REMEDIAL INVESTIGATION WORK PLAN
CHEMTURA CORPORATION
688-700 COURT STREET
BROOKLYN, NEW YORK

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Contents

Contents

1 Introduction

1.1 GENERAL

On behalf of Chemtura Corporation (Chemtura), WSP Engineering of New York, P.C. (WSP) has prepared this Remedial Investigation (RI) Work Plan for the former Chemtura facility located at 688-700 Court Street, Brooklyn, New York (Site). This RI is being implemented in response to Order on Consent R2-0346-98-01 (Order) between the New York State Department of Environmental Conservation (NYSDEC) and Crompton Corporation (succeeded by Chemtura), dated May 2002, and Amended Order on Consent D2-03811-10-08 (Amended Order) between NYSDEC and Chemtura, dated November 30, 2010.

In direct response to the Order and Amended Order, a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan was prepared and submitted to NYSDEC for review by letter dated January 13, 2011. The NYSDEC provided comments on the RFI Work Plan by letter dated March 31, 2011, which directed Chemtura to refer to the report as a "Remedial Investigation Work Plan". NYSDEC provided further clarification in their specific comments that, due to the reorganization of departments within the NYSDEC, the project had been transferred to the Division of Environmental Remediation (DER), and going forward, the project would be managed in the New York State Superfund Program. All future reports, including this work plan, would necessarily be referred to using program elements consistent with the State Superfund Program.

In response to the comments and to provide a forum for discussion of these programmatic changes, Chemtura requested a meeting with NYSDEC by letter dated April 7, 2011. The meeting subsequently took place at the NYSDEC office in Albany, New York, on May 25, 2011.

In accordance with the State Superfund Program, this Work Plan has been prepared using the NYSDEC's DER Technical Guidance for Site Investigation and Remediation (DER-10), dated May 2010, as a guide. This Work Plan continues to recognize the Order and Amended Order as the primary compliance documents, and the specific requirements of the Order and Amended Order are therefore incorporated. This Work Plan also incorporates the discussions and agreements made between Chemtura and the NYSDEC during the May 25 meeting.

1.2 RI OBJECTIVES

The primary objective of the RI Work Plan is to comply with the Compliance Schedule contained in the Amended Order. The following elements outlined in paragraph 1 of the Compliance Schedule are considered specific requirements of this RI Work Plan:

1. Expand on the "Off-site PCB Investigation Work Plan" letter dated July 15, 2010, from WSP to NYSDEC (Mr. Paul Patel, PE);
2. Define the extent of Site related contaminated groundwater using current groundwater data from all sides of the Site, including installation and sampling of sufficient off-Site groundwater wells and soil borings to delineate the vertical and horizontal extent of contamination; and
3. Evaluate the potential for soil vapor intrusion using sub-slab (sidewalk) vapor samples collected from outside of the occupied buildings at the Site, on the northern, southern, eastern, and western sides. The specific areas targeted will be Buildings 16 and 17 located along the western property boundary, as these are the only remaining operable buildings.

In addition, it should be noted that NYSDEC and Chemtura have had discussions of the value of sub-slab samples collected from the sidewalk outside of the Site Buildings 16 and 17. As a result of those

discussions, Chemtura has decided to propose collection of samples from beneath the slab on the inside of the buildings in order to directly characterize the nature of the sub-slab vapors.

This RI Work Plan also expands the scope of work to include a full Site characterization including the full list of organic and inorganic parameters. This will require samples to be collected in areas that have already been investigated during the Phase II and subsequent work. The complete scope of work is described in Section 4. The collection of additional samples for laboratory analysis will facilitate electronic transfer of data into the NYSDEC's Environmental Information Management System (EIMS) and replace existing data that is representative of conditions more than a decade ago. The extensive data collected more recently for polychlorinated biphenyls (PCB) characterization will be uploaded into the NYSDEC EIMS. This RI Work Plan will expand upon the existing PCB database for delineation purposes.

1.3 RI WORK PLAN ORGANIZATION

This RI Work Plan includes the following sections:

Section 1.0 Introduction

Section 2.0 Site Location and Background Information – contains a description of the Site history and background, including a chronological discussion of the various investigative and remedial activities conducted

Section 3.0 Data Gaps – contains an evaluation of the data gaps and presents the basis for further investigation

Section 4.0 Site Investigation Activities – contains a detailed description of the proposed investigative activities including contingency planning

Section 5.0 Quality Assurance Project Plan – provides a discussion of the data analysis and reporting requirements

Section 6.0 Health and Safety Plan – discusses the policies and procedures to be implemented to ensure protection of workers and public health and safety

Section 7.0 Schedule of Activities and Deliverables – presents the proposed investigation and reporting schedule

Section 8.0 Engineering Certification – New York State licensed professional engineer's certification to comply with the DER Technical Guidance for Site Investigation and Remediation (DER 10)

2 Site Location and Background Information

2.1 SITE DESCRIPTION

The Site is located at 688-700 Court Street in Brooklyn, New York and consists of numerous occupied, vacant, and/or partially demolished buildings located on approximately 5.5 acres. Figure 1 illustrates the Site Location and Figure 2 illustrates the Site Layout. The Site, which is generally impervious (covered with concrete, asphalt, or buildings), has been used for industrial and commercial purposes since approximately 1904.

The former chemical manufacturing facility has been completely decommissioned, and all former chemical storage and process tanks were decontaminated and removed from the facility as described in the document entitled "Closure Plan, Crompton Corporation, Former Witco Facility, Brooklyn, New York", dated May 2001.

The property is in a heavily industrialized area in the Red Hook section of Brooklyn, New York. The Site is bordered to the east by Court Street then National Grid USA and Hornbeck Offshore Transportation, LLC; to the west by Clinton Street then Sunlight Clinton Realty, LLC; and to the south by Bryant Street then Patchogue Oil Terminal Corporation (Figure 3). Red Hook Recreational Park is located immediately north of the Site. All of the adjacent and contiguous properties perform heavy industrial operations including petroleum terminals, machining and manufacturing, and waterfront industries. The Site is also located within 0.5 mile of the Gowanus Canal, a major industrial shipping waterway into the New York City area, and the location of the Gowanus Canal Superfund Site. In addition, the NYSDEC has provided information to WSP showing the Patchogue Oil Terminal Corporation located south of the Site under a spill response action (Spill #90-02896).

The surrounding area including the Site is largely zoned for manufacturing. The nearest residential zoned area is the Red Hook Recreational Area which begins on the opposite side of Halleck Street from the Site. However, the nearest residential structure in the westerly direction is across the park, approximately 2,400 feet away. The nearest residential zoned areas to the north, east, and south are on the opposite side of the Gowanus Expressway, approximately 1,800 feet, 2,400 feet, and 4,200 feet away, respectively .

2.2 SITE HISTORY

Between 1904 and 1958, the property was used as a lumberyard, marine canvas supply business, and an iron works facility. From 1958 until the mid-1960s, the Site was owned by Argus Chemical Laboratory, which manufactured vinyl stabilizers and plastic additives at the Site. In the mid-1960s, Witco Corporation purchased Argus Chemical Laboratory, but continued manufacturing plastic additives at the facility until 1999, when plant operations ceased. Witco Corporation later merged with Crompton & Knowles, and eventually, the merged company became known as Crompton Corporation. In 2005, Crompton Corporation merged with Great Lakes Chemical Corporation to form Chemtura Corporation (Chemtura).

The Site is currently owned by VIP Builders, LLC (VIP) and is used as a granite cutting/processing facility. Aside from random storage areas throughout the Site, the facility and operation is largely limited to Buildings 16 and 17.

2.3 SITE INVESTIGATION AND REMEDIATION CHRONOLOGY

Several investigations have been conducted at the facility to identify areas of potential concern and to delineate the nature and extent of contamination. The following information has been included to provide

information related to historical activities conducted at the Site. As mentioned in Section 1.2, this RI Work Plan proposes the collection of environmental data that will supersede and replace the existing database (with the exception of PCB data).

2.3.1 Phase I Environmental Site Assessment

A Phase I Environmental Site Assessment (Phase I) was completed for the Site in 1998. The results of the Phase I was presented in the Phase I Site Assessment report prepared by Fluor Daniel GTI, Inc. (GTI, March 1998). The Phase I identified areas of potential environmental concern based on a review of the Site history and operations that were conducted at that time and provided recommendations for further investigation.

2.3.2 Phase II Site Investigation

A Phase II Site Investigation (Phase II) was performed in May 1999 to evaluate the areas of potential environmental concern outlined in Phase I. Phase II included the collection and analyses of over 100 soil samples and the installation and groundwater sampling of over 15 monitoring wells. A summary of the Phase II investigation activities is provided in the report titled "Results of Phase II Site Investigation" (Phase II Report) prepared by Enviro-Sciences, Inc. (ESI, May 1999). The Phase II Investigation and the subsequent Phase II Report included the properties located at both 633 Court Street and 688 Court Street. Some of the more notable conclusions of the Phase II Report, pertaining to 688 Court Street, are as follows:

- Site Hydrogeology – Fill material, consisting of fine to course sand with silt and miscellaneous debris (ash, slag, coal, wood, brick, concrete), was observed across the Site from 0 to 12 feet below ground surface (ft. bgs) during the installation of monitoring wells and soil borings. Underlying the fill materials, a silt-clay layer was encountered, which has been determined to be the former base of the Gowanus Canal. The silt-clay layer was deepest in the northern half of the Site. Seemingly, due to the manmade coastline toward the east (mainly rip rap) and the potential for enhanced groundwater conductivity through this type of porous media, Site groundwater flow is generally from the east, flowing somewhat radially across the Site. The nature of the groundwater beneath the Site is saline, which is a reflection of the Site's proximity to the Gowanus Canal. The groundwater beneath the Site is not used as a drinking water source or as a source of water for Site processes. A comprehensive well search was completed which indicated that there are no public water supply wells in the vicinity of the Site and that there are no pumping wells on adjacent properties. Drinking water at the Site, as well as the remainder of Brooklyn, is supplied by New York City municipal distribution, which derives water from Upstate New York reservoirs.
- Site Fill Material – a total of eight of the 34 volatile organic compounds (VOCs), 21 of the 66 semi-volatile organic compounds (SVOCs), and seven of the eight RCRA metals were detected at concentrations exceeding the NYSDEC recommended soil cleanup objectives (RSCOs)[1].
- Site Groundwater – a total of five VOCs, 17 SVOCs, and seven RCRA metals were detected Site-wide at concentrations exceeding the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values (AWQSGVs). In addition, in terms of chloride and total dissolved solids (TDS) concentrations, six of the 13 samples collected satisfy the definition of "saline groundwater".

The Phase II Report further concluded that since the majority of the detected constituents are a result of past operations, historic fill, and were detected both on-Site and off-Site, the Potential Constituents of Concern (COCs) for the Site should be limited to toluene, xylenes (total), acetone, phenol, barium,

[1] RSCOs from Technical and Administrative Guidance Memorandum (TAGM) 4046. These RSCOs have been superseded by NYSDEC Policy CP-51, Soil Cleanup Guidance, dated October 21, 2010.

cadmium, and lead. However, the RI will be performed evaluating Target Compound List (TCL) VOCs and SVOCs, PCBs/Pesticides, and Target Analyte List (TAL) metals.

2.3.3 Supplemental Investigations

A subsequent groundwater sampling event conducted in December 1999 and a supplemental soil and groundwater investigation performed in April 2000 provided additional information where data gaps were identified from the Phase II investigation activities. A water level and separate phase hydrocarbons (SPH) gauging/fingerprinting study was also conducted from December 1999 through June 2000, and a supplemental metals-in-soil investigation was performed in February 2001. A detailed summary of these subsequent investigations is provided in the Corrective Measures Implementation Plan and discussed below.

2.3.4 Baseline Human and Environmental Health Evaluation

A Baseline Human and Environmental Health Evaluation was prepared for the Site in February 2000 and subsequently revised in April 2001 (ESI, April 2001). Based on the results of the evaluation, Site-specific target levels (SSTLs) were developed for VOCs and SVOCs in soil and groundwater. The SSTLs are protective risk-based cleanup concentrations for Site soils and groundwater. Based on previous soil and groundwater investigations, ESI identified a total of eight areas of concern (AOCs) at the Site, five of which contained organic compounds (VOCs and SVOCs) in soil or groundwater at concentrations that exceed the proposed SSTLs. The remaining three AOCs were affected by metals in shallow soil and have been addressed through excavation and off-Site disposal. The soil excavation activities are detailed in a letter report prepared by WSP, dated March 17, 2003. The estimated extent of contamination based on the Baseline Human and Environmental Health Evaluation is discussed in detail in the following subsections.

As required by NYSDEC, the human health exposure assessment will be updated based on current findings and conditions of the Site. The assessment will consider Part 375 Unrestricted Use Soil Cleanup Objectives. Subsequent to the RI, the Baseline Human and Environmental Health Evaluation will be revised accordingly.

2.3.5 Corrective Measures Implementation

In accordance with the Order, between May 2001 and February 2002, Crompton prepared a Remedial Action Work Plan (RAWP) and design drawings (collectively referred to as the Corrective Measures Implementation (CMI) Plan). Between April and June 2002, Crompton negotiated the final approval of the CMI Plan, which proposed a remediation approach based on dual phase extraction (DPE), steam enhancement to accelerate the rate at which residual organic constituents could be removed from the subsurface. The CMI Plan was prepared based on the compilation of the results of previous investigations, including Phase II, Supplemental Investigations, and the Human Health Evaluation. In summary, the primary organic COCs identified in soil and groundwater at the Site were benzene, toluene, xylenes, acetone, phenol, and naphthalene.

A pilot test was performed by WSP to obtain and verify parameters necessary for design, and in 2003, a full-scale DPE system was installed. The DPE system consisted of 47 injection wells, designated I-1 through I-47, and 44 extraction wells, designated E-1 through E-44. The system was subsequently operated between July 16, 2004 and July 30, 2007.

In July 2007, during a routine light non-aqueous phase liquid (LNAPL) removal, approximately 468 gallons of LNAPL were removed from the remedial systems storage tank, and according to normal practice, a sample of the liquid was submitted for analysis. The sample was found to contain polychlorinated biphenyls (PCB) at a concentration of 788 parts per million (ppm). The remediation system was shut down at once and has not been in operation since the detection.

2.3.6 PCB Investigations

Immediately following the detection of PCBs in the LNAPL, WSP collected LNAPL samples from extraction wells E-2, E-5, E-16, E-19, and E-42, which had been in operation immediately prior to the PCB detection in the recovered LNAPL. Wells E-16 and E-19 were found to contain 94.7 and 35.8 milligrams per kilogram (mg/kg) of PCBs, respectively.

Subsequently, WSP conducted three iterative rounds of soil investigation in response to the detection of PCBs at the Site. The initial soil investigation was conducted between October and November 2007 and was designed to determine the horizontal extent of PCBs in the subsurface. A grid system based on an interval of 20-feet was used for each round of investigations to determine sampling locations. Each grid node within the four areas of concern, identified based on past practices at the Site, was sampled. Results of the initial investigation were presented to the NYSDEC and EPA Region 2 PCB Coordinator in a letter dated March 13, 2008. The initial investigation also included well gauging of all the extraction wells on Site and sampling of the LNAPL with analysis of PCBs, if present, in the extraction well.

On August 18, 2008, WSP submitted a supplemental PCB investigation work plan to NYSDEC and to the EPA Region 2 PCB Coordinator. The supplemental investigation was designed to complete the horizontal delineation of PCB impacts to soil at the Site and begin vertical delineation of PCB concentrations greater than or equal to a screening value of 10 mg/kg.

Upon approval of the work plan, WSP conducted the supplemental investigation in September 2008, and preliminary draft results were presented to NYSDEC and the EPA in a letter dated January 22, 2009. This letter also included a work plan for a limited additional delineation investigation to further refine the spatial distribution of PCBs at the Site and gather sufficient data to begin a technical review of potential remedial options. Upon approval, WSP conducted the additional delineation investigation in May 2009.

At the conclusion of the PCB investigations, WSP submitted a report (August 21, 2009) titled “PCB Investigation Final Report, Chemtura Corporation, Brooklyn, New York”, summarizing the results of the PCB soil investigations completed at the Site between October 2007 and May 2009. Figure 4 illustrates the locations where total PCB concentration of at least one soil sample collected within the grid was above 10 mg/kg. Figure 5 illustrates the November 2007 LNAPL measurements and PCB analytical results. Based on the extensive investigation focused on delineation of the PCBs at the Site conducted to date, the involvement of EPA and NYSDEC in the investigation process, and WSP’s review of the PCB-related data collected, WSP believes that the on-Site PCB contamination has been adequately delineated.

Subsequent to the PCB Investigation Final Report, WSP prepared an Off-Site PCB Investigation Work Plan and submitted the Work Plan to NYSDEC for review via letter dated July 15, 2010. The work proposed in Section 4.1.1 provides for continuation of the PCB delineation activities described in the Work Plan, in accordance with the Compliance Schedule, item 1 of the Amended Order.

2.4 NATURE AND EXTENT OF CONTAMINATION

2.4.1 Soils

With the exception of the existing PCB data, the soil samples proposed for collection and analysis as a component of this RI Work Plan will be used to determine the nature and extent of contamination for soil. The new soil data will be compared to 6 NYCRR Part 375-6.8(a) Unrestricted Use Soil Cleanup Objectives (SCOs). If soil conditions are determined to serve as a source of groundwater degradation, the soil data will be further compared to 6 NYCRR Part 375-6.6 for the Protection of Groundwater SCOs.

Consistent with the Amended Order, the PCB delineation will be further developed based on the significant amount of soil and liquid samples collected to date for PCB analyses. The PCB analytical data compiled following shutdown of the remediation system will be formatted and submitted to the NYSDEC

EIMS to be utilized in the RI Report. A brief discussion of the PCB contamination detected to date is presented in the paragraphs that follow.

In order to more efficiently discuss the nature and extent of PCB contamination and address the strategies for remediation, the Site was divided into four Areas of Concern (AOCs) following the initial PCB investigations. The AOCs that were selected were:

AOC 1 – north of the Site and in the vicinity of former Buildings 13, 14, and 15

AOC 2 – the area immediately east of the treatment building

AOC 3 – south of former Buildings 12 and 13

AOC 4 – west side of former Building 17

The highest PCB concentrations and the widest distribution of PCBs in soil were found in AOC 1. This finding generally coincided with the areas identified as formerly containing a hot oil system (i.e., south of Building 14 and in the vicinity of Building 13). The highest concentration of PCBs in concrete at the Site (2,000 mg/kg) was found in a sample collected within the footprint of the former Building 14. Soil data from this location and adjacent areas indicate PCB impacts to the shallow soil down to the groundwater interface. This distribution is consistent with point source releases at a limited number of source areas (e.g., there are isolated areas of high concentrations in soils down to the water table that decrease quickly in concentration with horizontal distance). In addition, during PCB investigations of LNAPL and groundwater, the extraction wells within AOC 1, which were found to contain LNAPL generally, also contained elevated levels of PCBs. LNAPL samples analyzed for PCBs from AOC 1 were found to contain from 1.6 mg/kg up to 450 mg/kg PCBs. The highest concentrations were found within the former Building 14 footprint once again. The PCB soils data collected during the 2009 PCB investigation are illustrated in Figure 4. The PCB LNAPL data collected during the investigation are illustrated in Figure 5.

At the request of the New York City Department of Parks and Recreation (NYCDPR), TRC Engineers, Inc. (TRC) collected surface soil samples from bare soil areas at the Red Hook Park on May 13, 2010. Samples were collected at a depth of 0 to 2 inches bgs. A total of 20 composite samples were collected for PCB analysis. The analytical results show that PCBs were below the laboratory detection limit in all of the soils samples collected in the park. TRC reported the results of the investigation in a May 26, 2010 letter report to the NYCDPR.

2.4.2 Groundwater

WSP collected groundwater samples on a quarterly basis from select extraction and injection wells during operation of the DPE system and groundwater samples on an annual basis from existing on-Site and off-Site monitoring wells. The most recent groundwater sampling data was collected in December 2008. The estimated horizontal extent of each primary COC in groundwater at concentrations above NYSDEC TOGS 1.1.1 AWQSGVs are presented in Figures 6 through 11 and are based on data collected from existing monitoring and injection wells in December 2008.

