxidants and halogens.

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BENZENE

ICSC: 0015

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The vapour is heavier than air and may travel along the ground; distant ignition possible. As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
Reacts violently with oxidants, nitric acid, sulfuric acid and halogens causing fire and explosion hazard. Attacks plastic and rubber.

OCCUPATIONAL EXPOSURE LIMITS:

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous

TLV: 0.5 ppm as TWA; 2.5 ppm as STEL; (skin); A1; BEI issued; (ACGIH 2004).
MAK: H; Carcinogen category: 1; Germ cell mutagen group: 3A; (DFG 2004).

system, resulting in lowering of consciousness. Exposure far above the occupational exposure limit value may result in unconsciousness and death.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin. The substance may have effects on the bone marrow and immune system, resulting in a decrease of blood cells. This substance is carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 80°C
Melting point: 6°C
Relative density (water = 1): 0.88
Solubility in water, g/100 ml at 25°C: 0.18
Vapour pressure, kPa at 20°C: 10
Relative vapour density (air = 1): 2.7

Relative density of the vapour/air-mixture at 20°C (air = 1): 1.2
Flash point: -11°C c.c.
Auto-ignition temperature: 498°C
Explosive limits, vol% in air: 1.2-8.0
Octanol/water partition coefficient as log Pow: 2.13

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms.

NOTES

Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient.
Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

DIISOPROPYL ETHER	ICSC: 0906

Date of Peer Review: March 1996

Isopropyl ether
2,2'-Oxybispropane
2-Isopropoxypropane

CAS #	108-20-3	$C_6H_{14}O$ / $(CH_3)_2CHOCH(CH_3)_2$
RTECS #	TZ5425000	Molecular mass: 102.18
UN #	1159	
EC #	603-045-00-X	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	AFFF, powder, alcohol-resistant foam, water spray, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
Inhalation	Cough. Drowsiness. Sore throat.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
Eyes	Redness.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	(Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Rest. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING

Evacuate danger area! Consult an expert! Ventilation. Collect leaking and spilled liquid in sealable metal containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Personal protection: self-contained breathing apparatus.	**EU Classification** Symbol: F R: 11-19-66-67 S: 2-9-16-29-33 Note: [C] **UN Classification** UN Hazard Class: 3 UN Pack Group: II
EMERGENCY RESPONSE	**SAFE STORAGE**
Transport Emergency Card: TEC (R)-30S1159 NFPA Code: H1; F3; R1;	Fireproof. Cool. Keep in the dark. Keep in a well-ventilated room. Store only if stabilized.

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DIISOPROPYL ETHER

ICSC: 0906

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The vapour is heavier than air and may travel along the ground; distant ignition possible. As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
The substance can readily form explosive peroxides if unstabilized and explode on shaking.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 250 ppm as TWA; 310 ppm as STEL; (ACGIH 2004).
MAK: 200 ppm, 850 mg/m³; Peak limitation category: I(2); Pregnancy risk group: D; (DFG 2004).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its vapour.

INHALATION RISK:
A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes, the skin and the respiratory tract. The substance may cause effects on the central nervous system. Exposure above the OEL could cause lowering of consciousness.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis.

PHYSICAL PROPERTIES

Boiling point: 69°C Melting point: -60°C Relative density (water = 1): 0.7	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.5 Flash point: -28°C

Solubility in water: poor
Vapour pressure, kPa at 20°C: 15.9
Relative vapour density (air = 1): 3.5

Auto-ignition temperature: 443°C
Explosive limits, vol% in air: 1.4-7.9

ENVIRONMENTAL DATA

NOTES

Usually contains p-benzylaminophenol as stabilizer. An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert. Check for peroxides prior to distillation; eliminate if found.
Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

CUMENE	ICSC: 0170

Date of Peer Review: April 2000

(1-Methylethyl)benzene
2-Phenylpropane
Isopropylbenzene

CAS #	98-82-8	C_9H_{12} / $C_6H_5CH(CH_3)_2$
RTECS #	GR8575000	Molecular mass: 120.2
UN #	1918	
EC #	601-024-00-X	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Above 31°C explosive vapour/air mixtures may be formed.	Above 31°C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**PREVENT GENERATION OF MISTS!**	
Inhalation	Dizziness. Ataxia. Drowsiness. Headache. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	(See Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. Personal protection: filter respirator for organic gases and vapours.	Marine pollutant. **EU Classification** Symbol: Xn, N R: 10-37-51/53-65 S: (2)-24-37-61-62 Note: [C] **UN Classification** UN Hazard Class: 3 UN Pack Group: III
EMERGENCY RESPONSE	**SAFE STORAGE**
Transport Emergency Card: TEC (R)-30S1918 or 30GF1-III NFPA Code: H2; F3; R1	Fireproof. Separated from strong oxidants, acids. Cool. Keep in the dark. Store only if stabilized.

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CUMENE

ICSC: 0170

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
Reacts violently with acids and strong oxidants causing fire and explosion hazard. The substance can form explosive peroxides.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 50 ppm as TWA; (ACGIH 2004).
MAK: 50 ppm, 250 mg/m³; Peak limitation category: II(4); skin absorption (H); Pregnancy risk group: C; (DFG 2004).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation and through the skin.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes and the skin. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure far above the OEL may result in unconsciousness.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:

Repeated or prolonged contact with skin may cause dermatitis.