Again, these figures have been generated using a base map that contains historic features such as tank farm and tank locations to help identify potential historic source areas. In general, the highest contaminant concentrations, apart from the wells within the LNAPL plume, were found in the vicinity of former tank farms located at the center and southeast corner of the Site. Separate-phase hydrocarbons were identified primarily in the Building 7 and Building 14 areas of the Site.

These figures are provided for information only. The proposed RI data will supersede and replace the existing data base for groundwater.

2.4.3 Tar Seep Area

During the installation of monitoring well former MW-14 within the closed section of Halleck Street near the intersection with Court Street, a black tar layer was identified in the soil from 6 to 12 feet below

ground surface (bgs). Subsequent to the well installation, a soil boring effort was undertaken to delineate and characterize the tar substance. A total of eight soil borings were advanced around the location of MW-14, with aliquots of the tar sample being collected whenever the tar was observed. The initial characterization of the tar seep is discussed below, and the location and proposed activities to further delineate the tar substance are discussed in detail in Section 4.1.3.

The composite tar sample was analyzed for TCL VOCs and SVOCs and TAL metals.

Based on the Phase II report, five of the 34 VOCs were detected in the tar composite sample at concentrations exceeding the soil cleanup objectives in place at the time. The primary VOCs consisted of toluene, ethylbenzene, xylenes, methylene chloride, and trichloroethylene. The VOC results were not presented in the Phase II report tables.

Twenty of the 66 SVOCs were detected in the tar composite sample at concentrations exceeding the soil cleanup objectives in place at the time. The SVOCs detected consisted of 4-methylnapthalene (2,700 mg/kg), 2-methylphenol (350 mg/kg), acenapthene (3,900 mg/kg), acenapthylene (110 mg/kg), anthracene (4,800 mg/kg), benzo(a)anthracene (4,200 mg/kg), benzo(a)pyrene (4,000 mg/kg), benzo(b)fluoranthene (3,100 mg/kg), benzo(g,h,i)perylene (2,000 mg/kg), benzo(k)fluoranthene (3,500 mg/kg), chrysene (3,800 mg/kg), dibenzo(a,h)anthracene (560 mg/kg), dibenzofuran (2,900 mg/kg), fluoranthene (13,000 mg/kg), fluorene (3,700 mg/kg), indeno(1,2,3-cd)pyrene (1,800 mg/kg), naphthalene (8,200 mg/kg), phenanthrene (19,000 mg/kg), phenol (210 mg/kg), and pyrene (9,200 mg/kg) (ESI, 1999).

The only metals that were detected above the soil cleanup objectives were mercury (0.83 mg/kg) and lead (2120 mg/kg) (ESI, 1999).

Further analysis was completed to evaluate the tar by toxicity characteristic leaching procedure (TCLP). The extraction contained the following VOCs and SVOCs above NYSDEC TCLP Guidance Levels: benzene (53 µg/l), toluene (60 µg/l), ethylbenzene (17 µg/l), xylenes (89 µg/l), 2,4-dimethylphenol (6,300 mg/l), 2-methylphenol (7,100 mg/l), 4-ethylphenol (8,000 mg/l), acenaphthene (1,400 mg/l), anthracene (250 mg/l), fluoranthene (160 mg/l), fluorene (810 mg/l), naphthalene (26,000 mg/l), phenanthrene (1,200 mg/l), phenol (3,000 mg/l), and pyrene (120 mg/l) (ESI, 1999).It should be noted that the Phase II report suggested a naphthalene TCLP concentration of 26,000,000 with the units of grams/liter. However, WSP assumes the units on this analytical data point are intended to be µg/l.

A gas chromatograph of the composite sample was compared with those of gasoline, kerosene, diesel fuel, No. 2 fuel oil, No. 4 fuel oil, and No 6 fuel oil. The fingerprint did not match any of the standards that the laboratory routinely analyzed. The laboratory injected a coal tar standard from a previous project, and the tar composite sample was concluded to be similar, thus indicating the residual product identified is similar to a coal tar material (ESI, 1999).

Further discussion was presented in the Phase II report suggesting that the coal tar was likely not associated with the operations at 688 Court Street. The Phase II report further suggested that the coal tar could have been associated with the Barrett Tar Paper manufacturing which took place at 633 Court Street.

3 Soil, Groundwater, and Soil Vapor Standards

3.1 SOIL STANDARDS AND ACTION LEVELS

For the purposes of developing contaminant distribution maps, the results of the RI soil sample analyses will be compared against the standards presented in NYCRR Part 375-6.8(a) for unrestricted use or NYCRR Part 375-6.5 for protection of groundwater if the soil conditions are determined to be a source for groundwater degradation.

3.2 GROUNDWATER STANDARDS AND GUIDANCE VALUES

The results of the RI groundwater sample analyses will be compared against the standards and guidance values contained in NYSDEC TOGS 1.1.1. The values that are applicable to the Site are those for water class SA (saline), type H(FC), protection for human consumption of fish (Saline Waters), or when not available, SA-A(C) for fish propagation in saline waters. As discussed previously, the groundwater in Brooklyn is not used as a source of drinking water.

3.3 SUB-SLAB VAPOR ACTION LEVELS

Sub-slab vapor samples will be collected during the characterization, as discussed in Section 4. These samples will be evaluated against the decision matrices contained in Section 3 of Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006.

4 Site Investigation Activities

4.1 SOIL INVESTIGATIONS

4.1.1 PCB Contaminant Delineation

As discussed previously and as required by the Amended Order, this PCB investigation is designed to build upon the Off-Site PCB Investigation Work Plan submitted to NYSDEC by letter dated July 15, 2010. This PCB investigation is purposely separated from the organic and inorganic contaminant investigations described in Section 4.1.2 since the PCB delineation has been thoroughly implemented to date and is nearly complete. The results of the PCB delineation activities conducted to date are described in the PCB Investigation Final Report, dated August 21, 2009

The PCB contamination delineation activities are designed to further refine the spatial distribution of PCBs in the three off-Site areas discussed previously. Soil borings and samples will be installed and collected using direct-push sampling equipment at 45 locations as illustrated in Figure 12. These borings will be installed in areas where soil samples from previous borings installed off-Site and/or at the property boundary/wall have contained total PCB concentrations greater than 0.1 mg/kg as follows:

- North of the Site parallel to Halleck street (Grids: N2, O2, O3, O12; P2 through P5 and P12; Y2 through Y12; and Z2 through Z12)
- West of Building 17 (Grids: U26 through X26; and V27 through X27)
- South of the treatment building (Grids: U11 through U13; and T11 through T13)

The borings planned in rows Y are located at the southern edge of Red Hook Park property (New York City Department of Parks & Recreation). The borings in row Z are intended to be at least 20 ft. beyond row Y (at least 20 ft. on to Red Hook Park property). To minimize the potential for cross-contamination of samples, sample collection will be performed beginning from the most distant locations working toward the Site. To facilitate precision of borings, the sampling grid will be prepared in the field by a licensed surveyor. This grid will be set up consistent with the grid applied at the Site during previous investigations and will require the assistance of the WSP Site representative to locate previous grid locations. In addition, all new grid locations and/or proposed sampling locations will be evaluated for utility interferences or obstructions by a private utility locator using ground penetrating radar or other necessary means. Each location will be cored as necessary with a concrete coring machine or using a direct push vehicle mounted probe unit equipped with rotary concrete drill bits capable of cutting through concrete. All borings will be advanced from the ground surface down to two feet below the groundwater interface. The soil samples will be logged in the field for color, texture, and moisture content in accordance with the Unified Soil Classification System (USCS) and screened for organic vapors using a photo-ionization detector (PID). At each location and from every 1-foot interval (i.e. 0-1 feet, 1-2 feet, 2-3 feet, etc.) to 2 feet below the water table, a 1-foot homogenized soil sample will be collected.

Additionally, one shallow surface sample will be collected from the 0-2 inch interval from each of the borings proposed in rows Y and Z where the boring is located on bare soil or vegetation that is easily removable. If the area is vegetated, the 0-2 inch sample will be collected from below the vegetation. Shallow surface samples will not be collected from borings located on concrete and/or asphalt.

A subset of the proposed samples (not including the shallow surface samples from Y and Z) will be extracted and placed on hold at the laboratory pending the results of adjacent samples. Figure 12 distinguishes the sample locations that will be analyzed immediately from those that will be collected and placed on hold. These hold samples will be analyzed if any sample from an adjacent boring is found to contain PCBs greater than 0.1 mg/kg. For example, in column 2 the samples will be managed as follows:

- Column 2, Row N – all samples (including the 0-2 inch sample) will be submitted for analyses.
- Column 2, Row O – all samples (including the 0-2 inch sample) will be submitted for analyses.
- Column 2, Row P – all samples (including the 0-2 inch sample) will be held pending analyses of adjacent borings.
- Column 2, Row Y – all subsurface samples will be held pending analyses of adjacent borings. Shallow surface (0-2 inch) sample will be submitted for analysis immediately.
- Column 2, Row Z – all subsurface samples will be held pending analyses of adjacent borings. Shallow surface (0-2 inch) sample will be submitted for analysis immediately.

If any sample (from any 1-foot interval) from a boring contains PCBs above the SCOs, all samples from each adjacent borehole will be analyzed. In addition, NYSDEC and NYSDOH will be notified of any PCB detections off-Site.

As noted in the exception above, all shallow surface soil samples collected from rows Y and Z will be analyzed immediately, regardless of whether the deeper 1-foot composite samples are initially placed on hold. Appendix A contains a sampling matrix that will be used to guide sample collection and analysis.

All sample handling will be performed in strict accordance with relevant WSP procedures, including chain-of-custody procedures, and analyzed for PCBs by the U.S. Environmental Protection Agency (EPA) Method 8082/3540C. Field sampling procedures, laboratory handling, analytical protocols, data reduction, validation, and reporting will be conducted in accordance with the Quality Assurance Project Plan for the Site, included as Appendix A.

WSP will apply 6 NYCRR Part 375-6.8(a) SCOs to the off-Site investigation. As such, WSP will utilize comparative screening values of 0.1 mg/kg (representative of pre-disposal conditions), per the NYSDEC request.

4.1.2 Organic and Inorganic Contaminant Delineation

To provide current conditions Site characterization, WSP proposes collecting soil samples from locations that correspond to an approximate 50-foot grid pattern. Soil samples will be collected from each grid node shown on Figure 13, with several sample locations being moved slightly or added to investigate a location that is suspected of or known to contain contamination (based on previous investigations). Sample locations were added when the desired location fell outside of a 15-ft radius from the nearest grid node. The locations that will be investigated in addition to the grid nodes are:

- RI-SB-36 (former GB-13) – located within the western end of former Building 13, investigated due to previous elevated concentration of xylene. The location is in the center of a grid and will be investigated in addition to the surrounding grid nodes.
- RI-SB-16 (former GB-17) – located in the northwestern end of the warehouse (northeast corner of the Site), investigated due to previous elevated concentration of xylene. This sample location is approximately coincident with grid node G7, so an additional location will not be necessary.
- RI-SB-23 (former SB-12) – located at the northeast corner of the former Tank Farm No. 2, investigated due to previous elevated concentrations of acetone and xylene. The location is in the center of a grid and will be investigated in addition to the surrounding grid nodes.
- RI-SB-30 (former SB-22) – located at the northeast corner of former Building 12, investigated due to previous elevated concentration of phenol. The location is approximately coincident with grid node E4, so an additional location will not be necessary.

- RI-SB-32 (former SB-24) – located at the north end of the former Building 7, investigated due to previous elevated concentrations of phenol, benzene, and toluene. The location is not coincident with any grid nodes and will be sampled in addition to the surrounding nodes.
- RI-SB-48 (former GB-5) – located at the north end of the former Building 7 extension, investigated due to previous elevated concentrations of xylene and phenol. The location is not coincident with any grid nodes and will be sampled in addition to the surrounding nodes.
- RI-SB-57 (former SB-25) – located on the west end of the former Building 7 extension, investigated due to previous elevated concentration of phenol. The location is not coincident with any grid nodes and will be sampled in addition to the surrounding nodes.
- RI-SB-69 (former HWSA-1) – located east of the former Hazardous Waste Area (South Container Storage), investigated due to previous elevated concentration of xylene. The location is in the center of a grid and will be investigated in addition to the surrounding grid nodes.
- RI-SB-71 (former SB-35) – located at the center of the former Area 24 Tank Farm, investigated due to previous elevated concentration of toluene. The location is approximately coincident with grid node A7, so an additional location will not be necessary.
- RI-SB-62 (former GB-3) – located at the southeast corner of the former Tank Farm No. 5, investigated due to previous elevated concentration of benzene. The location is not coincident with any grid nodes and will be sampled in addition to the surrounding nodes.
- RI-SB-73 (former SB-39) – located east of former Building 19, investigated due to previous elevated concentration of xylene. The location is coincident with grid node A9, so an additional location will not be necessary.
- RI-SB-74 (former GB-1) – located within the east end of the former Building 19, investigated due to previous elevated concentration of xylene. The location is not coincident with any grid nodes and will be sampled in addition to the surrounding nodes.
- RI-SB-75 (former SB-40) – located south of the former Building 19, investigated due to previous elevated concentration of acetone. The location is not coincident with any grid nodes and will be sampled in addition to the surrounding nodes.

The sample identification will be numbered consecutively beginning at the northwest corner of the Site. In total, approximately 66 locations will be investigated on Site with approximately 132 samples collected and submitted for analyses. One on-Site location (RI-SB/MW-01) will be completed as a new monitoring well following sample collection.

In addition, Site perimeter locations were selected for collection of soil samples for further delineation. The primary goal in collecting these additional samples is to complete the delineation of the non-PCB contamination at the Site boundaries. The soil borings will be installed and samples collected from areas where soil samples from previous borings installed near the Site boundary have contained elevated concentrations of organics. Three of the borings planned will be completed as groundwater monitoring wells as discussed in Section 4.2. A total of nine locations will be investigated, and approximately 18 soil samples will be collected and submitted for analysis. The soil borings are labeled with sequential numbering consistent with on-Site locations. The borings planned for completion as monitoring wells are also labeled with sequential numbering (i.e., RI-SB/MW-01 through RI-SB/MW-04). Proposed boring location RI-SB-02 is located where tar was observed on the cobble stone near the corner of Court and Halleck Streets (Figure 13). As discussed in Section 4.1.3, additional borings will be advanced around this location. These sample locations will be labeled RI-SB-02a, -02b, -02c, etc.

In general, soil borings that are not intended to be completed as monitoring wells may be collected using the same procedures outlined in Section 4.1.1 above. In particular, these samples may be collected

using direct push equipment. All borings will be advanced from the ground surface to two feet below the groundwater interface. The soil samples will be logged in the field for color, texture, and moisture content in accordance with the USCS and screened for organic vapors using a PID. At each location, soil samples will be collected from the 0-2 feet and 2-4 feet depth intervals or until groundwater contact.

Soil borings that are intended to be completed as monitoring wells, noted as RI-SB/MW in the figure, will be installed using hollow stem auger (HSA) equipment. Samples will be similarly collected, characterized, screened, and packaged for shipment.

All sample handling will be performed in strict accordance with relevant WSP procedures, including chain-of-custody procedures. Samples will be analyzed for TCL VOCs and SVOCs by the EPA SW 846 Methods 8260 and 8270, TAL metals by the EPA SW 846 Method 6010, and pesticides by the EPA SW 846 Method 8081A. Field sampling procedures, laboratory handling, analytical protocols, data reduction, validation, and reporting will be conducted in accordance with the Quality Assurance Project Plan for the Site, included as Appendix A. Samples collected under this section will not be analyzed for PCBs. The on-Site PCB investigation and delineation is complete as discussed in the PCB Investigation Final Report, dated August 21, 2009. Additional work is recommended for the off-Site PCB delineation, which is discussed in detail in Section 4.1.1.

Soil sample analytical data will be compared against the NYCRR Part 375-6.8(a) for unrestricted use SCOs or NYCRR Part 375-6.5 for protection of groundwater SCOs if the soil conditions are determined to be a source for groundwater degradation.

4.1.3 Tar Seep Delineation

As discussed in Section 2.4.3, a tar-like substance has been both visually observed at the surface and identified in subsurface borings near the corner of Halleck and Court Streets. The tar seep delineation will focus on collection of a new composite sample for an updated characterization in addition to completing the delineation of the impacted soils. Figure 14 illustrates the location of former MW-14 (Tar Seep Area).

The Phase II report ultimately estimated that the area in which tar material was identified was approximately 30 ft. by 35 ft. Therefore, the sampling scheme that will be implemented in addition to RI-SB-02 will begin at a 15-foot radius around the former MW-14 location. Soil borings will be advanced toward the northeast, southeast, southwest, and northwest, in order to complement but not duplicate the borings done during the Phase II. If tar material is identified during any of the borings, the interval(s) will be noted, and an additional boring will be advanced a distance of five feet further outward. Sample aliquots will be collected of the tar material identified from each 2-foot interval. The samples will be composited for analysis at the conclusion of the soil borings. Aside from the characterization (composite) sample, the tar delineation program will be entirely qualitative with records being documented in the field log book.

4.2 GROUNDWATER INVESTIGATION

The groundwater component of this RI is designed to detect and delineate potential groundwater contamination and movement. The specific activities aimed at groundwater characterization consist of the following:

- Installation of at least four new groundwater monitoring wells (soil borings proposed for completion as monitoring wells at roughly the four corners of the Site), and location, inspection, repair, and/or development of all existing Site-related monitoring wells (not including remediation wells).
- Hydraulic monitoring and inspection of on-Site and off-Site wells for the presence of LNAPL and DNAPL.

- Purging and sampling of all Site monitoring wells and selected remediation system extraction wells.

4.2.1 Monitoring Well Installation and Development

Four new monitoring wells will be installed at the locations indicated on Figure 13, following borehole sampling. The soil boring and subsequent monitoring well at RI-SB/MW-02 is coincident with the location selected for the 633 Court Street Site Characterization, SC-SB/MW-05.

To ensure safety during drilling, all proposed locations will be marked in the field and evaluated for utility interferences or obstructions by a private utility locator using ground penetrating radar or other necessary means. Soil borings in locations selected for monitoring well installation will be performed using hollow-stem auger (HSA) techniques, with continuous split spoon sampling. Well boring and installation will be performed by a NYSDEC-registered groundwater well driller (in accordance with NYS Water Well Driller Registration, ECL § 15-1525) under the full time supervision of a WSP geologist. For boring locations through surficial concrete, each location will be cored with a concrete coring machine or appropriate drilling equipment, to provide a clean penetration through the concrete.

All borings will be advanced from the ground surface down to the underlying silt and clay layer. The soil samples will be logged in the field for color, texture, and moisture content in accordance with the USCS and screened for organic vapors using a photo-ionization detector (PID). Samples will be collected for analysis in accordance with the procedures outlined in the sections above.

In accordance with the Amended Order, all new wells will be screened from 2-ft above the static groundwater table down to the clay and silt layer that underlies the Site, to facilitate measurement and/or collection of LNAPL as well as dense non-aqueous phase liquid (DNAPL). Wells will be constructed using 2-inch polyvinyl chloride (PVC) well casing, 2-inch PVC well screen (0.010-inch slot size), and a filter pack using #2 silica sand. Well construction, sand pack and well seal, and well flush-mount finish will be performed in strict accordance with WSP standard operating procedures (SOPs).

Due to the long period of inactivity at the Site, the existing condition of several of the wells could not be confirmed during the initial Site visit. In particular, MW-18, MW-13, and MW-17 were not observed and may need to be replaced. As part of the RI, all existing wells will be identified, inspected, and scheduled for redevelopment or replacement as discussed above. The inspection will include the condition of the flush mount well cover and the condition of the top of the well casing and well cap/seal. If repairs are deemed necessary, these repairs will be completed while the drillers are at the Site for other RI activities.

Upon completion of new well installations, all new and existing wells will be developed (or redeveloped) to ensure low turbidity samples that are representative of the surrounding aquifer. Well purging and sampling will be performed no sooner than seven days after development to allow the wells to stabilize. Well development will be accomplished, in general, by repeated surging and pumping until the well yields water of acceptable turbidity at the beginning of a pumping cycle. Well development will be performed in accordance with WSP SOPs as well as ASTM D5521-05, Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers. All development and purge water will be collected and managed in accordance with WSP SOPs. Well development will be performed no sooner than 48 hours after well installation is completed.