PHYSICAL PROPERTIES

Boiling point: 152°C
Melting point: -96°C
Relative density (water = 1): 0.90
Solubility in water: none
Vapour pressure, Pa at 20°C: 427
Relative vapour density (air = 1): 4.2

Relative density of the vapour/air-mixture at 20°C (air = 1): 1.01
Flash point: 31°C c.c.
Auto-ignition temperature: 420°C
Explosive limits, vol% in air: 0.9-6.5
Octanol/water partition coefficient as log Pow: 3.66

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Check for peroxides prior to distillation; eliminate if found.
Card has been partly updated in April 2005. See sections Occupational Exposure Limits, Emergency Response.

ADDITIONAL INFORMATION

NAPHTHALENE

0667
April 2005

CAS No: 91-20-3
RTECS No: QJ0525000
UN No: 1334 (solid); 2304 (molten)
EC No: 601-052-00-2

Naphthene
$C_{10}H_8$
Molecular mass: 128.18

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 80 C explosive vapour/air mixtures may be formed. Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		**PREVENT DISPERSION OF DUST!**	
Inhalation	Headache. Weakness. Nausea. Vomiting. Sweating. Confusion. Jaundice. Dark urine.	Ventilation (not if powder), local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	MAY BE ABSORBED! (Further see Inhalation).	Protective gloves.	Rinse skin with plenty of water or shower.
Eyes		Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Diarrhoea. Convulsions. Unconsciousness. (Further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rest. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING	
Personal protection: filter respirator for organic gases and vapours. Do NOT let this chemical enter the environment. Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	Xn Symbol N Symbol R: 22-40-50/53 S: (2-)36/37-46-60-61 UN Hazard Class: 4.1 UN Pack Group: III	Do not transport with food and feedstuffs. Marine pollutant.

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-41S1334 (solid); 41GF1-II+III (solid); 41S2304 (molten) NFPA Code: H2; F2; R0	Separated from strong oxidants, food and feedstuffs. Store in an area without drain or sewer access.

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IMPORTANT DATA

Physical State; Appearance
WHITE SOLID IN VARIOUS FORMS, WITH CHARACTERISTIC ODOUR.

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air.

Chemical dangers
On combustion, forms irritating and toxic gases. Reacts with strong oxidants.

Occupational exposure limits
TLV: 10 ppm as TWA; 15 ppm as STEL; (skin); A4 (not classifiable as a human carcinogen); (ACGIH 2005).
MAK: skin absorption (H); Carcinogen category: 2; Germ cell mutagen group: 3B; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

Inhalation risk
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20 C. See Notes.

Effects of short-term exposure
The substance may cause effects on the blood, resulting in lesions of blood cells (haemolysis). See Notes. The effects may be delayed. Exposure by ingestion may result in death. Medical observation is indicated.

Effects of long-term or repeated exposure
The substance may have effects on the blood, resulting in chronic haemolytic anaemia. The substance may have effects on the eyes, resulting in the development of cataract. This substance is possibly carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 218 C Sublimation slowly at room temperature
Melting point: 80 C
Density: 1.16 g/cm^3
Solubility in water, g/100 ml at 25 C: none
Vapour pressure, Pa at 25 C: 11
Relative vapour density (air = 1): 4.42
Flash point: 80 C c.c.
Auto-ignition temperature: 540 C
Explosive limits, vol% in air: 0.9-5.9
Octanol/water partition coefficient as log Pow: 3.3

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment.

NOTES

Some individuals may be more sensitive to the effect of naphthalene on blood cells.

ADDITIONAL INFORMATION

TOLUENE	ICSC: 0078

Date of Peer Review: October 2002

Methylbenzene
Toluol
Phenylmethane

CAS #	108-88-3	$C_6H_5CH_3$ / C_7H_8
RTECS #	XS5250000	Molecular mass: 92.1
UN #	1294	
EC #	601-021-00-3	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding). Do NOT use compressed air for filling, discharging, or handling. Use non-sparking handtools.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	
Inhalation	Cough. Sore throat. Dizziness. Drowsiness. Headache. Nausea. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
Eyes	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove

			contact lenses if easily possible), then take to a doctor.
Ingestion	Burning sensation. Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area in large spill! Consult an expert in large spill! Remove all ignition sources. Ventilation. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Personal protection: self-contained breathing apparatus in large spill.	**EU Classification** Symbol: F, Xn R: 11-38-48/20-63-65-67 S: (2-)36/37-46-62 **UN Classification** UN Hazard Class: 3 UN Pack Group: II
EMERGENCY RESPONSE	**SAFE STORAGE**
Transport Emergency Card: TEC (R)-30S1294 NFPA Code: H 2; F 3; R 0;	Fireproof. Separated from strong oxidants.

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TOLUENE

ICSC: 0078

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The vapour mixes well with air, explosive mixtures are formed easily. As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
Reacts violently with strong oxidants causing fire and explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS:

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes and the respiratory tract. The substance may cause effects on the central nervous system. If this liquid is swallowed, aspiration into the lungs

TLV: 50 ppm as TWA; (skin); A4; BEI issued; (ACGIH 2004).
MAK: 50 ppm, 190 mg/m³; H; Peak limitation category: II(4); Pregnancy risk group: C; (DFG 2004).

may result in chemical pneumonitis. Exposure at high levels may result in cardiac dysrhythmia and unconsciousness.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin. The substance may have effects on the central nervous system. Exposure to the substance may enhance hearing damage caused by exposure to noise. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 111°C
Melting point: -95°C
Relative density (water = 1): 0.87
Solubility in water: none
Vapour pressure, kPa at 25°C: 3.8
Relative vapour density (air = 1): 3.1

Relative density of the vapour/air-mixture at 20°C (air = 1): 1.01
Flash point: 4°C c.c.
Auto-ignition temperature: 480°C
Explosive limits, vol% in air: 1.1-7.1
Octanol/water partition coefficient as log Pow: 2.69

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is suggested. Use of alcoholic beverages enhances the harmful effect.
Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

TRICHLOROETHYLENE

0081
October 2000

CAS No: 79-01-6
RTECS No: KX4550000
UN No: 1710
EC No: 602-027-00-9

1,1,2-Trichloroethylene
Trichloroethene
Ethylene trichloride
Acetylene trichloride
C_2HCl_3 / $ClCH=CCl_2$
Molecular mass: 131.4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible under specific conditions. See Notes.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION		Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**PREVENT GENERATION OF MISTS! STRICT HYGIENE!**	
Inhalation	Dizziness. Drowsiness. Headache. Weakness. Nausea. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety spectacles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give plenty of water to drink. Rest.

SPILLAGE DISPOSAL	PACKAGING & LABELLING	
Ventilation. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Personal protection: filter respirator for organic gases and vapours. Do NOT let this chemical enter the environment.	T Symbol R: 45-36/38-52/53-67 S: 53-45-61 UN Hazard Class: 6.1 UN Pack Group: III	Do not transport with food and feedstuffs. Marine pollutant.

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-61S1710 NFPA Code: H2; F1; R0	Separated from metals (see Chemical Dangers), strong bases, food and feedstuffs. Dry. Keep in the dark. Ventilation along the floor.

IPCS
International Programme on Chemical Safety

UNEP

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission

SEE IMPORTANT INFORMATION ON THE BACK.

IMPORTANT DATA

Physical State; Appearance
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Physical dangers
The vapour is heavier than air. As a result of flow, agitation, etc., electrostatic charges can be generated.

Chemical dangers
On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes (phosgene, hydrogen chloride). The substance decomposes on contact with strong alkali producing dichloroacetylene, which increases fire hazard. Reacts violently with metal powders such as magnesium, aluminium, titanium, and barium. Slowly decomposed by light in presence of moisture, with formation of corrosive hydrochloric acid.

Occupational exposure limits
TLV: 50 ppm as TWA; 100 ppm as STEL; A5; BEI issued; (ACGIH 2004).
MAK: Carcinogen category: 1; Germ cell mutagen group: 3B; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation and by ingestion.

Inhalation risk
A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20 C.

Effects of short-term exposure
The substance is irritating to the eyes and the skin. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system, resulting in respiratory failure. Exposure could cause lowering of consciousness.

Effects of long-term or repeated exposure
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the central nervous system, resulting in loss of memory. The substance may have effects on the liver and kidneys (see Notes). This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 87 C
Melting point: -73 C
Relative density (water = 1): 1.5
Solubility in water, g/100 ml at 20 C: 0.1
Vapour pressure, kPa at 20 C: 7.8
Relative vapour density (air = 1): 4.5
Relative density of the vapour/air-mixture at 20 C (air = 1): 1.3
Auto-ignition temperature: 410 C
Explosive limits, vol% in air: 8-10.5
Octanol/water partition coefficient as log Pow: 2.42

ENVIRONMENTAL DATA

The substance is harmful to aquatic organisms. The substance may cause long-term effects in the aquatic environment.

NOTES

Combustible vapour/air mixtures difficult to ignite, may be developed under certain conditions.
Use of alcoholic beverages enhances the harmful effect.
Depending on the degree of exposure, periodic medical examination is suggested.
The odour warning when the exposure limit value is exceeded is insufficient.
Do NOT use in the vicinity of a fire or a hot surface, or during welding.
An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.
Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

TETRACHLOROETHYLENE

0076
April 2000

CAS No: 127-18-4
RTECS No: KX3850000
UN No: 1897
EC No: 602-028-00-4

1,1,2,2-Tetrachloroethylene
Perchloroethylene
Tetrachloroethene
C_2Cl_4 / $Cl_2C=CCl_2$
Molecular mass: 165.8

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			

EXPOSURE		**STRICT HYGIENE! PREVENT GENERATION OF MISTS!**	
Inhalation	Dizziness. Drowsiness. Headache. Nausea. Weakness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety goggles, face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give plenty of water to drink. Rest.