In addition, two wells will be selected for performance of in-situ single well hydraulic conductivity testing. Unless redevelopment, purging, and sampling indicates that these wells will require replacement, MW-9 (southwest corner of the Site) and MW-19 (north of the Site in near Red Hook Park) will be utilized for aquifer testing in accordance with WSP SOPs. The objective of performance testing is to measure the hydraulic conductivity of the aquifer (water-bearing zone) in the immediate vicinity of the monitoring well. The hydraulic conductivity test will be documented as described in the SOP. Field sampling procedures, laboratory handling, analytical protocols, data reduction, validation, and reporting will be conducted in accordance with the Quality Assurance Project Plan for the Site, included as Appendix A.

4.2.2 Hydraulic Monitoring and LNAPL/DNAPL Inspections

The purpose of LNAPL and DNAPL measurements and data collection is to evaluate the presence and movement of free-phase organic contaminants at the Site. The data collected will be compared to previous inspections and measurements to understand the movement, rate, and direction of the free-phase plume(s).

Prior to collecting groundwater samples, a complete round of water level measurements will be obtained for all on-Site monitoring wells (3 wells), off-Site monitoring wells (8 wells), and selected on-Site remediation extraction wells (11 wells). At each location, the static water level will be measured and recorded, relative to the north edge of the top of the well casing. The complete well network (including proposed new well locations) is illustrated in Figure 13.

In addition, each well will be inspected for the presence of LNAPL and DNAPL. Depth and thickness measurements will be performed for all wells in which LNAPL or DNAPL is identified. All inspections and measurements, laboratory handling, analytical protocols, data reduction, validation, and reporting will be conducted in accordance with the Quality Assurance Project Plan for the Site, included as Appendix A.

4.2.3 Monitoring Well Sampling and Analysis

All new and existing monitoring wells, as well as a set of 11 remediation extraction wells, will be sampled in accordance with WSP SOPs. Sampling will be limited to those wells that do not exhibit characteristics of free-phase organics (LNAPL or DNAPL). The wells to be sampled are illustrated on Figure 13 and include:

- off-Site monitoring wells: MW-13, MW-18, MW-19, MW-16, and MW-17, in addition to the 3 new RI-SB/MW locations
- on-Site monitoring wells: MW-4 and MW-9, in addition to RI-SB/MW-01 location
- on-Site remediation extraction wells: E-2, E-4, E-6, E-7, E-15, E-18, E-21, E-29, E-32, E-36, and E-42

All groundwater samples will be collected, handled, preserved, and shipped in accordance with WSP SOPs. Groundwater samples will be analyzed for TCL VOCs and SVOCs by the EPA SW 846 Methods 8260 and 8270, TAL metals by the EPA SW 846 Method 6010, and pesticides/PCBs by the EPA SW 846 Method 8081A and 8082.

Field sampling procedures, laboratory handling, analytical protocols, data reduction, validation, and reporting will be conducted in accordance with the Quality Assurance Project Plan for the Site, included as Appendix A.

4.3 SUB-SLAB VAPOR INVESTIGATION

Sub-slab vapor samples will be collected through the concrete slabs of occupied buildings located at the Site, specifically Buildings 16 and 17, as requested by NYSDEC. Six soil vapor samples (three per building) are proposed for collection (RI-SV-01 through RI-SV-06). The locations proposed for sub-slab sampling are illustrated in Figure 13. Since the building is an operating warehouse facility, specific locations will be selected in the field based on the available space. It is understood that the results of the sub-slab vapor samples will be evaluated by NYSDEC, and additional indoor air samples may be required as a result.

Sub-slab vapor samples will be collected by installing permanent vapor sampling probes in accordance with the procedures contained in the following guidance documents:

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

- Standard Operating Procedure (SOP) for Installation of Sub-Slab Vapor Probes and Sampling Using EPA Method TO-15 to Support Vapor Intrusion Investigations.

Sub-Slab vapor probes will be constructed using ¼" stainless steel tubing with swagelok fittings installed within a 3/8" pilot hole drilled entirely through the slab and into the sub-slab material. All sub-slab vapor probe installation and sampling will be performed in accordance with the guidance documents. Sub-slab vapor samples will be collected after purging three liters of vapor from each sampling location. The purge volume will be measured using tedlar bags, and the volumes will be evacuated using a peristaltic pump and dedicated tubing. Following purging, sub-slab vapor samples will be collected using suma canisters and will be analyzed for TCL VOCs. All vapor sample results will be evaluated utilizing the Soil Vapor/Indoor Air Matrices provided in Section 3 of the guidance.

Field sampling procedures, laboratory handling, analytical protocols, data reduction, validation, and reporting will be conducted in accordance with the Quality Assurance Project Plan for the Site, included as Appendix A.

4.4 SAMPLE LOCATION SURVEY

Following completion of all sample collection, well installation, and existing well inspection, development, and sampling, all new and existing wells and sampling points will be surveyed by a licensed land surveyor. The survey is designed to provide horizontal and vertical control of all samples collected and measurements obtained and will include the following minimum elements:

- building corners, fences, walls, roads, and other Site structural features
- horizontal location and elevation of ground surface as well as the top of casing (TOC) for all groundwater monitoring wells (new and existing, on-Site and off-Site) and existing extraction wells
- horizontal and vertical location of all PCB sampling points and other soil boring locations for non-PCB parameters
- horizontal and vertical location of all sub-slab vapor sampling points

The survey data will be collected consistent with the requirements of NYSDECs EIMS.

4.5 CONTINGENCY PLANNING

The following subsection have been developed to present the logic involved in determining if and when additional sampling is necessary, or when samples should be eliminated in favor of alternate locations. The three potential situations that were identified with a moderate probability of occurrence were: PCBs are detected in the first round of off-Site soil samples analyzed; LNAPL or DNAPL is identified in additional locations or new locations compared to those previously recorded; or elevated PID readings are measured in borings that are intended to be downgradient or upgradient (unimpacted by Site operations). Contingent procedures are outlined below for these three cases.

4.5.1 PCBs Detected in First Round of Off-Site Soil Samples

The current PCB investigation has been developed due to trace levels of PCBs detected at the Site boundary during the PCB Investigation of 2009. The current program has been designed with built-in contingency for unexpected detection of PCBs in soils. However, in the unexpected situation where elevated levels of PCBs are detected in subsurface soils at the limits of the proposed sampling grid, additional sampling locations will be selected, and additional samples will be collected. Additional sampling for PCBs will be done with concurrence from NYSDEC, and locations will be selected using the same rationale that has been proposed for these three off-Site areas.

If shallow surface samples on the Red Hook Park property are found to contain PCBs, NYSDEC, NYSDOH, Chemtura, and WSP will discuss the detection, evaluate the risk to public health, and determine the best path forward to ensure protection of the public and environment.

4.5.2 LNAPL or DNAPL Identified in Monitoring Wells or Extraction Wells

During the RI activities, existing and new monitoring wells and existing remediation system extraction wells will be inspected for LNAPL and DNAPL. The results of these inspections will be compared to historic delineation of the known plume(s), and unexpected results will be noted. DNAPL has not been observed at the Site during any of the previous investigations and is not expected during the RI. Contingent activities for LNAPL observations are intended to provide an accurate delineation of the LNAPL plume and are discussed below.

Due to the close proximity of the extraction wells to one another and the measured depths of LNAPL in the center of the Site, new observations in the central area are expected, mainly between wells where LNAPL has already been detected. If LNAPL is newly detected in an extraction well, the observation will be noted, and the nearest downgradient location will be inspected. The subsequent inspection is performed to ensure that the LNAPL detection is bounded by a well or monitoring point without LNAPL. If the LNAPL plume cannot be adequately delineated due to detections in the outermost extraction wells, and existing monitoring wells cannot be used to confidently delineate the LNAPL plume, additional monitoring well(s) will be installed at an appropriate distance further downgradient. Additional soil boring and well installation will be performed as described in Sections 4.1 and 4.2.

Detections of LNAPL in off-Site monitoring wells are not expected during the RI. However, in the event that LNAPL is detected in any of these wells, an additional groundwater monitoring well will be installed at an appropriate distance further downgradient. The exact location of the additional well(s) will be determined in the field with NYSDEC concurrence. Additional soil boring and well installation will be performed as described in Sections 4.1 and 4.2.

4.5.3 Elevated PID Screening

Above background PID readings are expected in most samples due to the nature of the fill material that is wide spread across the Site and the vicinity. During the screening activities, investigators will develop a realistic Site background PID reading or range of expected PID readings. This background range will be used as a basis for comparison when screening borings and to identify significant variations above background. As planned, two soil samples will be collected from each soil boring.

When a soil boring exhibits significantly elevated PID readings, investigators will determine appropriate locations for additional borings in consultation with Chemtura and NYSDEC.

5 Quality Assurance Project Plan

The RI Quality Assurance Project Plan (QAPP) is included as Appendix A to this RI Work Plan. The QAPP contains the following elements:

- Project Quality Organization, Roles, and Responsibilities
- Quality Assurance Objectives and Criteria
- Data Quality Requirements and Assessments
- Chemical Analyses and Quality Assurance Protocols
- Field Sampling Procedures
- Sampling Equipment Decontamination Procedures
- Quality Assurance Samples
- Sample Volume, Preservation, and Holding Times
- Documentation and Reporting and Chain-of-Custody Requirements
- Calibration Procedures and Frequency
- Sample Preparation and Analytical Procedures
- Internal, Field, and Laboratory Quality Control Checks
- Data Reduction, Validation, and Reporting
- Performance, System Audits, and Corrective Action

The QAPP will be updated as needed to address unexpected conditions and sampling requirements that may not be covered by the current document.

6 Health and Safety Plan

The RI Health and Safety Plan (HASP) is included as Appendix B to this RI Work Plan. The HASP contains detailed procedures designed to protect the health of Site workers and the public during the RI field work. The HASP will be closely adhered to during all RI activities. The HASP contains the following elements:

- Project Organization
- Description of Planned On-Site Activities
- Monitoring Procedures, Site Controls, and Decontamination
- Personal Protective Equipment
- On-Site Safety Equipment
- Training and Medical Monitoring Requirements
- Contingency Plan and Emergency Procedures

7 Schedule of Activities and Deliverables

7.1 SCHEDULE

In accordance with the Order, a schedule of Site activities has been developed and is included as Figure 15. All of the characterization activities begin from the "effective date" of the Order, November 30, 2010. This RI Work Plan has been revised and is being submitted to NYSDEC based on comments received by letters dated March 31 and September 9, 2011

The exact schedule following this submission will vary based on NYSDEC review content and duration, as well as the success in addressing the Site access issues discussed below. An estimated schedule with assumed review and comment durations is presented in the figure.

Although access to the Site has not been difficult in the past, completion of the RI scope in a manner and on a schedule that is compliant with the Amended Order is directly impacted by the access agreements granted by VIP and other adjacent land owners to Chemtura and its engineers and contractors. In accordance with the Amended Order, Chemtura understands that its inability to gain access to a location or to obtain permits necessary for the work, in a timely manner, despite good faith efforts, will not be deemed non-compliant with the Amended Order. In this unplanned case, appropriate adjustments will be made to the project schedule.

In addition to the NYC Department of Parks and Recreation, Chemtura is aware of the following landowners (based on ACRIS) that will require notification of the scope of work, schedule, and access needs:

Property Address	Property Owner
688-702 Court Street Block 621, Lots 1 and 34 (Site)	VIP Builders, LLC C/O Coral Realty LLC 400 Broome Street New York, NY 10013
718-720 Court Street Block 621, Lot 134 (Southeast corner of Site)	George Lainas and Felli Agioulasitis 7716 Narrows Avenue Brooklyn, NY 11209

7.2 DELIVERABLES

Commencing with the approval of this RI Work Plan, Chemtura will provide written monthly progress reports describing Site/project related activities completed during the prior reporting period and discuss what is scheduled for the upcoming period. The monthly progress reports will be submitted to the NYSDEC electronically by the 10th day of each month.

All data generated as a result of the implementation of this RI Work Plan will be provided to the NYSDEC in an electronic format compatible with the NYSDEC Environmental Information Management System (EIMS).

Upon completion of the field work, an RI Report will be produced and submitted to the NYSDEC. The RI Report will be prepared in accordance with Section 3.13 of NYSDEC DER-10 /Technical Guidance for Site Investigation and Remediation.

8 Engineering Certification

I, Kevin D. Sullivan, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this RI Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Respectfully Submitted,

WSP Engineering of New York, P.C.

Date: _____

Kevin D. Sullivan, P.E. License No.:_____

Seal:

It is a violation of the laws of the state of New York, for any person, unless acting under the direction of a Licensed Professional Engineer, to alter any item or any portion of this document in any way. If an item bearing the seal of a Licensed Professional Engineer is altered, the altering Engineer shall affix to the item his/her seal and notation “altered by” followed by his/her signature and the date of such alteration, and a specific description of the alteration.

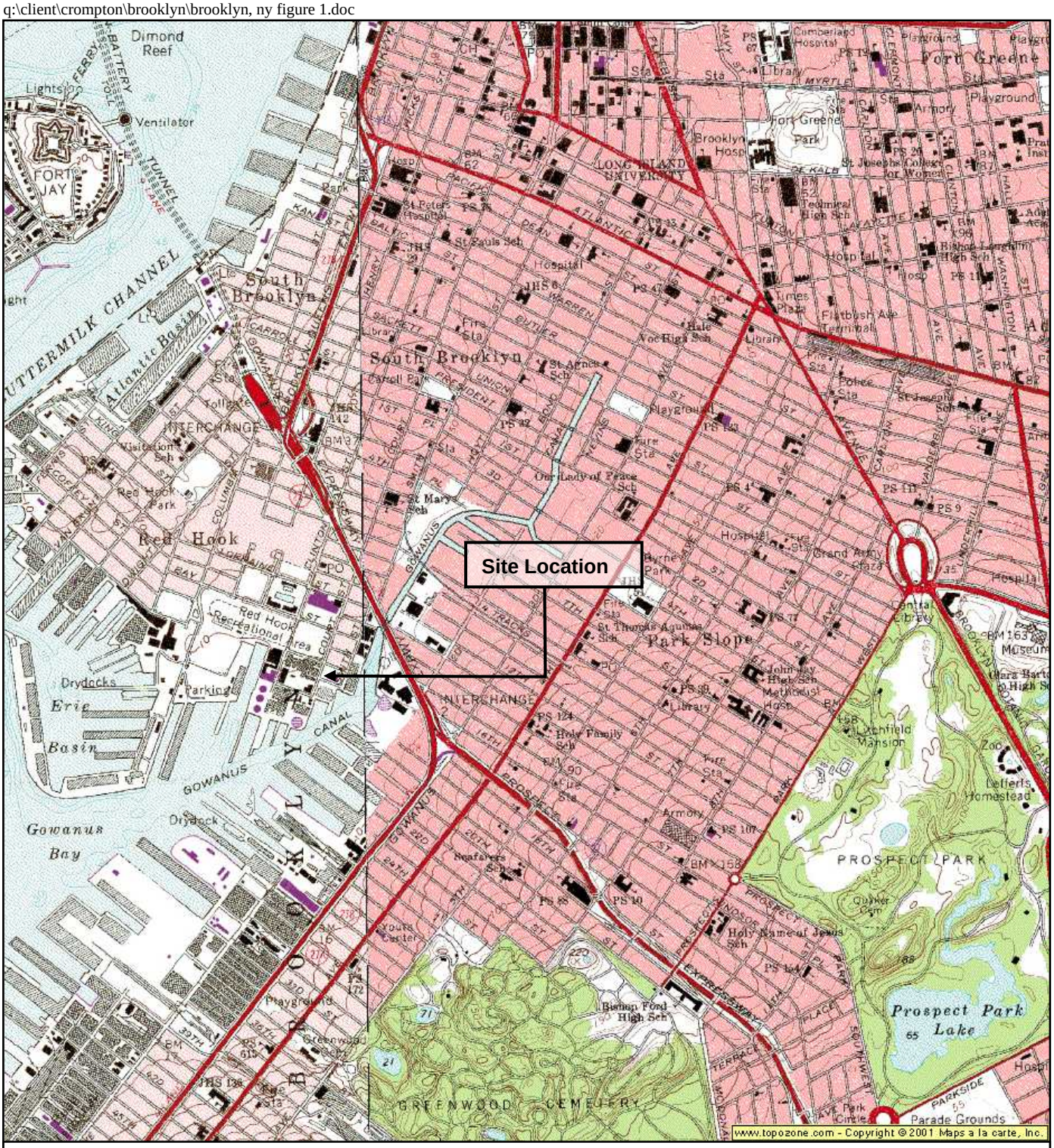
9 References

GTI, 1998. Phase I Site Assessment Report, Fluor Daniel GTI, Inc., March 1998

ESI, 1999. Results of Phase II Site Investigation, Enviro-Sciences, Inc., May 1999

Figures

q:\client\crompton\brooklyn\brooklyn, ny figure 1.doc



Reference

7.5 Minute Series Topographic Quadrangle
Jersey City, New York – New Jersey
Photorevised 1976 Scale 1:25,000 Metric

N

Quadrangle Location

Scale in Meters

0 500 1000

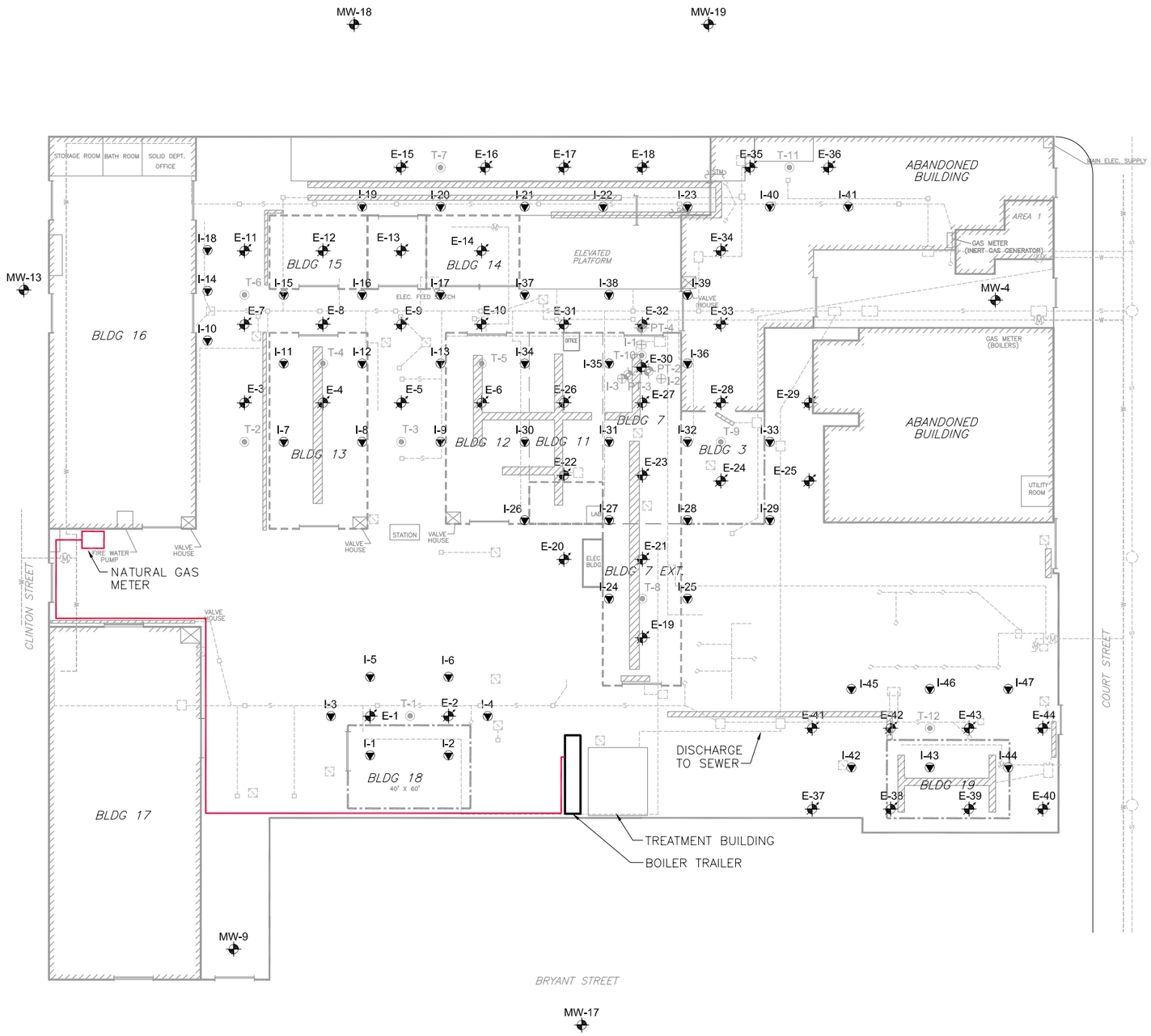
0 1000 2000

Scale in Feet

WSP Engineering of New York P.C.
11190 SUNRISE VALLEY
SUITE 300
RESTON, VIRGINIA 20191
703-709-6500

WSP Engineering of New York, P.C.

Figure 1
Site Location
Chemtura Corporation
688 Court Street
Brooklyn, New York



LEGEND

- PILOT-SCALE PIEZOMETER TEMPERATURE WELL
- PILOT-SCALE INJECTION WELL
- FULL-SCALE EXTRACTION WELL
- FULL-SCALE INJECTION WELL
- THERMOCOUPLE
- MONITORING WELL
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)

B REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

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Drawn By: EGC
Checked: GEK
Approved: KAS
DWG Name: 00004271-024

CHEMTURA CORPORATION
688-700 COURT STREET
BROOKLYN, NEW YORK
PREPARED FOR
CHEMTURA CORPORATION

Figure 2

SITE LAYOUT

WSP Engineering of New York, P.C.
2360 Sweet Home Road, Suite 3
Amherst, New York 14228
(716) 691-5232
www.wspenvironmental.com/usa

RED HOOK
RECREATIONAL AREA

BAY STREET

RED HOOK
RECREATIONAL AREA

CLINTON STREET

SUNLIGHT CLINTON
REALTY, LLC

688 COURT STREET
SITE

633 COURT
STREET SITE

SIGOURNEY STREET

SMITH STREET

COURT STREET

HALLECK STREET

NATIONAL GRID USA

PATCHOGUE OIL
TERMINAL CORPORATION

BRYANT STREET

HORNBECK OFFSHORE
TRANSPORTATION, LLC

COURT STREET

PATCHOGUE OIL
TERMINAL CORPORATION

UPPER NEW YORK BAY

UPPER NEW YORK BAY

REFERENCE: 1. ENVIRO-SCIENCES, INC FIGURE PREPARED FOR WITCO CORPORATION DATED MAY 15, 1999, FIGURE 19, DRAWING NO. WBR-002D, TITLED METALS DETECTED IN GROUNDWATER EXCEEDING NYS CLASS GA STANDARDS FOR MARCH 24, 1999

2. SURROUNDING AREAS FROM GOOGLE EARTH PRO.

B

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Drawn By: EGC

Checked:

Approved:

DWG Name: 00004270-010

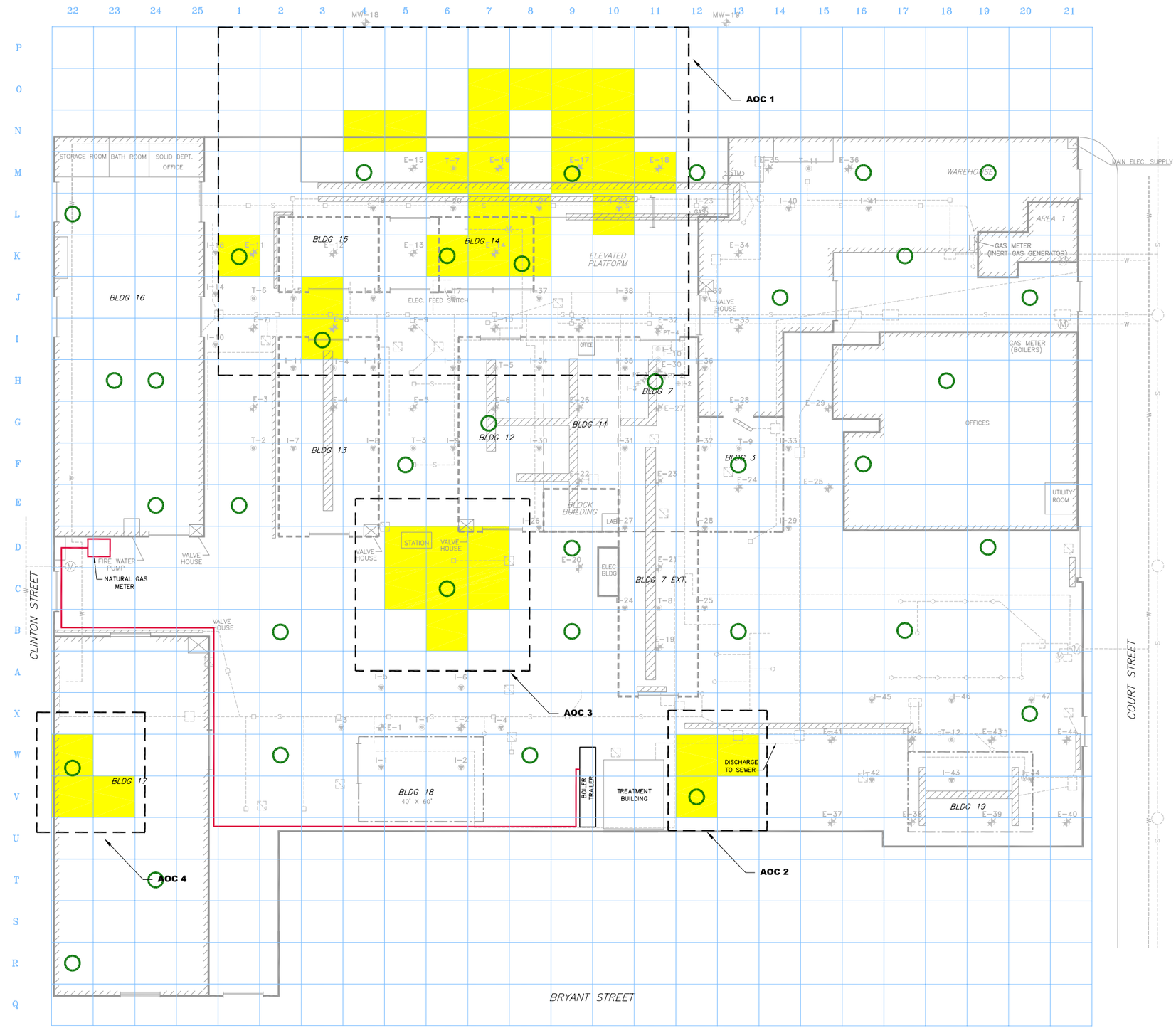
CHEMTURA CORPORATION
688 COURT STREET
BROOKLYN, NEW YORK

PREPARED FOR
CHEMTURA CORPORATION

Figure 3

SITE VICINITY MAP

WSP
Engineering of
New York, P.C.
2360 Sweet Home Road, Suite 3
Amherst, New York 14228
(716) 691-5232
www.wspenvironmental.com/usa



GENERAL NOTES:

1. WELL AND THERMOCOUPLE LOCATIONS ARE APPROXIMATE.
2. PCB SAMPLE LOCATIONS ARE APPROXIMATE.

LEGEND

- CONCRETE SAMPLE LOCATION
- PILOT-SCALE PIEZOMETER TEMPERATURE WELL
- PILOT-SCALE INJECTION WELL
- FULL-SCALE EXTRACTION WELL
- FULL-SCALE INJECTION WELL
- THERMOCOUPLE
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)

20' x 20' — TOTAL PCB CONCENTRATION OF AT LEAST ONE SOIL SAMPLE COLLECTED WITHIN GRID >10 mg/kg

AREA OF CONCERN

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0 25 50 75
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REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

REVISIONS

REV	DESCRIPTION	DATE
1	Revised	Appr.
2	Revised	Appr.
3	Revised	Appr.

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CHECKED:
APPROVED:

PCB DISTRIBUTION IN SOIL (>10 mg/kg) AND PCB AREAS OF CONCERN

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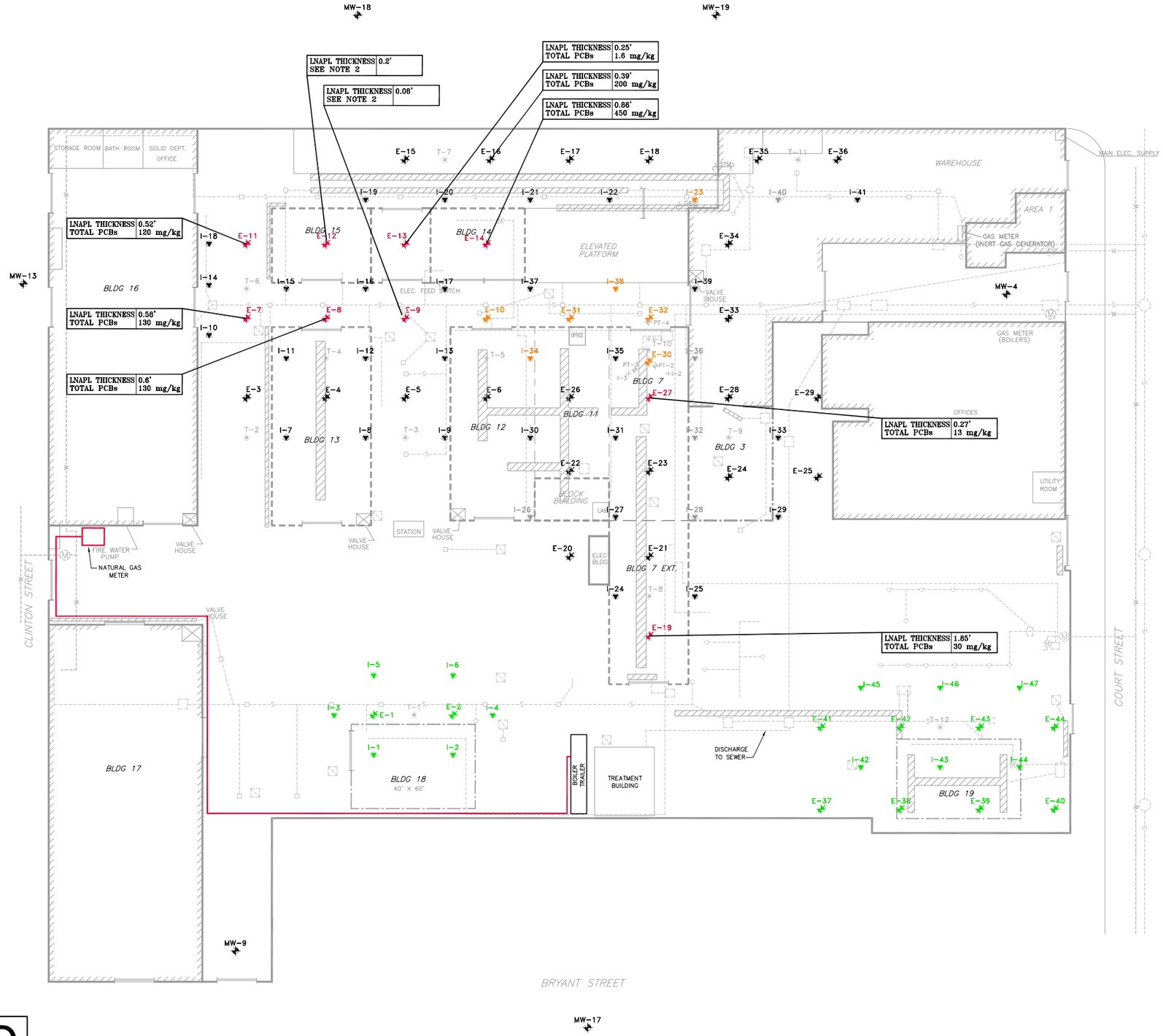
FIGURE 4

Drawing Number
00004271-025

GENERAL NOTES:

1. WELL AND THERMOCOUPLE LOCATIONS ARE APPROXIMATE.
2. WSP ENGINEERING WAS UNABLE TO COLLECT A SUFFICIENT VOLUME OF LNAPL FOR PCB ANALYSIS.
3. MONITORING WELL WAS GAUGED AS PART OF THE ANNUAL GROUNDWATER SAMPLING CONDUCTED IN JULY 2007. NO MEASURABLE OR RESIDUAL LNAPL WAS DETECTED AS PART OF THAT SAMPLING, OR SAMPLING CONDUCTED IN PREVIOUS ANNUAL SAMPLING EVENTS.



LEGEND

- PILOT-SCALE PIEZOMETER TEMPERATURE WELL
- PILOT-SCALE INJECTION WELL
- FULL-SCALE EXTRACTION WELL (NO MEASUREABLE LNAPL)
- FULL-SCALE INJECTION WELL (NO MEASUREABLE LNAPL)
- FULL-SCALE EXTRACTION WELL (MEASUREABLE LNAPL)
- THERMOCOUPLE
- MONITORING WELL (SEE NOTE 3)
- FULL-SCALE EXTRACTION WELL (RESIDUAL LNAPL)
- FULL-SCALE INJECTION WELL (RESIDUAL LNAPL)
- FULL-SCALE EXTRACTION WELL (NOT INCLUDED IN LNAPL INVESTIGATION)
- FULL-SCALE INJECTION WELL (NOT INCLUDED IN LNAPL INVESTIGATION)
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)

REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

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2	Revised	Appr.
3	Revised	Appr.
4	Revised	Appr.

SEAL

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PCB DISTRIBUTION IN LNAPL
(MAY 2009)

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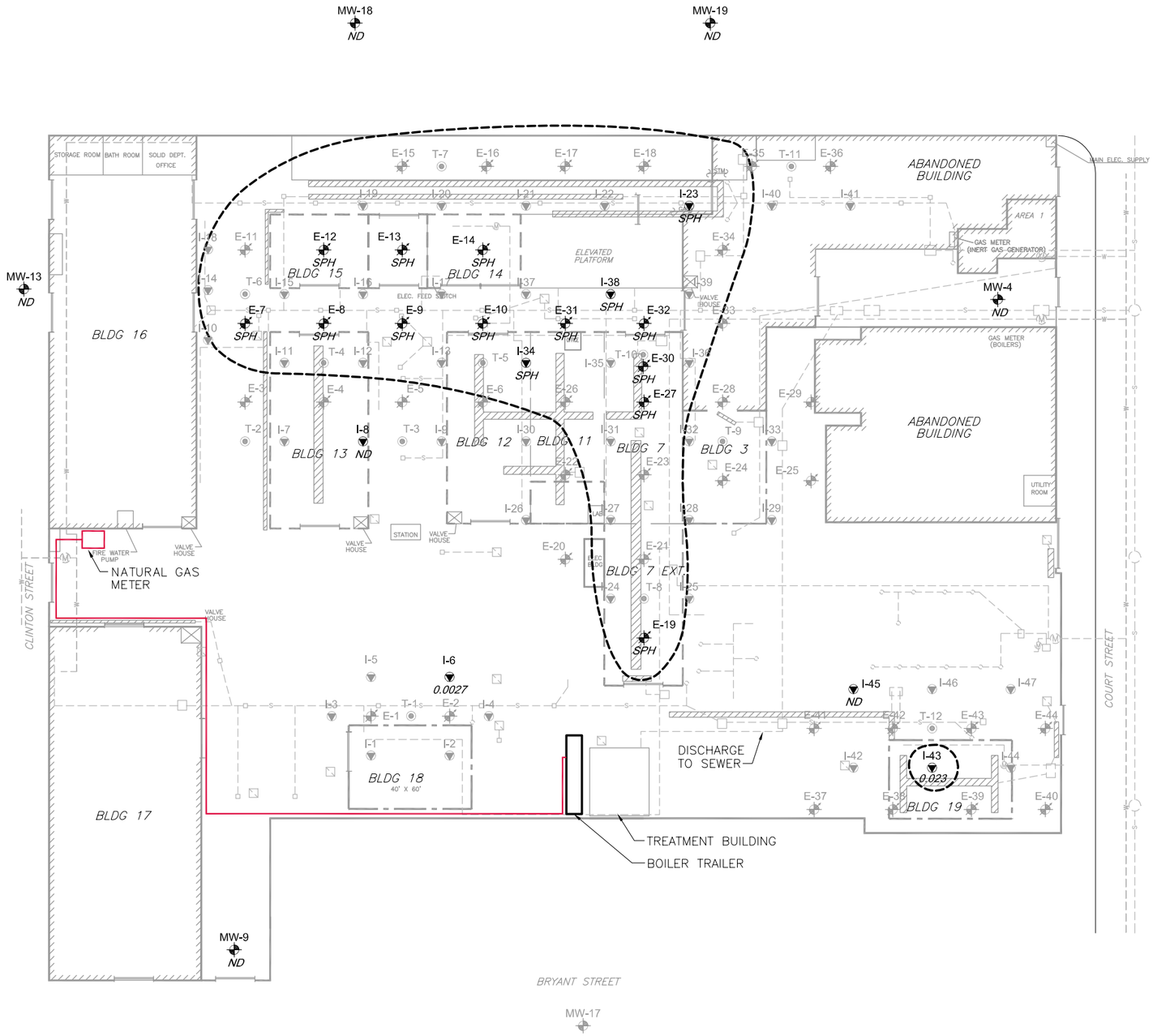
FIGURE 5

Drawing Number
00004271-026

D



LEGEND

- MONITORING WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE EXTRACTION WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE INJECTION WELL (GRAY IF NO SAMPLE COLLECTED)
- THERMOCOUPLE
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)
- INFERRED AREA WITH CONCENTRATIONS EXCEEDING NEW YORK'S AMBIENT GROUNDWATER QUALITY STANDARD OF 0.010 mg/l [TOGS 1.1.1]

ND — COMPOUND NOT DETECTED ABOVE LABORATORY DETECTION LIMIT

SPH — SEPARATE PHASE HYDROCARBONS DETECTED IN JULY 2007 (WELL/SAMPLE IS ASSUMED TO EXCEED STANDARD)

MW-16 1.2

B REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

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Figure 6

BENZENE CONCENTRATIONS IN GROUNDWATER (mg/l) DECEMBER 2008

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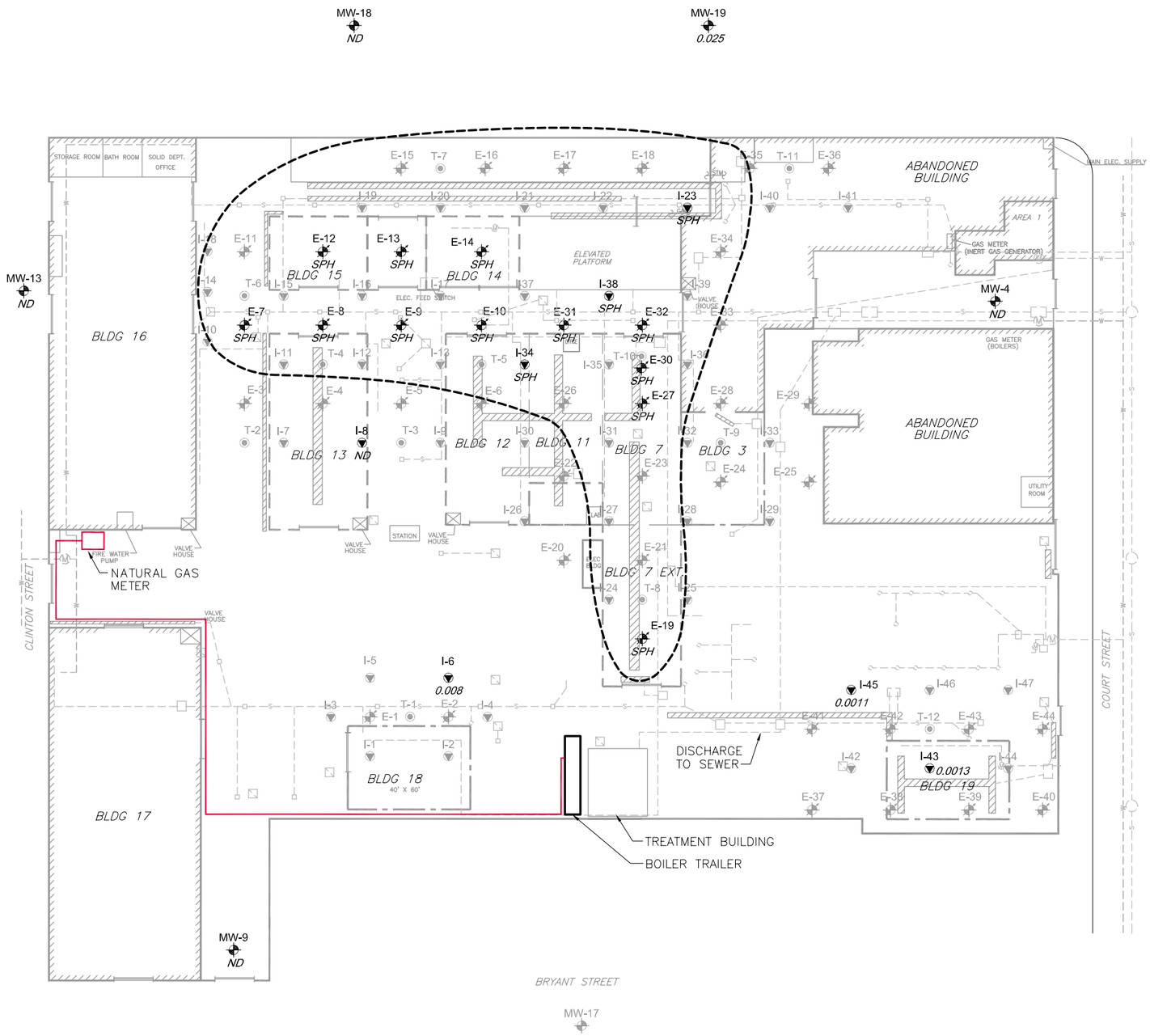