SPILLAGE DISPOSAL	**PACKAGING & LABELLING**	
Ventilation. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. Personal protection: filter respirator for organic gases and vapours.	Xn Symbol N Symbol R: 40-51/53 S: (2-)23-36/37-61 UN Hazard Class: 6.1 UN Pack Group: III	Do not transport with food and feedstuffs. Marine pollutant.

EMERGENCY RESPONSE	**SAFE STORAGE**
Transport Emergency Card: TEC (R)-61S1897 NFPA Code: H2; F0; R0	Separated from metals, (see Chemical Dangers), food and feedstuffs. Keep in the dark. Ventilation along the floor.

IPCS
International Programme on Chemical Safety

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission

SEE IMPORTANT INFORMATION ON THE BACK.

IMPORTANT DATA

Physical State; Appearance
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Physical dangers
The vapour is heavier than air.

Chemical dangers
On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes (hydrogen chloride, phosgene, chlorine). The substance decomposes slowly on contact with moisture producing trichloroacetic acid and hydrochloric acid. Reacts with metals such as aluminium, lithium, barium, beryllium.

Occupational exposure limits
TLV: 25 ppm as TWA, 100 ppm as STEL; A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued; (ACGIH 2004).
MAK: skin absorption (H); Carcinogen category: 3B; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation and by ingestion.

Inhalation risk
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20 C.

Effects of short-term exposure
The substance is irritating to the eyes, the skin and the respiratory tract. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure at high levels may result in unconsciousness.

Effects of long-term or repeated exposure
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the liver and kidneys. This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 121 C
Melting point: -22 C
Relative density (water = 1): 1.6
Solubility in water, g/100 ml at 20 C: 0.015
Vapour pressure, kPa at 20 C: 1.9
Relative vapour density (air = 1): 5.8
Relative density of the vapour/air-mixture at 20 C (air = 1): 1.09
Octanol/water partition coefficient as log Pow: 2.9

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment.

NOTES

Depending on the degree of exposure, periodic medical examination is suggested.
The odour warning when the exposure limit value is exceeded is insufficient.
Do NOT use in the vicinity of a fire or a hot surface, or during welding.
An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.
Card has been partly updated in April 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

APPENDIX B

ACTIVITY HAZARD ANALYSES

Project Identification 2040 White Plains Rd.	**Location** Bronx, NY	**Estimated Dates** May 2005
Phase of Work Mobilization/ Demobilization	**Page 1 of 1**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
1. Monitoring well / chemical oxidant injection well installation	Slips/trips/falls	• Maintain alertness to slip/trip/fall hazards; • Maintain good housekeeping; • Walk, do not run; • Wear footwear with soles that grip; • Unloading areas should be on even terrain; and • Mark and repair if possible tripping hazards.
	Manual lifting and material handling	• Instruct personnel on proper lifting techniques; • Use proper lifting techniques; and • Team lifting will be used for heavy loads or use mechanical lifting devices.
	Temperature extremes	• Drink plenty of fluids: • Train personnel of signs/symptoms of heat/cold stress; • Monitor air temperatures when extreme weather conditions are present; and • Stay in visual and verbal contact with your buddy.
	Vehicular traffic	• Spotters will be used when backing up trucks and heavy equipment and when moving equipment.
	Overhead hazards	• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1; • All ground personnel will stay clear of suspended loads; • All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects; and • All overhead hazards will be identified prior to commencing work operations.
	Noise	• Ear plugs or ear muffs shall be worn for operations that exceed 85 decibels.
	Electrocution	• Equipment will be equipped with GFCI; • A licensed electrician will conduct all electrical work; • All equipment will stay a minimum of 15 feet from overhead-energized electrical lines (50 kV). This distance will increase .4 inches for each 1 kV above 50 kV.
	Biological hazards	• Be alert to the presence of biological hazards; • Wear insect repellent; • Follow procedures in Section 4.2.2 for tick bites; • FOL/HSO should be aware of on-site personnel with allergic reactions in insect bites and stings.

Project Identification 2040 White Plains Rd.	**Location** Bronx, NY	**Estimated Dates** May 2005
Phase of Work Excavation and Loading Operations	**Page 1 of 2**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
1. Mix Chemical Oxidant Solution 2. Inject Chemical Oxidant	Chemical hazards	• Wear appropriate PPE per Table 6-1; • Practice contamination avoidance; • Follow proper decontamination procedures; and • Wash hands/face before eating, drinking or smoking.
	Hand and power tool usage	• Equip all electrical equipment with GFCI's; • Inspect all electrical equipment and tools prior to use; • Daily inspections will be performed; • Remove broken or damaged tools from service; • Use the tool for its intended purpose; • Use in accordance with manufacturer instructions; and • Tag and remove defective equipment.
	Temperature extremes	• Drink plenty of fluids: • Train personnel of signs/symptoms of heat/cold stress; • Monitor air temperatures when extreme weather conditions are present; and, • Stay in visual and verbal contact with your buddy.
	Manual lifting and material handling	• Instruct personnel on proper lifting techniques; • Use proper lifting techniques; and • Team lifting will be used for heavy loads or use mechanical lifting devices.
	Fire/Explosion	• ABC type fire extinguishers shall be readily available; • No smoking in work area.
	Biological hazards	• Be alert to the presence of biological hazards; • Wear insect repellent; • Follow procedures in Section 4.2.2 for tick bites; • FOL/HSO should be aware of on-site personnel with allergic reactions in insect bites and stings.
	Heavy equipment	• Drill rigs will be operated in accordance with procedures outlined in Section 10.4 • Eye contact with operators will be made before approaching equipment; • Equipment will not be approached on blind sides; • All equipment will be equipped with backup alarms or spotters shall be used.
	Slips/Trips/Falls	• Maintain alertness to slip/trip/fall hazards; • Maintain good housekeeping; • Walk, do not run; • Wear footwear with soles that grip; • Unloading areas should be on even terrain; and • Mark and repair if possible tripping hazards.