LEGEND

- MONITORING WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE EXTRACTION WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE INJECTION WELL (GRAY IF NO SAMPLE COLLECTED)
- THERMOCOUPLE
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)
- INFERRED AREA WITH CONCENTRATIONS EXCEEDING NEW YORK'S AMBIENT GROUNDWATER QUALITY STANDARD OF 6.0 mg/l (SA, A(c)) [TOGS 1.1.1]

ND — COMPOUND NOT DETECTED ABOVE LABORATORY DETECTION LIMIT

SPH — SEPARATE PHASE HYDROCARBONS DETECTED IN JULY 2007 (WELL/SAMPLE IS ASSUMED TO EXCEED STANDARD)

B REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

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Figure 7

TOLUENE CONCENTRATIONS IN GROUNDWATER (mg/l) DECEMBER 2008

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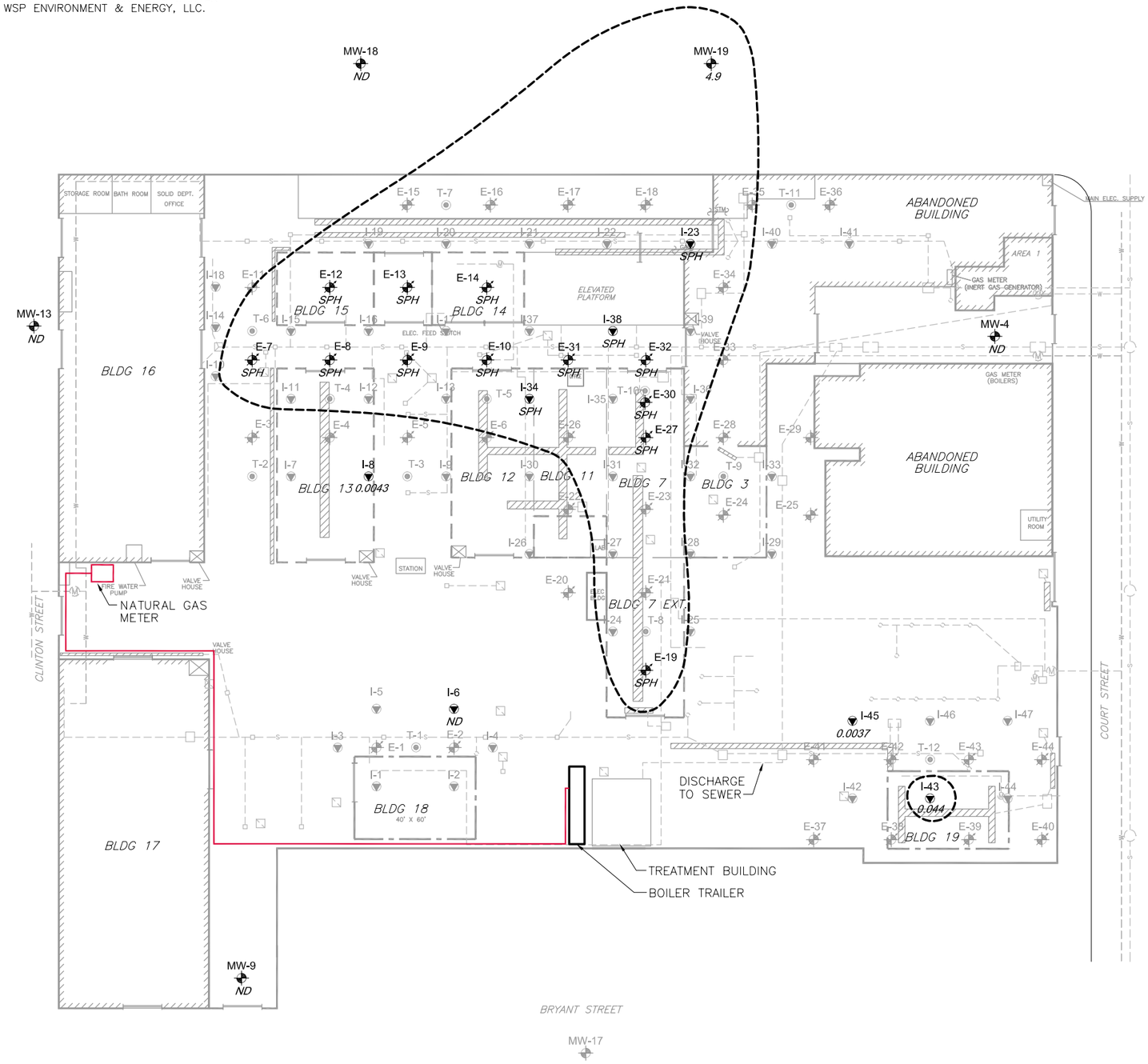

LEGEND

- MONITORING WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE EXTRACTION WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE INJECTION WELL (GRAY IF NO SAMPLE COLLECTED)
- THERMOCOUPLE
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)
- INFERRED AREA WITH CONCENTRATIONS EXCEEDING NEW YORK'S AMBIENT GROUNDWATER QUALITY STANDARD OF 0.019 mg/l (SA,A(c)) [TOGS 1.1.1]

ND — COMPOUND NOT DETECTED ABOVE LABORATORY DETECTION LIMIT

SPH — SEPARATE PHASE HYDROCARBONS DETECTED IN JULY 2007 (WELL/SAMPLE IS ASSUMED TO EXCEED STANDARD)

B REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

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Figure 8

XYLENES (TOTAL) CONCENTRATIONS IN GROUNDWATER (mg/l) DECEMBER 2008

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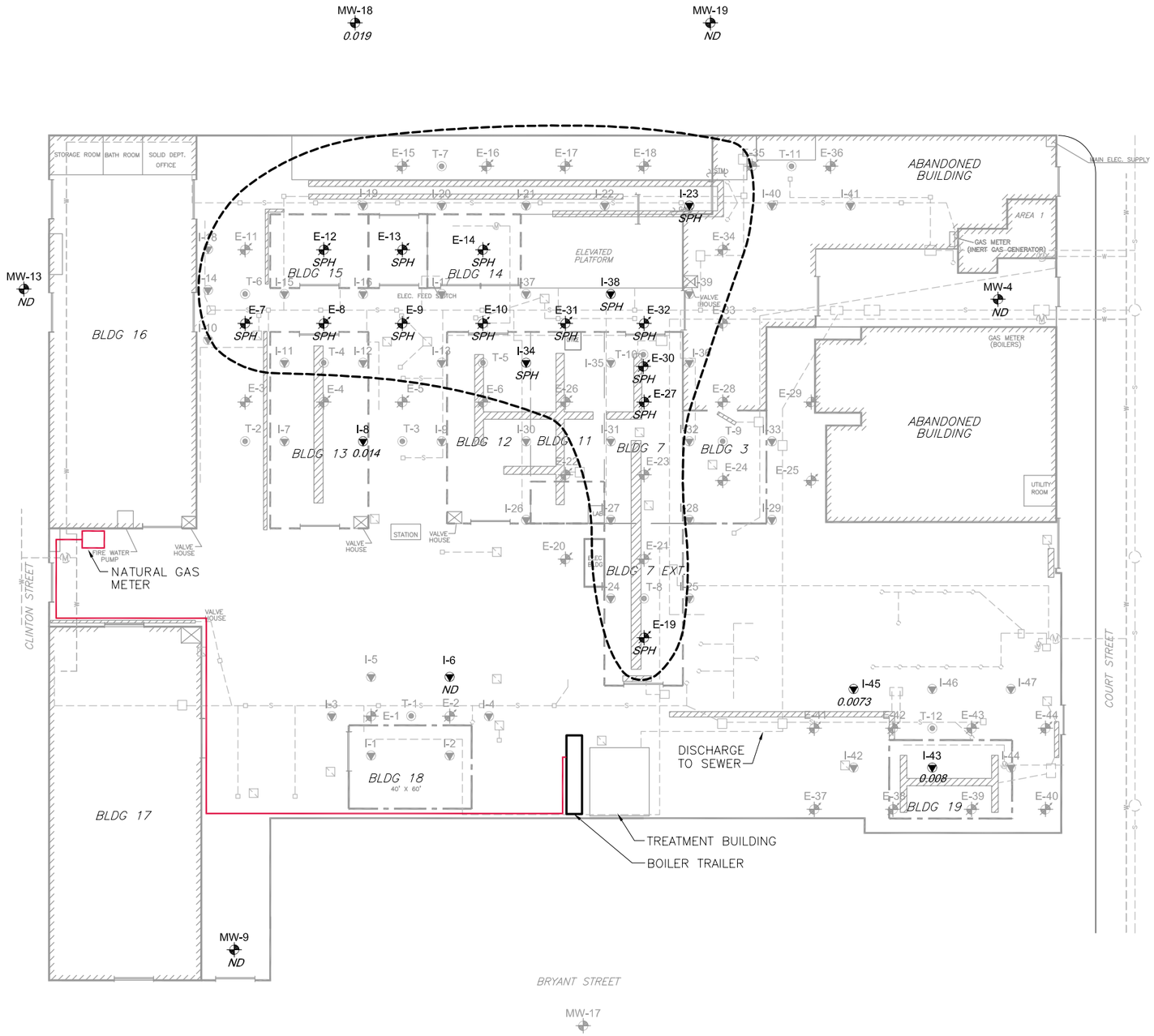

LEGEND

- MONITORING WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE EXTRACTION WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE INJECTION WELL (GRAY IF NO SAMPLE COLLECTED)
- THERMOCOUPLE
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)
- INFERRED AREA WITH CONCENTRATIONS EXCEEDING NEW YORK'S AMBIENT GROUNDWATER QUALITY STANDARD OF 0.05 mg/l [TOGS 1.1.1]

ND — COMPOUND NOT DETECTED ABOVE LABORATORY DETECTION LIMIT

SPH — SEPARATE PHASE HYDROCARBONS DETECTED IN JULY 2007 (WELL/SAMPLE IS ASSUMED TO EXCEED STANDARD)

B REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

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Figure 9

ACETONE CONCENTRATIONS IN GROUNDWATER (mg/l) DECEMBER 2008

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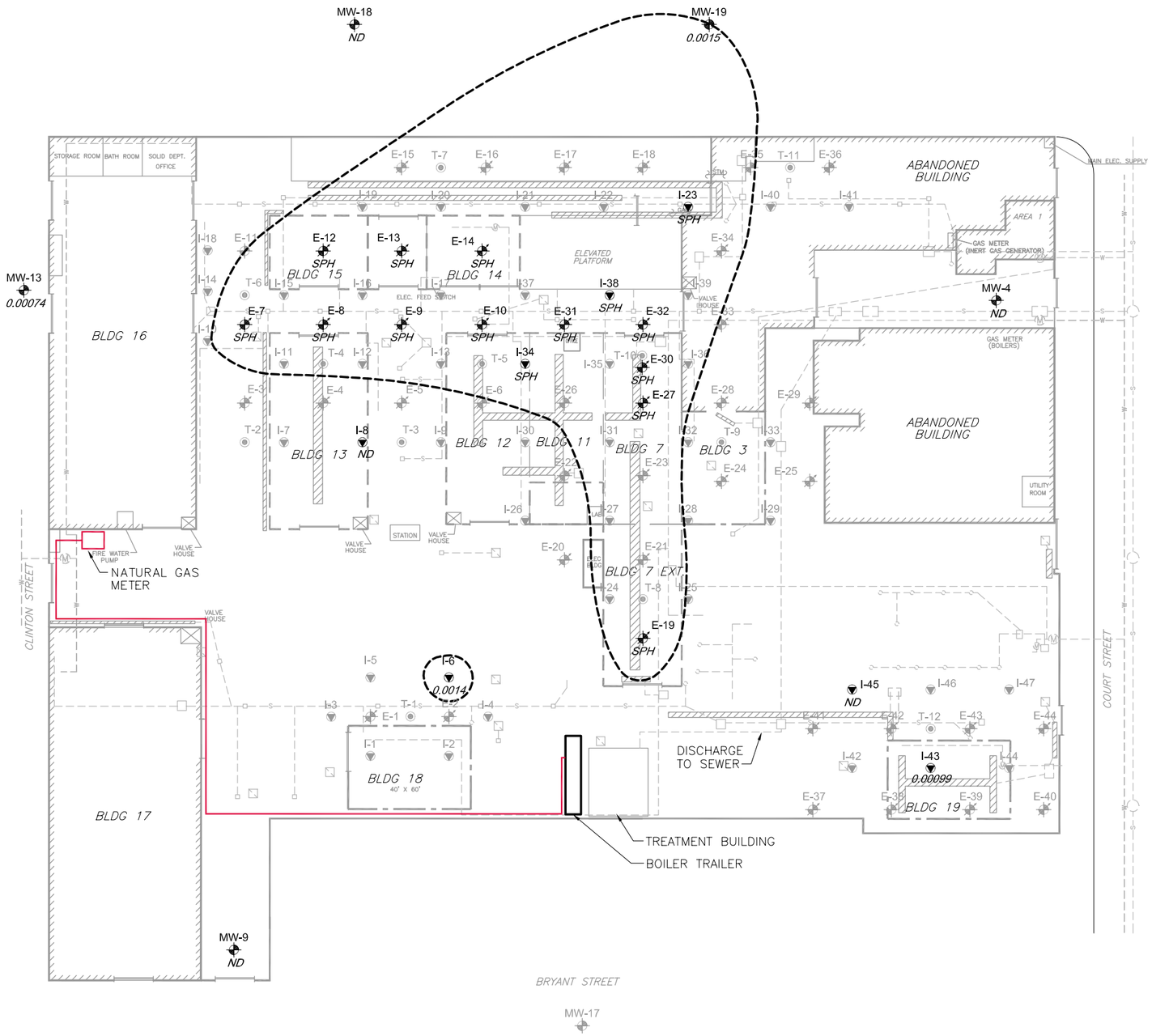

LEGEND

- MONITORING WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE EXTRACTION WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE INJECTION WELL (GRAY IF NO SAMPLE COLLECTED)
- THERMOCOUPLE
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)
- INFERRED AREA WITH CONCENTRATIONS EXCEEDING NEW YORK'S AMBIENT GROUNDWATER QUALITY STANDARD OF 0.001 mg/l [TOGS 1.1.1]

ND — COMPOUND NOT DETECTED ABOVE LABORATORY DETECTION LIMIT

SPH — SEPARATE PHASE HYDROCARBONS DETECTED IN JULY 2007 (WELL/SAMPLE IS ASSUMED TO EXCEED STANDARD)

B REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

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Figure 10

PHENOL CONCENTRATIONS IN GROUNDWATER (mg/l) DECEMBER 2008

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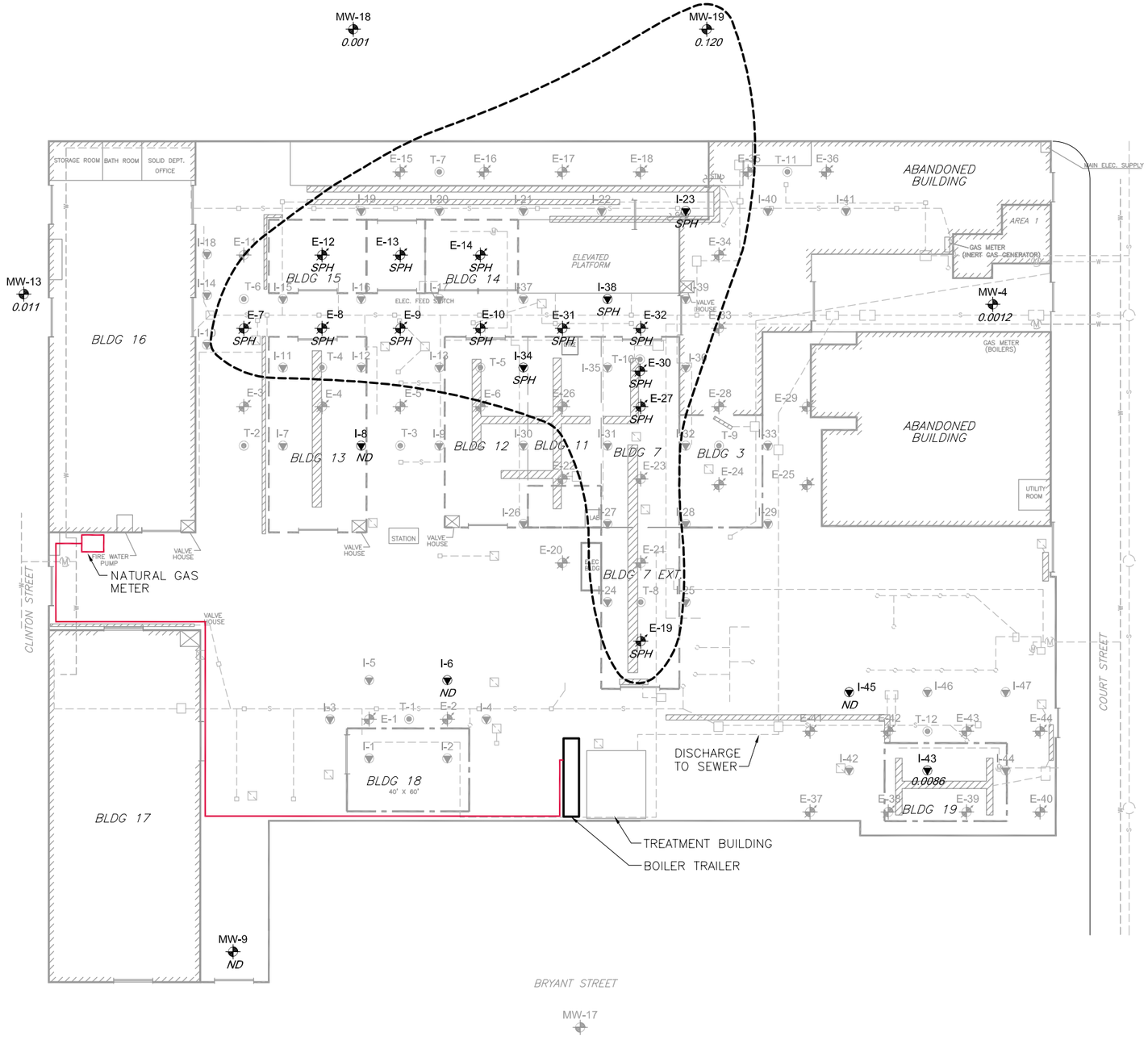

LEGEND

- MONITORING WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE EXTRACTION WELL (GRAY IF NO SAMPLE COLLECTED)
- FULL-SCALE INJECTION WELL (GRAY IF NO SAMPLE COLLECTED)
- THERMOCOUPLE
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)
- INFERRED AREA WITH CONCENTRATIONS EXCEEDING NEW YORK'S AMBIENT GROUNDWATER QUALITY STANDARD OF 0.016 mg/l (SA,A(c)) [TOGS 1.1.1]

ND — COMPOUND NOT DETECTED ABOVE LABORATORY DETECTION LIMIT

SPH — SEPARATE PHASE HYDROCARBONS DETECTED IN JULY 2007 (WELL/SAMPLE IS ASSUMED TO EXCEED STANDARD)

B REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

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Figure 11

NAPHTHALENE CONCENTRATIONS IN GROUNDWATER (mg/l)
DECEMBER 2008

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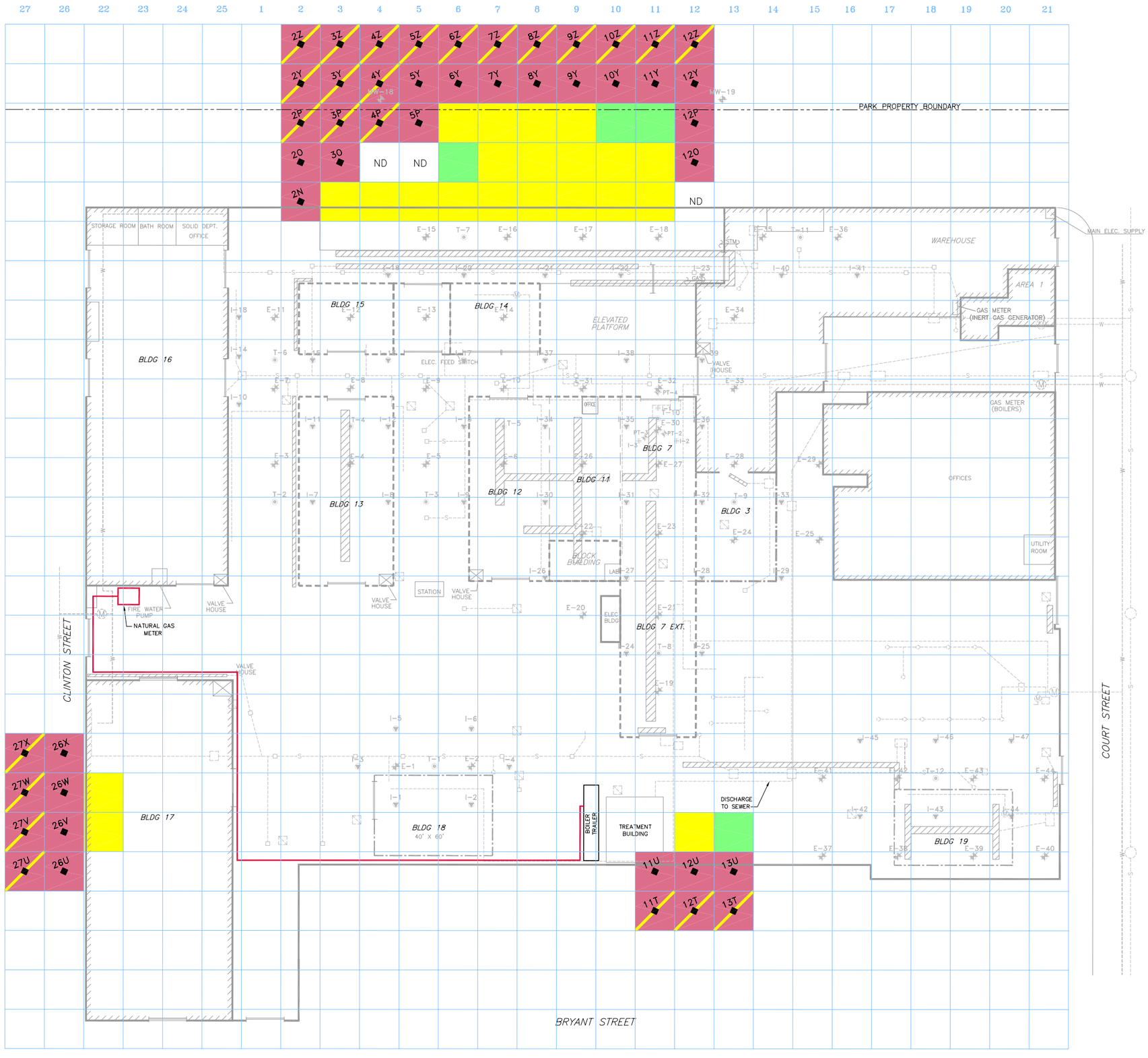

GENERAL NOTES:

1. WELL AND THERMOCOUPLE LOCATIONS ARE APPROXIMATE.
2. PCB SAMPLE LOCATIONS ARE APPROXIMATE.

LEGEND

- PILOT–SCALE PIEZOMETER TEMPERATURE WELL
- PILOT–SCALE INJECTION WELL
- FULL–SCALE EXTRACTION WELL
- FULL–SCALE INJECTION WELL
- THERMOCOUPLE
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE–EXISTING TRENCH
- PRE–EXISTING SEWER LINE
- PRE–EXISTING WATER LINE
- PRE–EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)

20' × 20' — TOTAL PCB CONCENTRATION OF AT LEAST ONE SOIL SAMPLE COLLECTED WITHIN GRID >1 mg/kg

20' × 20' — TOTAL PCB CONCENTRATION OF AT LEAST ONE SOIL SAMPLE COLLECTED WITHIN GRID >0.1 mg/kg

ND — TOTAL PCB CONCENTRATION OF ALL SAMPLES COLLECTED WITHIN GRID LESS THAN 0.1 mg/kg

20' × 20' — PROPOSED OFFSITE SAMPLE LOCATION (EXPEDITED ANALYSIS)

20' × 20' — PROPOSED OFFSITE SAMPLE LOCATION (EXTRACT AND HOLD)

NOTE:
ONLY SAMPLE RESULTS FROM GRIDS LOCATED OFFSITE OR ON THE PROPERTY BOUNDARY ARE SHOWN, IE COLUMN 23 AND ROWS N, O, P, AND V.

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3	Revised	Appr.

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PROPOSED OFFSITE PCB SAMPLE LOCATIONS

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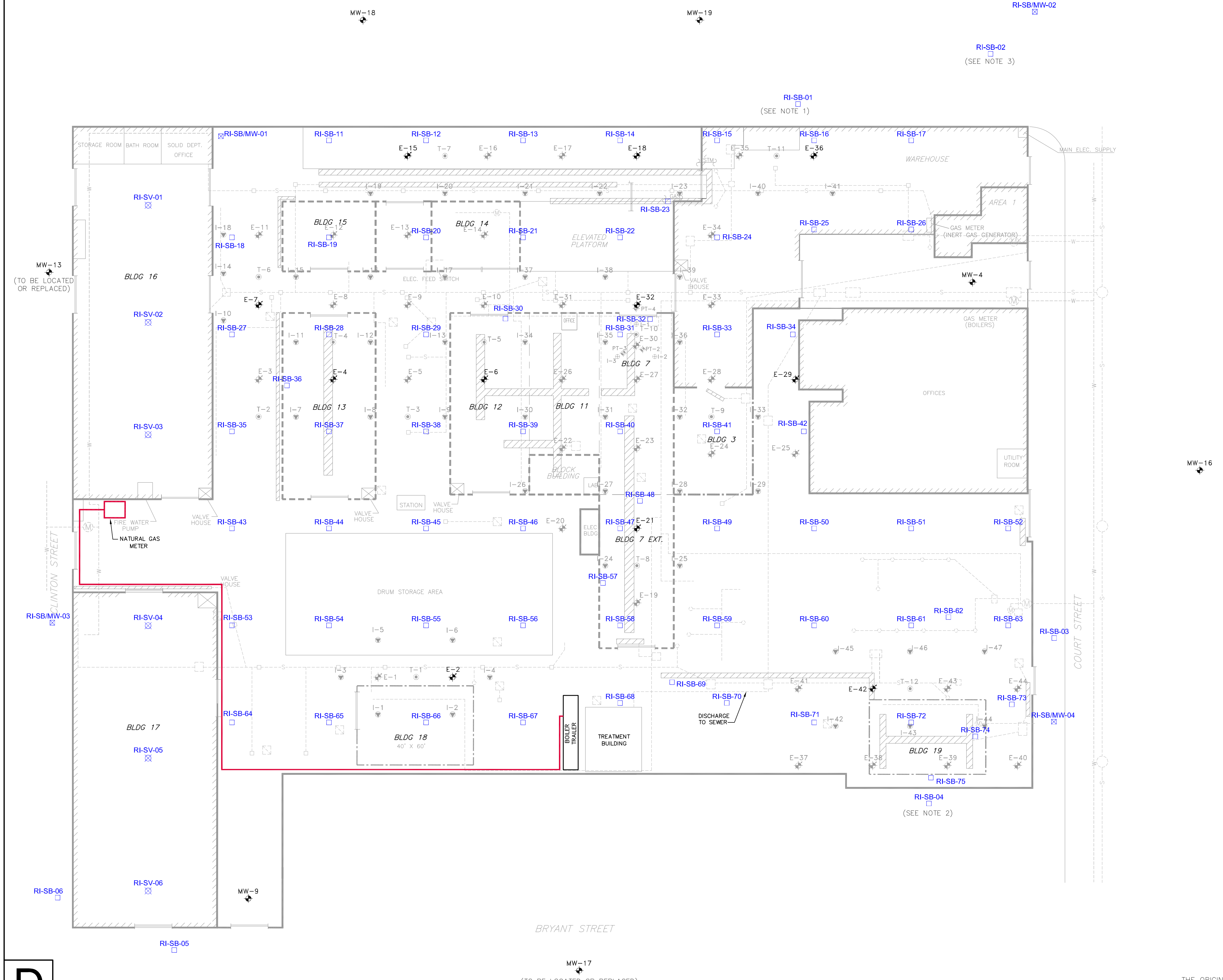
FIGURE 12

Drawing Number
00004271–033

D



LEGEND

- PILOT-SCALE PIEZOMETER TEMPERATURE WELL
- PILOT-SCALE INJECTION WELL
- FULL-SCALE EXTRACTION WELL
- FULL-SCALE INJECTION WELL
- THERMOCOUPLE
- MONITORING WELL
- MONITORING WELL TO BE SAMPLED
- EXTRACTION WELL TO BE SAMPLED
- RI-SB — SOIL BORING TO BE COMPLETED AS PART OF THE RI ACTIVITIES
- RI-SB/MW — SOIL BORING/MONITORING WELL TO BE COMPLETED AS PART OF THE RI ACTIVITIES
- RI-SV — SOIL VAPOR SAMPLING LOCATION
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)

NOTES:

1. SOIL BORING LOCATION TO BE FIELD LOCATED BASED ON DEBRIS/SOIL PILES.
2. SOIL BORING PROPOSED INSIDE OF GARAGE.
3. THIS SAMPLE IS LOCATED WHERE TAR-LIKE LIQUIDS WERE OBSERVED ON COBBLE STONE SURFACE.

D

REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

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REV | DESCRIPTION

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RI SOIL BORINGS AND GROUNDWATER SAMPLE LOCATIONS

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FIGURE 13

Drawing Number
00004270-011

RED HOOK
RECREATIONAL AREA

RI-SB-01

RI-SB/MW-02

MW-14

RI-SB-02

RI-SV-16

RI-SV-17

WAREHOUSE

688
COURT STREET

RI-SV-25

RI-SV-26

GAS METER
(INERT GAS GENERATOR)

AREA 1

MAIN ELEC. SUPPLY

MW-4

COURT STREET

MW-2

LABORATORY

633
COURT STREET

STILLS

SB-2

MW-1

HALLECK STREET

NATIONAL
GRID USA

LEGEND

- MONITORING WELL
- MONITORING WELL TO BE SAMPLED
- RI-SB — SOIL BORING TO BE COMPLETED AS PART OF THE RI ACTIVITIES
- RI-SB/MW — SOIL BORING/MONITORING WELL TO BE COMPLETED AS PART OF THE RI ACTIVITIES
- RI-SV — SOIL VAPOR SAMPLING LOCATION
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)

REFERENCE: 1. ENVIRO-SCIENCES, INC FIGURE PREPARED FOR WITCO CORPORATION DATED MAY 15, 1999, FIGURE 19, DRAWING NO. WBR-002D, TITLED METALS DETECTED IN GROUNDWATER EXCEEDING NYS CLASS GA STANDARDS FOR MARCH 24, 1999

2. SURROUNDING AREAS FROM GOOGLE EARTH PRO.

B

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0 50 100
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Approved:
DWG Name: 00004270-012

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Figure 14

TAR SEEP AREA

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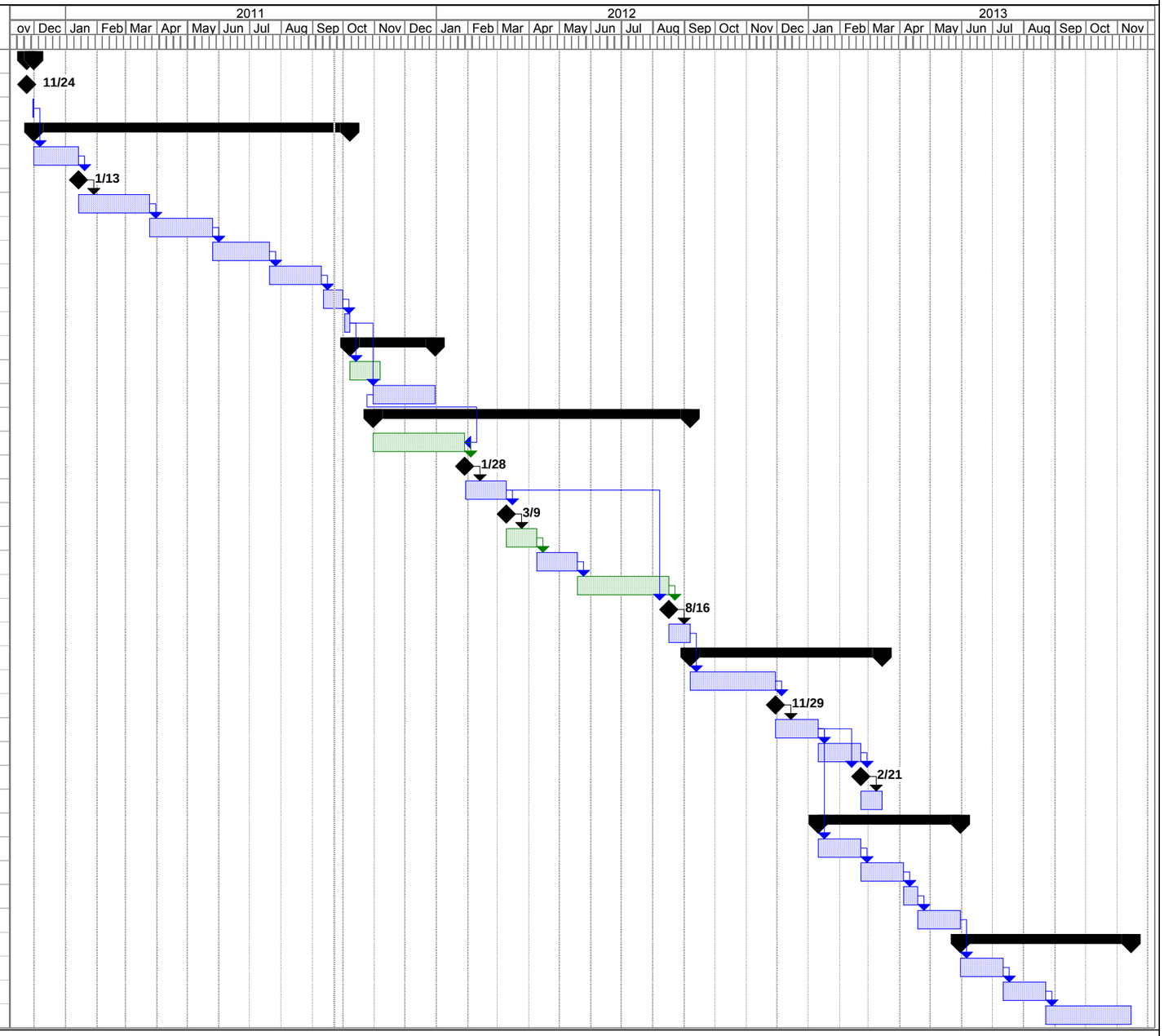
WSP Engineering of New York, P.C.

Figure 15
RI Implementation Schedule
Chemtura Corporation
Brooklyn, New York

WSP Engineering of New York, P.C.
2360 Sweet Home Road, Ste 3
Amherst, New York 14228

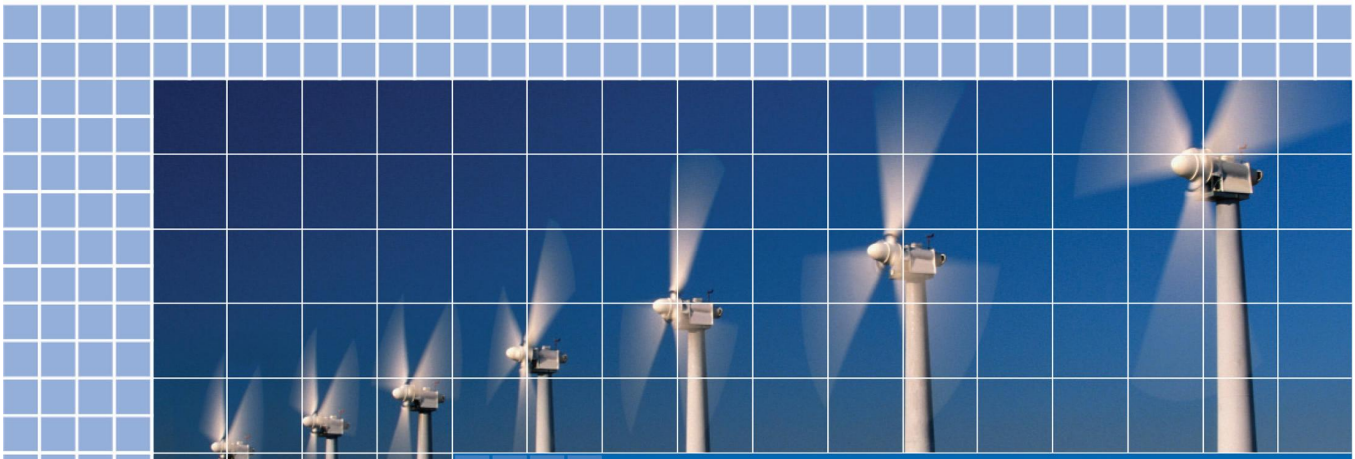
ID	Task Name	Duration	Start	Finish	Predecessors
1	**Consent Order**	**5 days**	**Wed 11/24/10**	**Tue 11/30/10**	
2	Consent Order - Chemtura	0 days	Wed 11/24/10	Wed 11/24/10	
3	Consent Order - NYSDEC	1 day	Tue 11/30/10	Tue 11/30/10	
4	**RI Work Plan**	**221 days**	**Wed 12/1/10**	**Fri 10/7/11**	
5	Draft RFI Work Plan	30 days	Wed 12/1/10	Thu 1/13/11	3
6	Draft RFI Work Plan Submittal	0 days	Thu 1/13/11	Thu 1/13/11	5
7	NYSDEC Review and Comment	50 days	Fri 1/14/11	Thu 3/24/11	6
8	Comment Resolution (RFI to RI)	44 days	Fri 3/25/11	Wed 5/25/11	7
9	Prepare Remedial Investigation Work Plan	40 days	Thu 5/26/11	Wed 7/20/11	8
10	NYSDEC Review and Comment	37 days	Thu 7/21/11	Fri 9/9/11	9
11	Final Revision and Resubmit	15 days	Mon 9/12/11	Fri 9/30/11	10
12	Approved RI Work Plan	5 days	Mon 10/3/11	Fri 10/7/11	11
13	**Remedial Investigation Implementation**	**60 days**	**Sat 10/8/11**	**Fri 12/30/11**	
14	CO Requirement - 30 Days to Start	30 days	Sat 10/8/11	Sun 11/6/11	12
15	Field Implementation	45 days	Mon 10/31/11	Fri 12/30/11	12FS+15 days
16	**Remedial Investigation Report**	**224 days**	**Mon 10/31/11**	**Thu 9/6/12**	
17	RI Report Preparation (CO Requirement)	90 days	Mon 10/31/11	Sat 1/28/12	15SF+90 days
18	RI Report Submittal	0 days	Sat 1/28/12	Sat 1/28/12	17
19	NYSDEC Review	30 days	Mon 1/30/12	Fri 3/9/12	18
20	NYSDEC Provides Phase 2 Scope	0 days	Fri 3/9/12	Fri 3/9/12	19
21	CO Requirement - 30 Days to Start	30 days	Sat 3/10/12	Sun 4/8/12	20
22	Phase 2 Field Implementation	30 days	Mon 4/9/12	Fri 5/18/12	21
23	Final RI Report Preparation (CO Requirement)	90 days	Sat 5/19/12	Thu 8/16/12	22
24	Final RI Deliverable	0 days	Thu 8/16/12	Thu 8/16/12	23,19
25	NYSDEC Review/Request FS	15 days	Fri 8/17/12	Thu 9/6/12	24
26	**Feasibility Study Report**	**135 days**	**Fri 9/7/12**	**Thu 3/14/13**	
27	FS Preparation	60 days	Fri 9/7/12	Thu 11/29/12	25
28	Draft FS Submittal	0 days	Thu 11/29/12	Thu 11/29/12	27
29	NYSDEC Review and Comment	30 days	Fri 11/30/12	Thu 1/10/13	28
30	Final FS Preparation	30 days	Fri 1/11/13	Thu 2/21/13	29
31	Final FS Submittal	0 days	Thu 2/21/13	Thu 2/21/13	29,30
32	NYSDEC Review and Approval	15 days	Fri 2/22/13	Thu 3/14/13	31
33	**Proposed Plan**	**100 days**	**Fri 1/11/13**	**Thu 5/30/13**	
34	Proposed Plan Preparation	30 days	Fri 1/11/13	Thu 2/21/13	29
35	NYSDEC Review and Comment	30 days	Fri 2/22/13	Thu 4/4/13	34
36	Proposed Plan Completion	10 days	Fri 4/5/13	Thu 4/18/13	35
37	Public Review Period	30 days	Fri 4/19/13	Thu 5/30/13	36
38	**Record of Decision**	**120 days**	**Fri 5/31/13**	**Thu 11/14/13**	
39	Record of Decision Preparation	30 days	Fri 5/31/13	Thu 7/11/13	37
40	NYSDEC Review and Comment	30 days	Fri 7/12/13	Thu 8/22/13	39
41	Final Record of Decision	60 days	Fri 8/23/13	Thu 11/14/13	40