Project Identification 2040 White Plains Rd.	**Location** Bronx, NY	**Estimated Dates** April 2005
Phase of Work Excavation and Loading Operations	**Page 2 of 2**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
	Noise	• Hearing protection mandatory at or above 85 dBA. • Instruct personnel how to properly wear heating protective devices. • Disposable ear plugs or other hearing protection required when working near noisy equipment..
	Steam/Heat/Splashing	• Use face shield and safety glasses or goggles; • Stay out of the splash/steam radius; • Do not direct steam at anyone; • Do not hold objects with your foot and steam area near it; • Ensure that the direction of spray minimizes spread of constituents of concern; and • Use shielding as necessary.
	Excavation hazards	• Follow 29 CFR 1926 Subpart P.
	Overhead hazards	• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1; • All ground personnel will stay clear of suspended loads; • All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects; and • All overhead hazards will be identified prior to commencing work operations.

Project Identification 2040 White Plains Rd.	**Location** Bronx, NY	**Estimated Dates** May 2005
Phase of Work Soil Sampling	**Page 1 of 1**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
• Collect Groundwater samples.	Chemical hazards	• Wear appropriate PPE per Table 6-1; • Practice contamination avoidance; • Follow proper decontamination procedures; and • Wash hands/face before eating, drinking or smoking.
	Temperature extremes	• Drink plenty of fluids: • Train personnel of signs/symptoms of heat/cold stress; • Monitor air temperatures when extreme weather conditions are present; and • Stay in visual and verbal contact with your buddy.
	Manual lifting and material handling	• Site personnel will be instructed on proper lifting techniques; mechanical devices should be used to reduce manual handling of materials; team lifting should be utilized if mechanical devices are not available.
	Slips/Trips/Falls	• Maintain alertness to slip/trip/fall hazards; • Maintain good housekeeping; • Walk, do not run; • Wear footwear with soles that grip; • Unloading areas should be on even terrain; and • Mark and repair if possible tripping hazards.

APPENDIX C

MEDICAL DATA SHEET

MEDICAL DATA SHEET

The brief medical data sheet shall be completed by on-site personnel and will be kept in the Support Zone by the HSO as a project record during the conduct of site operations. It accompanies any personnel when medical assistance is needed or if transport to a hospital is required.

Project: _____

Name: _____ Home Telephone: _____

Address: _____

Age: _____ Height: _____ Weight: _____ Blood Type: _____

Name and Telephone Number of Emergency Contact: _____

Drug or Other Allergies: _____

Particular Sensitivities: _____

Do You Wear Contacts? _____

Provide A Check List Of Previous Illnesses: _____

_____

What Medications Are You Presently Using?_____

_____

Do You Have Any Medical Restrictions? _____

_____

Name, Address, And Phone Number Of Personal Physician:_____

_____

APPENDIX D

GENERAL HEALTH AND SAFETY WORK PRACTICES

GENERAL HEALTH AND SAFETY WORK PRACTICES

1. All site personnel must attend each day's Daily Briefing and sign the attendance sheet.

2. Any individual taking prescribed drugs shall inform the FOL/HSO of the type of medication. The FOL/HSO will review the matter with the HSM and the Corporate Medical Consultant (CMC), who will decide if the employee can safely work on-site while taking the medication.

3. The personal protective equipment specified by the FOL/HSO and/or associated procedures shall be worn by all site personnel. This includes hard hats and safety glasses which must be worn at all times in active work areas.

4. Facial hair (beards, long sideburns or mustaches) which may interfere with a satisfactory fit of a respirator mask is not allowed on any person who may be required to wear a respirator.

5. Personnel must follow proper decontamination procedures and shower as soon as possible upon completion of work shift.

6. Eating, drinking, chewing tobacco or gum, smoking and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the exclusion zone or the contamination reduction zone. (Exceptions may be permitted by the HSM to allow fluid intake during heat stress conditions).

7. All lighters, matches, cigarettes and other forms of tobacco are prohibited in the Exclusion Zone.

8. All signs and demarcations shall be followed. Such signs and demarcation shall not be removed, except as authorized by the FOL/HSO.

9. No one shall enter a permit-required confined space without a permit and appropriate training. Confined space entry permits shall be implemented as issued.

10. All personnel must follow Hot Work Permits as issued.

11. All personnel must use the Buddy System in the Exclusion Zone.

12. All personnel must follow the work-rest regimens and other practices required by the heat stress program.

13. All personnel must follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources.

14. No person shall operate equipment unless trained and authorized.

15. No one may enter an excavation greater than four feet deep unless authorized by the Competent Person. Excavations must be sloped or shored properly. Safe means of access and egress from excavations must be maintained.

16. Ladders and scaffolds shall be solidly constructed, in good working condition, and inspected prior to use. No one may use defective ladders or scaffolds.

17. Fall protection or fall arrest systems must be in place when working at elevations greater than six feet for temporary working surfaces and four feet for fixed platforms.

18. Safety belts, harnesses and lanyards must be selected by the Supervisor. The user must inspect the equipment prior to use. No defective personal fall protection equipment shall be used. Personal fall protection that has been shock loaded must be discarded.

19. Hand and portable power tools must be inspected prior to use. Defective tools and equipment shall not be used.

20. Ground fault interrupters shall be used for cord and plug equipment used outdoors or in damp locations. Electrical cords shall be kept out walkways and puddles unless protected and rated for the service.

21. Improper use, mishandling, or tampering with health and safety equipment and samples is prohibited.

22. Horseplay of any kind is prohibited.

23. Possession or use of alcoholic beverages, controlled substances, or firearms on any site is forbidden.

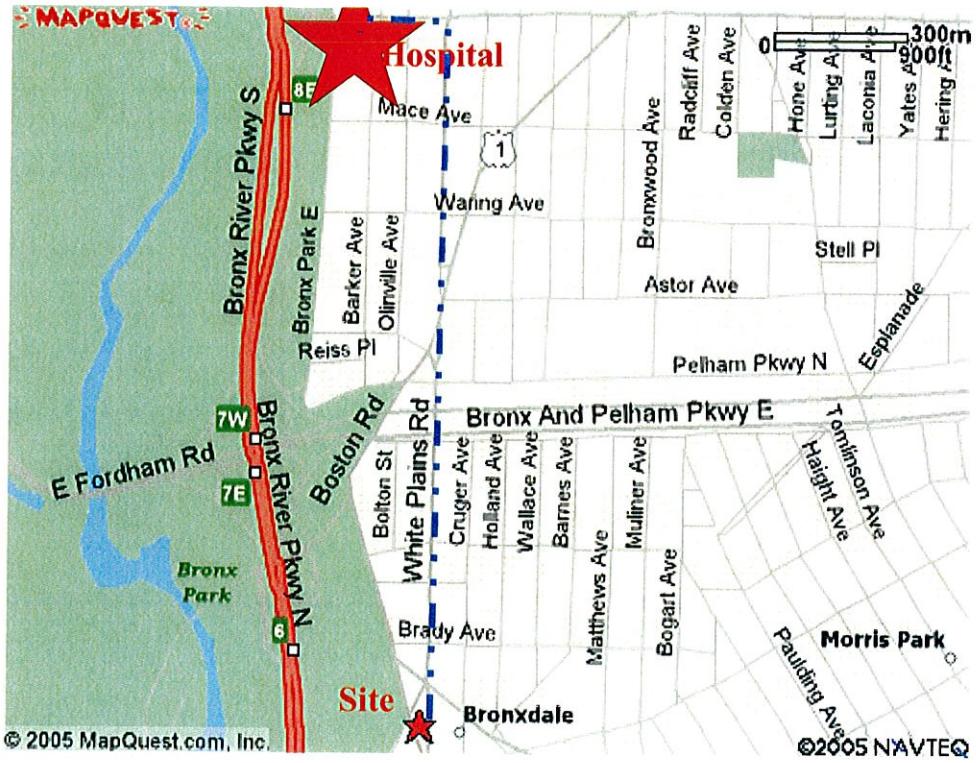
24. All incidents, no matter how minor, must be reported immediately to the Supervisor.

25. All personnel shall be familiar with the Site Emergency Response Plan, which is contained in Section 12 of the HASP.

The above Health and Safety Rules are not all inclusive and it is your responsibility to comply with all regulations set forth by OSHA, the client, PWGC Supervisors, and the FOL/HSO.

APPENDIX E

HOSPITAL ROUTE MAP



Directions:

Proceed north on White Plains Road to Allerton Avenue.

Make a left (west) on Allerton Avenue and follow to Beth Abraham Hospital (612 Allerton Ave.).