Project: 688 Court St RI Schedule rev
Date: Thu 9/22/11

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Appendix A – Quality Assurance Project Plan



QUALITY ASSURANCE PROJECT PLAN
REMEDIAL INVESTIGATION WORK PLAN
688-700 COURT STREET
BROOKLYN, NEW YORK
Case No.: D2-03811-10-08

September 2011

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WSP Engineering of New York, P.C.

Contents

Contents

Figures

Tables

1 Project Description

On behalf of Chemtura Corporation (Chemtura), WSP Engineering of New York, P.C. (WSP) has prepared this Quality Assurance Project Plan (QAPP) as an appendix to the Remedial Investigation (RI) Work Plan for the former Chemtura facility located at 688-700 Court Street in Brooklyn, New York (Site).

1.1 INTRODUCTION

This QAPP describes the quality assurance/quality control (QA/QC) protocols to be used during all sampling activities associated with the RI for the Site. The QAPP was prepared in accordance with requirements outlined in the November 30, 2010, Amended Order on Consent (Case No.: D2-03811-10-08) entered into by Chemtura and the New York State Department of Environmental Conservation (NYSDEC) for the Site. WSP prepared this QAPP in accordance with NYSDEC's DER-10 Technical Guidance for Site Investigations and Remediation (Guidance), dated May 3, 2010

A copy of the approved QAPP as well as any pertinent WSP Standard Operating Procedures (SOPs) will be kept at the Site during implementation of the RI activities. All personnel involved in the implementation of sampling programs will be properly trained to ensure strict adherence to the QAPP and other plans.

1.2 SCOPE OF QUALITY ASSURANCE PROJECT PLAN

The QAPP provides information on the objectives, project organization, and specific QA/QC procedures required to implement all environmental sampling activities associated with the RI for the Site and yield technically defensible data. Essential elements addressed in this QAPP include:

- project description
- project organization
- QA objectives and criteria
- sampling procedures and sample custody
- instrumentation calibration and maintenance
- analytical procedures
- internal QC checks
- data reduction, validation, and reporting
- specific standard operating procedures used to assess data
- precision, accuracy, representativeness, and completeness
- corrective action

1.3 SITE LOCATION AND DESCRIPTION

The Site is located at 688-700 Court Street in Brooklyn, New York, and consists of numerous occupied, vacant, and/or partially demolished buildings located on approximately 5.5 acres. The Site, which is generally impervious (covered with either concrete, asphalt, or buildings), has been used for industrial and commercial purposes since approximately 1904. Between 1904 and 1958, the property was used as a lumberyard, marine canvas supply business, and an iron works facility. From 1958 until the mid-1960s, the Site was owned by Argus Chemical Laboratory, which manufactured vinyl stabilizers and plastic

additives at the Site. In the mid-1960s, Witco Corporation purchased Argus Chemical Laboratory, but continued manufacturing plastic additives at the facility until 1999, when plant operations ceased. Witco Corporation later merged with Crompton & Knowles and, eventually, the merged company became known as Crompton Corporation. In 2005, Crompton Corporation merged with Great Lakes Chemical Corporation to form Chemtura Corporation (Chemtura).

The Site is currently owned by VIP Builders, LLC and is used as a granite cutting/processing facility. Aside from random storage areas throughout the Site, the facility and operation is largely limited to Buildings 16 and 17.

The former chemical manufacturing facility has been completely decommissioned and all former chemical storage and process tanks were decontaminated and removed from the facility as described in the document entitled “Closure Plan, Crompton Corporation, Former Witco Facility, Brooklyn, New York”, dated May 2001.

The property is in a heavily industrialized area in the Red Hook section of Brooklyn, New York. The Site is bordered to the east by Court Street then Brooklyn Union Gas and Spentonbush Red Star Companies; to the west by Clinton Street then American Import/Export Trucking; and to the south by Bryant Street then Hess Oil Company. Red Hook Recreational Park is located immediately north of the Site. All of the adjacent and contiguous properties (with the exception of the park) perform heavy industrial operations including petroleum terminals, machining and manufacturing, and waterfront industries. The Site is also located within 0.5 mile of the Gowanus Canal, a major industrial shipping waterway into the New York City area, and the location of the Gowanus Canal Superfund Site.

1.4 FIELD SAMPLING PROGRAM

WSP anticipates collecting groundwater, soil, and sub-slab vapor samples on-Site and in off-Site areas surrounding the Site. Procedures for different types of sampling techniques are described fully in the appendices to this QAPP.

1.4.1 Groundwater Sampling

At least four new monitoring wells (RI-SB/MW-01, -02, -03, and -04) will be installed as part of the RI. Upon completion of new well installations, all new and existing wells will be developed (or redeveloped) to ensure low turbidity samples that are representative of the surrounding aquifer. Monitoring well sampling will be scheduled no sooner than seven days after well development to allow the well to stabilize. Well development will be accomplished, in general, by repeated surging and pumping until the well yields water of acceptable turbidity at the beginning of a pumping cycle. Well development will be performed in accordance with SOPs as well as ASTM D5521-05, Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers. All development and purge water will be collected and managed in accordance with SOPs. Confirmation of proper development will include measurements of pH, conductivity, and turbidity (NTU).

Prior to collecting groundwater samples, a complete round of water level measurements will be obtained for all on-Site monitoring wells (3 wells), off-Site monitoring wells (8 wells), and selected on-Site remediation extraction wells (11 wells). This activity will also involve noting and measuring any free-phase organics found in any of the monitoring points.

All new and existing monitoring wells, as well as a set of 11 remediation extraction wells, will be sampled in accordance with SOPs. Well development will be scheduled no sooner than 48 hours after completion of the well installation, to allow the grout seal to set properly. Sampling will be limited to those wells that do not exhibit characteristics of free-phase organics (light non-aqueous phase liquid [LNAPL] or dense non-aqueous phase liquid [DNAPL]). All groundwater samples will be collected, handled, preserved, and shipped in accordance with SOPs.

Groundwater samples will be analyzed for Target Compound List (TCL) Volatile Organic Compounds (VOCs) and Semi-volatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Methods 8260 and 8270, Target Analyte List (TAL) metals by EPA SW 846 Method 6010, and pesticides and polychlorinated biphenyls (PCBs) by EPA SW 846 Method 8082/3540C.

The results of the characterization groundwater sample analyses will be compared against the standards and guidance values contained in NYSDEC TOGS 1.1.1. The values that are applicable to the Site are those for water class SA (saline), type H(FC), protection for human consumption of fish (Saline Waters), or when not available, SA-A(C) for fish propagation in saline waters. The groundwater in Brooklyn is not used as a source of drinking water

There has been no information presented in either the Phase I or the Phase II documents to suggest that Pesticides might have been used at the site (tarpaper manufacturer and petroleum storage). For this reason, pesticides are not evaluated in the groundwater (or soil) in the SC Work Plan and this QAPP.

1.4.2 Soil Sampling

Soil borings and samples will be installed and collected using either hollow stem augering (HSA) or direct-push sampling equipment at 45 locations to further refine the spatial distribution of polychlorinated biphenyls (PCBs) in off-Site areas of the property. These borings will be installed in areas where soil samples from previous PCB investigations have contained total PCB concentrations greater than 0.1mg/kg. All sample handling will be performed in strict accordance with relevant WSP procedures, including chain-of-custody procedures, and analyzed for PCBs by the. EPA Method 8082/3540C.

In addition to the PCB direct-push investigation, approximately 75 additional boring locations will be installed and approximately 150 soil samples will be collected from a 50-foot grid across the site. Several grid nodes are moved slightly off the grid to coincide with prior borehole locations with elevated concentrations of contaminants. Samples will be analyzed for TCL VOCs and SVOCs by the EPA SW 846 Methods 8260 and 8270, TAL metals by EPA SW 846 Method 6010, and pesticides by EPA SW 846 Method 8080. The samples collected from the grid locations will not be analyzed for PCBs due to the extensive amount of PCB data already available at the Site as well as the overlapping PCB investigation that will be undertaken as part of the RI.

1.4.3 Sub-Slab Vapor Sampling

Sub-slab vapor samples will be collected through the building slabs in three locations from each of the active site buildings (Buildings 16 and 17). These buildings appeared during the Site visit, to be open warehouse type structures with no significant partitioned areas. Therefore, the sub-slab locations will be distributed throughout the common building areas. Sub-slab vapor samples will be collected by installing permanent vapor sampling probes in accordance with the procedures contained in the following guidance documents:

- Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006, New York State Department of Health, Center for Environmental Health (NYSDOH Guidance).
- Standard Operating Procedure (SOP) for Installation of Sub-Slab Vapor Probes and Sampling Using EPA Method TO-15 to Support Vapor Intrusion Investigations.

Sub-Slab vapor probes will be constructed using ¼" stainless steel tubing with swagelok fittings installed within a 3/8" pilot hole drilled entirely through the slab and into the sub-slab material. All sub-slab vapor probe installation and sampling will be performed in accordance with the guidance documents noted above. Sub-slab vapor samples will be collected after purging 3-liters of vapor from each sampling location. The purge volume will be measured using tedlar bags and the volumes will be evacuated using a peristaltic pump and dedicated tubing.

Following purging, sub-slab vapor samples will be collected using SUMMA® canisters, and will be analyzed for TCL VOCs using EPA Method TO-15. Analytical data will be compared against the Soil Vapor/Indoor Air Matrices provided in Section 3 of the NYSDOH Guidance.

2 Project Organization and Responsibility

The names (where available), addresses, and telephone numbers of key individuals responsible for overall project management, collecting valid measurement data, and assessment of measurement systems for precision and accuracy are listed in Table 1.

WSP is the principal consultant to Chemtura on the Site and will be responsible for performing all sampling services, including field operations, data management, and reporting. Mr. John Simon, executive vice president of WSP, is the client manager for Chemtura. Mr. Simon is responsible for ensuring that all work completed for Chemtura meets or exceeds expectations.

Mr. Kevin Sullivan, P.E., is the project manager for the implementation of the RI and has overall responsibility for the sampling and analysis activities conducted in accordance with this QAPP. Mr. Sullivan will manage the coordination and implementation of the investigative and any subsequent remedial activities, provide senior technical and resource management support, and routinely evaluate program performance. Mr. Sullivan has the authority to commit the firm's resources to accomplish the project objectives. He will have ultimate responsibility for WSP and subcontractor performance and, together with the client manager, will form the WSP management team for the project

The project's technical staff will be composed of junior and senior staff with engineering and/or geological educational backgrounds and experience in implementing environmental site investigations. These staff members will lead and execute the project's technical and operational tasks and will be responsible for leading and coordinating the day-to-day activities of the subcontractors (laboratory and drilling) hired to complete the RI implementation. The technical staff also has the responsibility for collecting samples and assuring compliance with the schedule and QA/QC procedures. In addition, the technical staff will provide data management and data QA/QC.

WSP's quality assurance officer (QAO) for the Site, Mr. Todd Waldrop, is responsible for all aspects of QA/QC related to the sampling activities. He will coordinate with the WSP project manager and the laboratory QA managers. He will report directly to WSP's project manager or client manager when corrective action is required as a result of QA/QC reviews.

A subcontract laboratory will be used to provide the proposed analytical services for water, soil, and air samples. WSP will ensure that the selected laboratory participates in the EPA's Contract Laboratory Program (CLP), has obtained certification for NYSDEC Analytical Services Protocol (ASP), and is certified for the proposed analytical routines in the applicable categories under the New York State Department of Health's Environmental Laboratory Approval Program. Laboratory references will be provided upon request. The laboratory's QA manager will work with WSP's QAO to facilitate coordination of all planned sampling and chemical testing activities. The laboratory's QA managers or their designees working under their direction will serve as the representative for day-to-day contacts with WSP. Copies of laboratory quality manuals (LQMs) are available upon request.

The key individuals and their major areas of responsibility are outlined below. These individuals are responsible for the performance of tasks through the task leaders and the maintenance of quality work throughout all sampling and analysis activities.

- **Overall QA/QC**
  - Todd Waldrop, WSP
  - Kevin Sullivan, WSP
- **Field Sampling Operations and QC**
  - Assigned Technical Junior and Senior Staff, WSP

- Todd Waldrop, WSP

- **Laboratory Analyses and Laboratory QC**
  - Todd Waldrop, WSP
  - Laboratory QA manager (to be defined)
- **Data Review**
  - Assigned Technical Junior and Senior Staff, WSP
  - Todd Waldrop, WSP

3 Quality Assurance Objectives and Criteria

The criteria used most commonly to specify data quality objectives (DQOs) and to evaluate available sampling, analytical, and QA/QC options during investigation and remedial activities are as follows:

- Precision – A measure of the reproducibility of analyses under a set of given conditions.
- Accuracy – A measure of the bias that exists in a measurement system.
- Representativeness – The degree to which sampling data accurately and precisely represent selected characteristics.
- Completeness – The measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under “normal” conditions.
- Comparability – The degree of confidence with which one data set can be compared to another.

The following section presents the criteria for accomplishing the precision, accuracy, representativeness, completeness, and comparability parameters that will be used to attain the QAPP objectives.

3.1 DATA QUALITY REQUIREMENTS AND ASSESSMENTS

DQOs are quantitative and qualitative statements specifying the quality of environmental data required to support the decision making process. DQOs define the total uncertainty in the data that is acceptable for each activity. This uncertainty includes both sampling error and instrument error. The overall objective is to keep the total uncertainty within an acceptable range that will not limit the intended use of the data. This objective will be achieved by establishing specific data quality requirements, such as detection limits, criteria for accuracy and precision, data comparability, and data completeness. Data quality requirements and assessments applicable to the analytical laboratory and consistent with the projected data use have been developed and are described in this section.

3.1.1 Chemical Analyses and Quality Assurance Protocols

Samples collected during the RI will be analyzed using approved EPA methods included in SW-846 (3rd Edition), including updates, other EPA manuals, or promulgated regulations. The proposed analytical methods for all the samples, including the associated analytical parameters, are summarized in Table 2. The DQOs for precision, accuracy, and completeness will be based on the QC requirements stipulated by the analytical methods. The sample containers, preservatives, and holding times for each analysis are also summarized in Table 2. Table 3 summarizes the reporting limits associated with TCL parameters to be analyzed. For purposes of QC, a minimum of 5 percent of samples from each media collected in the field for laboratory analyses will be replicated (i.e., there will be 1 duplicate sample for every 20 samples collected). These duplicates are “blind” to the laboratory. Laboratory duplicates will also be analyzed at the rate of 1 per every 20 samples.

The accuracy of analytical techniques and instrument calibration is monitored through the use of calibration standards. QC checks, such as the analysis of equipment blanks and trip blanks, will provide guidance and will ascertain the integrity of the analyses. Equipment blanks will be prepared at a rate of one per equipment type per monitoring event, when non-disposable equipment is used. A trip blank will be submitted with each cooler of aqueous samples shipped to the laboratory for analysis of VOCs. QC samples will be prepared in accordance with the Work Plan and SOPs.

The sample matrices (i.e., solids and groundwater) will be examined to evaluate their affect on the analytical protocol. Examination will be performed by analysis of one matrix spike/matrix spike duplicate (MS/MSD) for every 20 samples of the same matrix.

Laboratory QC reference samples are integrated into the analytical scheme to assess accuracy and precision. All laboratory QC samples are to be analyzed according to the same protocols as the investigative samples, including all dilutions, spikes, and processing. QC reference samples will be evaluated based on the EPA acceptance criteria specified in SW-846. Laboratory blanks are to be analyzed with each run to detect container, sample preparation, reagent, or system contamination.

3.1.2 Field Sampling Quality Requirements

The objective for collecting field samples is to maximize the confidence in the data in terms of precision, accuracy, completeness, and comparability. This QAPP presents the frequency with which field duplicates and blanks will be collected such that a certain degree of precision and accuracy can be calculated. The DQOs for field duplicates are to achieve precision equal to or greater than laboratory duplicate precision requirements specified in SW-846. The DQO, for the completeness of data, with respect to sampling, is 100 percent. It is anticipated that there may be deficiencies. However, every effort will be made to obtain valid data for all sampling points. Deficiencies will be discussed with appropriate personnel and a determination will be made as to whether they affect the numerical accuracy of the data and the objectives of the project.

3.2 DATA QUALITY ASSURANCE ASSESSMENT

All data will be reported to the NYSDEC completely. No data will be omitted unless an error occurred in the analyses or the run was invalidated because of QC sample recovery or poor precision.

Method-specific requirements for accuracy and precision will be followed. Data precision is routinely evaluated based on the results of the samples analyzed in duplicate. The range is calculated and then divided by the average of the two analyses. When multiplied by 100, this value equals the relative percent difference (RPD) between the duplicate samples. The RPD of duplicates in each data set will be compared with method-specific precision requirements to determine the accuracy of the data.

3.3 DATA REPRESENTATIVENESS

All proposed field-testing and measurement procedures are designed to maximize the goal that field data will represent the conditions found at the Site. All sampling efforts will be conducted using procedures designed to maximize the goal that the sample will be representative of the matrix from which it was taken. For example, all groundwater samples from monitoring wells will be collected after purging of stagnant water in the well to allow collection of groundwater that is representative of the water-bearing zone.

All analytical activities are designed to produce data representative of the samples submitted for analysis. The main tool for ensuring data representativeness is the laboratory QA/QC protocol described in this QAPP.