Total distance: Approx. 1.14 miles

Address:

Beth Abraham Hospital
612 Allerton Ave.
Bronx, New York
(718) 519-0152

APPENDIX F

INCIDENT REPORT FORM / INVESTIGATION FORM

INCIDENT / NEAR MISS REPORT AND INVESTIGATION - PAGE 1 OF 2

TYPE OF INCIDENT - CHECK ALL THAT APPLY

INJURY/ILLNESS	VEHICLE DAMAGE	PROPERTY DAMAGE	FIRE
SPILL/RELEASE	PERMIT EXCEEDENCE	NEAR MISS	OTHER

GENERAL INFORMATION

PROJECT NAME: DATE OF REPORT: REPORT NO.:

DATE OF INCIDENT: TIME: DAY OF WEEK:

LOCATION OF INCIDENT:

WEATHER CONDITIONS: ADEQUATE LIGHTING AT SCENE? YES NO

N/A

DESCRIBE WHAT HAPPENED (STEP BY STEP - USE ADDITIONAL PAGES IF NECESSARY)

AFFECTED EMPLOYEE INFORMATION

NAME: EMPLOYEE: YES NO

HOME ADDRESS:

SOCIAL SECURITY NO.: HOME PHONE NO.:

JOB CLASSIFICATION: YEARS IN JOB CLASSIFICATION:

HOURS WORKED ON SHIFT PRIOR TO INCIDENT: AGE:

DID INCIDENT RELATE TO ROUTINE TASK FOR JOB CLASSIFICATION? YES NO

INJURY/ILLNESS INFORMATION

NATURE OF INJURY OR ILLNESS:

OBJECT/EQUIPMENT/SUBSTANCE CAUSING HARM:

FIRST AID PROVIDED? YES NO

IF YES, WHERE WAS IT GIVEN: ON-SITE OFF-SITE

IF YES, WHO PROVIDED FIRST AID:

WILL THE INJURY/ILLNESS RESULT IN: RESTRICTED DUTY LOST TIME UNKNOWN

INCIDENT / NEAR MISS REPORT AND INVESTIGATION - PAGE 2 OF 2 REPORT NO.
MEDICAL TREATMENT INFORMATION
WAS MEDICAL TREATMENT PROVIDED? YES NO
IF YES, WAS MEDICAL TREATMENT PROVIDED: ON-SITE DR.'S OFFICE HOSPITAL
NAME OF PERSON(S) PROVIDING TREATMENT:
ADDRESS WHERE TREATMENT WAS PROVIDED:
TYPE OF TREATMENT:
VEHICLE AND PROPERTY DAMAGE INFORMATION
VEHICLE/PROPERTY DAMAGED:
DESCRIPTION OF DAMAGE:
SPILL AND AIR EMISSIONS INFORMATION:
SUBSTANCE SPILLED OR RELEASED: FROM WHERE: TO WHERE:
ESTIMATED QUANTITY/DURATION:
CERCLA HAZARDOUS SUBSTANCE? YES NO
REPORTABLE TO AGENCY? YES NO SPECIFY:
WRITTEN REPORT: YES NO TIME FRAME:
RESPONSE ACTION TAKEN:
PERMIT EXCEEDENCE
TYPE OF PERMIT: PERMIT #:
DATE OF EXCEEDENCE: DATE FIRST KNOWLEDGE OF EXCEEDENCE:
PERMITTED LEVEL OR CRITERIA:
EXCEEDENCE LEVEL OR CRITERIA:
REPORTABLE TO AGENCY? YES NO SPECIFY:
WRITTEN REPORT: YES NO TIME FRAME:
RESPONSE ACTION TAKEN:
NOTIFICATIONS
NAMES OF PERSONNEL NOTIFIED: DATE/TIME:
CLIENT NOTIFIED: DATE/TIME:
AGENCY NOTIFIED: DATE/TIME:
CONTACT NAME:
PERSONS PREPARING REPORT
EMPLOYEE'S NAME:(PRINT) SIGN:
SUPERVISOR'S NAME:(PRINT) SIGN:

INVESTIGATIVE REPORT

DATE OF INCIDENT: DATE OF REPORT: REPORT NUMBER:

INCIDENT COST: ESTIMATED: $_____ ACTUAL: $_____

OSHA RECORDABLE(S): YES NO # RESTRICTED DAYS ____ # DAYS AWAY FROM WORK ____

CAUSE ANALYSIS

IMMEDIATE CAUSES - WHAT ACTIONS AND CONDITIONS CONTRIBUTED TO THIS EVENT?

BASIC CAUSES - WHAT SPECIFIC PERSONAL OR JOB FACTORS CONTRIBUTED TO THIS EVENT?

ACTION PLAN

REMEDIAL ACTIONS - WHAT HAS AND OR SHOULD BE DONE TO CONTROL EACH OF THE CAUSES LISTED?

ACTION	PERSON RESPONSIBLE	TARGET DATE	COMPLETION DATE

PERSONS PERFORMING INVESTIGATION

INVESTIGATOR'S NAME: (PRINT) SIGN: DATE:

INVESTIGATOR'S NAME: (PRINT) SIGN: DATE:

INVESTIGATOR'S NAME: (PRINT) SIGN: DATE:

MANAGEMENT REVIEW

PROJECT MANAGER: (PRINT) SIGN: DATE:

COMMENTS:

H&S MANAGER: (PRINT) SIGN: DATE:

COMMENTS:

Examples of Immediate Causes

Substandard Actions

1. Operating equipment without authority
2. Failure to warn
3. Failure to secure
4. Operating at improper speed
5. Making safety devices inoperable
6. Removing safety devices
7. Using defective equipment
8. Failure to use PPE properly
9. Improper loading
10. Improper placement
11. Improper lifting
12. Improper position for task
13. Servicing equipment in operation
14. Under influence of alcohol/drugs
15. Horseplay

Substandard Conditions

1. Guards or barriers
2. Protective equipment
3. Tools, equipment, or materials
4. Congestion
5. Warning system
6. Fire and explosion hazards
7. Poor housekeeping
8. Noise exposure
9. Exposure to hazardous materials
10. Extreme temperature exposure
11. Illumination
12. Ventilation
13. Visibility

Examples of Basic Causes

Personal Factors

1. Capability
2. Knowledge
3. Skill
4. Stress
5. Motivation

Job Factors

1. Supervision
2. Engineering
3. Purchasing
4. Maintenance
5. Tools/equipment
6. Work Standards
7. Wear and tear
8. Abuse or misuse

Management Programs for Control of Incidents

1. Leadership and administration
2. Management training
3. Planned inspections
4. Task analysis and procedures
5. Task observation
6. Emergency preparedness
7. Organizational rules
8. Accident/incident analysis
9. Personal protective equipment
10. Health control
11. Program audits
12. Engineering controls
13. Personal communications
14. Group meetings
15. General promotion
16. Hiring and placement
17. Purchasing controls

APPENDIX G

DAILY BRIEFING SIGN-IN SHEET

DAILY BRIEFING SIGN-IN SHEET

Date: _____ Project Name/Location:_____

Person Conducting Briefing:_____

1. AWARENESS (topics discussed, special safety concerns, recent incidents, etc.)

_____
_____
_____
_____

2. OTHER ISSUES (HASP changes, attendee comments, etc.)

_____
_____
_____
_____

3. ATTENDEES (Print Name):

1.	21.
2.	22.
3.	23.
4.	24.
5.	25.
6.	26.
7.	27.
8.	28.
9.	29.
10.	30.
11.	31.
12.	32.
13.	33.
14.	34.
15.	35.
16.	36.
17.	37.
18.	38.
19.	39.
20.	40.

ATTACHMENT - B
Sub-Slab Venting System Certification Letter & Specification Drawings

P.W. GROSSER
CONSULTING, INC

P.W. GROSSER
CONSULTING ENGINEER &
HYDROGEOLOGIST, PC

630 JOHNSON AVENUE
SUITE 7

BOHEMIA

NEW YORK

11716-2618

PHONE
631-589-6353

FAX
631-589-8705

VISIT US AT
www.pwgrosser.com

October 10, 2006

Ms. Rui Jun Feng
NYSDEC Region 2
47-40 21st Street
Long Island City, NY 11101

Re: 2040-2060 White Plains Road
Bronx, New York
BCP Site No.: C203031

Dear Ms. Feng:

This is to inform you that I performed a final engineering inspection of the vapor barrier at the above referenced site on September 5, 2006. The 30 mil HDPE vapor barrier had been fully installed on the subgrade beneath the new building structure prior to pouring of the first floor concrete floor. Four previous inspections were performed during August 2006 by an inspector from P.W. Grosser Consulting under my supervision, in which the contractor was notified of areas in the vapor barrier that required repair. The installation of the vapor barrier was in accordance with our design specifications, including extending the vapor barrier up the wall to the height of the new concrete first floor. The contractor had provided large overlaps along seams and sealed seams with tape. Patches were also placed over areas where a good seam could not be produced due to folds in the material, as well as where laborers had penetrated the vapor barrier in order to install the reinforcing steel for the concrete floor. Both techniques provided a secure vapor seal.

In addition, the below-grade piping for the sub-slab depressurization system was inspected and was deemed to be installed in accordance with our design specifications.

Please call if you have any questions or wish to discuss this matter further.

Very truly yours,
P.W. Grosser Consulting

Brian M. McCaffrey, P.E.
Senior Engineer

ACEC
American Council of Engineering Companies

ATTACHMENT - A
Health & Safety Plan

P.W. GROSSER CONSULTING, INC.

HEALTH AND SAFETY PLAN
FOR
CHEMICAL OXIDATION TREATMENT
UNDER THE
REMEDIAL WORK PLAN

2040 WHITE PLAINS ROAD
BRONX BOROUGH, NEW YORK

OCTOBER 2006

HEALTH AND SAFETY PLAN

Site:	**Former Shell Service Station**
Location:	**2040 White Plains Road, Bronx, New York**
Prepared By:	**P.W. GROSSER CONSULTING, INC.**
Date Prepared:	**OCTOBER 2005**
Version:	1
Revision:	1
Project Description:	**INTERIM REMEDIAL ACTION**
Waste types:	**Liquid**
Characteristics:	**Volatile Organic Compounds**
Background Review:	**Complete**
Overall Hazard:	**Low to Moderate**

P.W. GROSSER CONSULTING (PWGC) AND PWGC'S SUBCONTRACTORS DO NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE NATURE OF THIS SITE AND THE ACTIVITY OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED SPECIFICALLY FOR THIS SITE AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

APPROVALS

By their signature, the undersigned hereby certify that this Health and Safety Plan (HASP) has been reviewed and approved for use in conducting remedial actions at 2040 White Plains Road, Bronx, NY.

Project Manager	Date
Health and Safety Officer	Date

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