3.4 DATA COMPARABILITY

All data collection mechanisms outlined in the RI Work Plan and this QAPP are designed to produce comparable data. Tests performed at various locations across the Site will be conducted using accepted procedures in a consistent manner between locations and over time, and will include appropriate QA/QC procedures (i.e., instrument calibration) to ensure the validity of the data. Any limits on the comparability of test data will be noted and test results will be evaluated on that basis.

All samples will be analyzed by the laboratory using the protocols for sample preservation, holding times, sample preparation, analytical methodology, and QC as described in SW-846 (3rd Edition), the NYSDEC ASP and other EPA-approved manuals. Data will be reduced, reported, and documented in a consistent

manner. For example, water quality data will be reported using a consistent set of units. Any deviations from established protocols will be noted so that data comparability can be maintained.

3.5 DATA COMPLETENESS

The data generated by the field sampling are intended to be complete. Analytical and field data completeness will be addressed by applying data quality checks and assessments described in this section to ensure that the data collected are valid and significant.

3.6 DATA MANAGEMENT

To meet data management objectives, all aspects of the field sampling including sample design, collection, shipment, analysis, use, and decisions, will be performed in conjunction with rigorous QA/QC documentation. The specific details of this documentation can be found throughout this QAPP. Separate data quality requirements for field sampling and laboratory analysis will allow any problems in the system to be isolated and resolved. Conversely, the data quality requirements are also designed to provide an indication of the variability inherent to the overall system.

Through the use of a phased approach to sampling, analysis, data assessment (data review), data qualification, and feedback, the overall data management objective is to provide a complete database with a high degree of confidence that thoroughly characterizes the environmental media collected in relation to the Site.

4 Field Sampling Procedures

Field sampling procedures and equipment decontamination procedures are described fully in the RI Work Plan and associated SOPs. A copy of all pertinent SOPs will be maintained at the Site during all field activities.

In general, samples will be numbered with less than nine alphanumeric characters. The location of soil samples collected to refine the spatial distribution of PCBs in off-Site areas of the Site will be based on the continuation of the 20 foot by 20-foot grid established during previous PCB investigations. The first set of characters will denote the grid row and column in which the sample was collected (i.e. A1, B1, B2, C2, etc…). The remaining digits will denote the depth interval below ground surface from which the sample was collected (e.g. “01” for 0 to 1 feet, “12” for 1 to 2 feet).

The first set of characters for soil samples collected for further delineation of organic and inorganic constituents will denote the investigation phase (i.e. RI) and soil boring number in which the sample was collected (ex. RI-SB-01, RI-SB-02, etc…). Soil borings that will eventually be completed as monitoring wells will be designated RI-SB/MW-XX for the purposes of soil sample collection and analyses. The remaining digits will denote the depth interval below ground surface form, which the sample was collected.

Groundwater samples will be identified according to the monitoring well identification (i.e. MW-18, MW-19, etc…) at which the sample was collected. QA/QC samples, such as blind duplicates, will be assigned arbitrary sample identifications and sampling times using the same numbering scheme described above to assure that they are not identified as QA/QC samples by the laboratory.

Sub-slab vapor samples will be identified with the nomenclature of “SSV”. The next two digits for each sample type will indicate the order in which the sample was collected (e.g., 1, 2, 3).

The laboratory will provide appropriate preservatives for sample containers. The required holding times, sample containers, and preservative requirements are presented in Table 2 along with the respective matrices and methods. Procedures for collecting QC samples are identical to the environmental sample collection procedures described in the RI Work Plan and SOPs. When the collection of MS/MSD samples is required, three times the normal volume will be collected at the designated sample location for each matrix.

4.1 SAMPLING PROCEDURES

WSP personnel will complete all sampling activities in accordance with the SOPs, the Work Plan, and this QAPP.

Field observations and data will be recorded in the field logbook during sample collection. Field parameters collected during purging of the monitoring wells will be recorded in the logbook and will include but are not limited to the time, volume purged, temperature, pH, specific conductance, and any usual colors or odors. Sample data recorded in the logbook will include, but are not limited to the date, time, sample location and ID number, and proposed analyses.

4.2 SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES

Non-disposable sampling equipment will be decontaminated before each use in accordance with the RI Work Plan and SOPs. In general, the SOP for sampling equipment decontamination is as follows:

1. Use appropriate PPE as specified in the HASP.

2. Prepare a decontamination area by spreading polyethylene sheeting on a firm, flat surface (if possible). Create a berm around the decontamination area to contain inadvertent spillage. A berm can be created by rolling under the edges of the polyethylene sheeting or by draping the plastic over a wooden frame, etc.
3. Prepare a solution of non-phosphate detergent and tap water in a container.
4. Wipe sampling equipment with paper towels to remove residual soil or gross contamination. Heavy oils or grease may be removed with paper towels soaked with isopropanol.
5. Disassemble sampling equipment (e.g., split-spoon samplers and bailers). Wash equipment thoroughly in a non-phosphate detergent and hot tap water (if available) solution. Teflon bailers must be disassembled and the inside washed with a long-handled bottle brush or short-handled brush pulled through the bailer with rope.
6. Rinse the equipment with hot tap water (if available).
7. If the equipment will be used to collect samples for metals analysis, follow the tap water rinse with a 10% nitric acid solution rinse. Carbon steel equipment (e.g., bucket augers, split-spoons) should be rinsed with 1% nitric acid solution to reduce the potential for oxidizing the metal surfaces. Collect the nitric acid rinse in a separate bucket for proper disposal. Rinse the equipment with tap water.
8. Thoroughly rinse the equipment with deionized water.
9. Spray the equipment with isopropanol and allow to completely air dry. The solvent rinse must be collected in a separate bucket. Isopropanol is the recommended solvent for organic contaminants because it is readily available and is not a Department of Transportation hazardous material. However, other solvents (e.g., acetone, hexane, methanol) may be more effective in removing certain contaminants, such as oils or PCBs.
10. Rinse the equipment with deionized water using at least five times the volume of solvent used in the previous step.
11. After the equipment has been allowed to completely air dry, each piece must be individually wrapped with aluminum foil (shiny side out), and then wrapped in plastic. Note: Decontamination solvents may introduce contaminants to environmental samples. It is very important to ensure that the equipment has completely dried before use or storage.
12. After the final decontamination event on a project, label each piece of equipment with the date of decontamination, the initials of decontamination personnel, and the type of decontamination solutions used.
13. Note any discrepancies from standard decontamination procedures in the field logbook.
14. Field decontamination wash water should be containerized for offsite disposal in accordance with state and federal requirements. The volume of spent solvent generated during field decontamination should be minimal. Solvents should be collected in separate buckets and allowed to evaporate. Comply with related SOPs for managing investigation-derived wastes.
15. Paper towels soaked with solvent should be allowed to air dry and be disposed of with the general trash. Under no circumstances should any decontamination solution be disposed of on soil surfaces.

4.3 QA SAMPLES

Samples such as trip blanks, blind duplicates, equipment blanks, and MS/MSD samples will be collected for QA purposes. As shown on Table 2, one trip blank will accompany each container of samples for VOC analysis. One blind duplicate and one MS/MSD sample will be collected for every 20 field samples.

One equipment blank will be collected during each sampling event involving sampling equipment decontamination. Split samples may be collected at the discretion of the NYSDEC.

4.4 SAMPLE VOLUME

Care will be taken that sufficient sample volume is provided for all necessary analyses to be performed, including equipment blanks, field duplicates, MS/MSD samples, and field samples.

4.5 SAMPLE PRESERVATION AND HOLDING TIMES

Groundwater and soil samples will be immediately placed on ice to maintain a temperature of approximately 4ºC. WSP will coordinate with the laboratory to ensure that all holding times are not exceeded. A comprehensive list of proper sample preservation and holding times is presented in Table 2.

4.6 FIELD DOCUMENTATION OF SAMPLING AND SITE OBSERVATIONS

Field records provide the direct evidence and support for the necessary technical interpretations, judgments, and discussions concerning project activities as well as historical evidence for later reviews and analyses. It is important that these records are accurate, complete, legible, identifiable, retrievable, and protected against deterioration or loss. Field records will consist of bound field log books, sample location maps, and chain-of-custody forms. If field analysis or screening is performed, such as with a PID, field records will also include equipment maintenance and calibration information. Other field records, such as personnel training forms and the site-specific health and safety plan (HASP), included as Appendix B to the RI Work Plan, will be kept on-Site during all field activities.

5 Documentation and Chain-of-Custody

Sample custody is controlled and maintained through the chain-of-custody procedures. Chain of custody is the means by which the possession and handling of samples will be tracked from the source (field) to the laboratory. A sample is considered to be in a person's custody if it is in the person's possession, or in the appropriate ice chest or shipping container, and that person has secured it to prevent tampering.

5.1 SAMPLE CONTAINER PREPARATION

Sample containers for the investigations will be prepared and supplied by the laboratory. These containers will be new and certified to be contaminant-free by the manufacturer for each lot number.

5.2 FIELD SAMPLING OPERATIONS

WSP personnel will be responsible for the custody of samples from the time they are collected until they are hand-delivered to the laboratory or transferred to the shipping company for delivery to the laboratory. The chain-of-custody procedures for the sampling activities are described below.

The sample will be placed in a thermal shipping container with ice and will otherwise be preserved as required. The container will remain within the sampler's view or locked in the sampling vehicle for temporary storage and transport to the sample staging area.

On arrival at the sample staging area, the sampler will fill out chain-of-custody form(s) to account for each sample. Trip blanks and QA samples may be sent with each group of samples as listed in Table 2. The copy of the chain-of-custody form will be retained as a permanent record in the project files.

The location of sampling points in the field will be documented to ensure that sampling points can be relocated in the future and are accurately represented in subsequent reports. Soil sampling locations will be temporarily marked in the field with a survey flag or by another appropriate method (e.g., paint). Monitoring well and direct-push sampling locations will be surveyed both horizontally and vertically by a New York State-licensed land surveyor. The survey and field notes showing the sample locations will be retained as a permanent record in the project files. After the samples have been packaged for shipment in accordance with SOP's, the sampler will record the date and time and sign in the appropriate block of the form to relinquish custody. The original chain-of-custody record will be placed inside a sealed bag within the shipping container. The shipping container will then be sealed with custody seals and secured with strapping tape. The seals will indicate whether the samples have been tampered with during transport to the laboratory.

The laboratory will assume custody of the samples on receipt. A designated laboratory sample coordinator will record the date and time and sign the chain-of-custody form upon receipt. The sample coordinator will immediately inspect the shipment for damage and completeness and will report any problems to the WSP QAO. The laboratory sample coordinator will then complete the appropriate lab tracking forms and logs. A copy of each completed chain-of-custody form (following receipt at the laboratory) will ultimately be returned to WSP and will be included in an appendix to the RI Report.

5.3 LABORATORY OPERATIONS

The laboratory sample coordinator is responsible for custody of the samples from the time of sample receipt to the time of discard. Laboratory custody procedures are outlined in the laboratory's LQM and at a minimum will include the following:

- identification of the responsible party (sample custodian) who is authorized to sign for incoming field samples, obtain documents of shipment, and verify the data entered onto the sample custody records

- provision for a laboratory sample custody log consisting of serially numbered, standard, lab-tracking report sheets
- specification of laboratory sample custody procedures for sample handling, storage, and disbursement for analysis

6 Instrument Calibration and Preventative Maintenance

Calibration and maintenance procedures and schedules have been established for all test and measuring equipment to be used at the Site. By following these procedures, the accuracy of instruments and measuring equipment will be maintained.

6.1 FIELD INSTRUMENTS

Field meters to be used during sampling activities include an electronic water level indicator, a PID, and a single device (e.g. a Horiba U-10 water quality meter or equivalent) or multiple meters to measure pH, temperature, and conductivity. Calibration will be checked as necessary in accordance with the manufacturer's recommendations to ensure proper measurements are taken. The probe on the water level indicator will be cleaned after use at each well. All calibration, maintenance, repair, and equipment usage will be recorded in the field log book.

Minimal maintenance is required for the field testing equipment. All equipment that may be used will be checked before starting any field tests. Battery checks will be made for all instruments before sampling begins and periodically during the day. Battery-operated field instruments such as PIDs will be recharged daily.

The field monitoring equipment and measuring devices are maintained by the instrument suppliers under a routine schedule, thereby minimizing the potential for unscheduled downtime. Field maintenance will consist mainly of keeping the instruments clean and dry. If necessary, replacement parts for damaged instruments or replacement instruments will be delivered within 1 day from the instrument supplier.

6.2 LABORATORY INSTRUMENTS

The calibration and maintenance schedule for the laboratory analytical instruments are described in the laboratory's LQM.

7 Internal Quality Control Checks

7.1 FIELD QUALITY CONTROL CHECKS

QC procedures for temperature, pH, and specific conductance measurements of water samples will include calibrating the instruments as described in Section 6.1 of this QAPP. Assessment of field sampling precision and bias will be made by collecting field duplicates and equipment blanks for laboratory analysis. Samples will be collected in accordance with the applicable procedures in the RI Work Plan and associated appendices and Section 4 of the QAPP. If requested by Chemtura or the NYSDEC, WSP may conduct internal audits of field sampling procedures to ensure QC objectives are met.

7.2 LABORATORY QUALITY CONTROL CHECKS

Laboratory QC checks will be conducted in accordance with the laboratory LQM and the analytical method.

8 Data Reduction, Validation, and Reporting

The reporting scheme from sample collection to data validation is described in this section. As previously described, samples will be collected and sent by overnight carrier or delivered to the laboratory with the proper chain-of-custody documentation. After the analytical data have been reviewed by laboratory personnel, data packages meeting the requirements specified in this section will be compiled.

8.1 FIELD DATA

Direct reading field instruments will be used during the implementation of the RI Work Plan. The direct reading data will be recorded in the field log books. Relevant data will be presented in tabular form as part of the RI report. All instrument calibration data will be included in field log books. Extra care will be exercised by field personnel to ensure proper transcription of data from instruments to field log books. Periodic audits of field log books by project management will ensure proper recording of field data and the proper calibration of all instruments.

8.2 LABORATORY DATA

The procedures used to calculate concentrations will be the same as those specified in the specific analytical methodology used. Laboratory data will be reduced by the laboratory by procedures outlined in the laboratory's LQM or similar document.

8.2.1 Data Validation

Before transmitting laboratory data, an agent of the laboratory will check 100 percent of the data for QA purposes. The laboratories will produce data reports that allow for validation by including all QA/QC deliverables for the relevant analytical method. Method-appropriate equations for precision, accuracy, bias, and completeness will be used for all analyses. The data packages will be reviewed thoroughly by WSP's QAO (or designated data validation subcontractor) for data validation purposes. For volatile parameters, data validation will be based on ensuring that the following criteria comply with the EPA CLP National Functional Guidelines:

- holding times
- GC and/or GC/MS instrument performance check
- initial calibration
- continuing calibration
- laboratory blank sample results
- surrogate recoveries
- MS/MSD sample results
- field duplicates, where applicable
- internal standards
- target compound identification
- analyte quantitation and reporting limits
- system performance
- overall assessment

For inorganic parameters, data validation will be based on ensuring that the following criteria comply with the Functional Guidelines:

- holding times
- laboratory blank sample results
- laboratory control sample/reference sample
- MS/MSD sample results
- field duplicates, where applicable
- analyte quantitation and reporting limits
- overall assessment

A preliminary review upon initial receipt of data will be performed to verify that all necessary paperwork (such as chain-of-custody forms, analytical reports, and laboratory personnel signatures) and deliverables are present. A data usability summary report (DUSR) will be prepared. The report will consist of a general introduction section, followed by qualifying statements that should be taken into consideration for the analytical results to be used. Based on the QA review, CLP qualifier codes will be placed next to specific sample results on the data summary table(s). These qualifier codes will serve as an indication of the qualitative and quantitative reliability of the reported analytical results.

When the review has been completed, the QAO (or designated data validation subcontractor) will submit the DUSR report and the validated data to the Project Manager for subsequent evaluation and interpretation. If field or laboratory data are determined to be unusable, corrective action will be implemented as outlined in Section 10.0 of this document.

All analytical environmental data collected during completion of the RI will be independently validated by a third party not affiliated with Chemtura, WSP, or the laboratory.

8.2.2 Data Reporting

The laboratories will be required to provide Category B data packages in accordance with NYSDEC ASP. The data packages will provide all the necessary information for validation as detailed in this QAPP and will contain at a minimum the following information:

- a cover page, including:
  - the Site name and address
  - laboratory name and address
  - laboratory certification number
  - date of analytical report preparation
  - the signature of laboratory director
- a list of field and corresponding laboratory sample identification numbers
- a list of analytical methods used, including matrix cleanup method
- the method detection and practical quantitation limits for each analyte (per analytical method)
- sample results, including date of analysis
- method blank results
- chain-of-custody documentation

Once the data validation is complete, analytical data will be summarized in tabular form with sample number, sample matrix description, parameters analyzed and their corresponding detected concentrations and CLP qualifiers where appropriate. The results from the sampling activities will be incorporated into reports as data tables and maps showing sampling locations and analyte concentrations.

8.2.3 Data Management

A rigorous data control program will be implemented to ensure that all documents are accounted for following completion of the work. Accountable documents include items such as log books, field data records, laboratory data packages, photographs, and reports. The project manager will be responsible for maintaining a central file in which all documents will be inventoried.

The documentation of sample collection will include the use of bound field log books in which all information on sample collection will be entered in indelible ink. Appropriate information will be recorded to reconstruct the sampling event, including the Site name (top of each page), sample identification, brief description of sample, date and time of collection, sampling method, field measurements and observations, and sampler's initials and date on the bottom of each page.

8.2.4 Data Reports to NYSDEC

The NYSDEC's DER has adopted a standardized electronic data deliverable (EDD) format that is required for all data submitted under this SC. All analytical data generated during the RI will be reported to NYSDEC using the Electronic Information Management System (EIMS) and will be formatted using the NYSDEC format files that are compatible with EQuIS from EarthSoft® Inc.

9 Specific Routine Procedures to Assess Data

The process of assessing completed data will include the sampling activities detailed in the Work Plan, DQOs from this QAPP, and the DUSR reports where applicable. The project management team will utilize the Guidance for Data Quality Assessment (EPA QA/G-9 QA97) to determine whether the DQO objectives were met during field activities, the sampling plan design achieved desired results, and the data gathered through sample collection was representative of the areas of concern. In addition, the Data Quality Assessment guidance document will be used to select an appropriate statistical method (if necessary) that uses data collected to verify completeness of the sampling plan design and assists in drawing appropriate conclusions from the data.

10 Corrective Action

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-QC performance, which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Corrective action shall only be implemented after approval by Mr. Kevin Sullivan, WSP's project manager. If immediate corrective action is required, approvals secured by telephone from Mr. Sullivan should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action plan will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying Mr. Sullivan, who in turn will notify Mr. Simon, WSP's client manager, and Mr. George Collentine of Chemtura. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established QC procedures in the QAPP or Work Plan will be identified and corrected in accordance with the QAPP. Mr. Sullivan, or his designee, will issue a nonconformance report for each nonconformance condition.

10.1 FIELD CORRECTIVE ACTION

Corrective action in the field may be required when the sampling program is changed (e.g., more/less samples, sampling locations other than those specified), or when sampling procedures and/or field analytical procedures require modification due to unexpected conditions. In general, WSP's field team leader, project manager, or QAO may identify the need for corrective action. The field staff, in consultation with the field team leader, will recommend a corrective action. WSP's project manager will approve the corrective measure that will then be implemented by the field team. It will be the responsibility of the field team leader to ensure that the corrective action has been implemented.

Corrective actions resulting in fewer samples, alternate locations, or other changes that may affect project QA objectives may require approvals of all levels of project management, including Mr. Kevin Sarnowicz, the NYSDEC project manager.

Corrective action resulting from internal field reviews will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. WSP's QAO will identify deficiencies and recommend corrective action to WSP's project manager. WSP's field team leader and field team will implement the recommended corrective action, document activities completed in the field log book, and report the activities to the entire project management team. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be temporarily suspended until appropriate revisions are made.

10.2 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

WSP may identify the need for corrective action during either data validation or data assessment. Potential types of corrective action may include re-sampling by the field team or reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team, and whether the data to be collected are necessary to meet the required QA objectives (e.g., the holding time for samples is not exceeded). When the QAO (or designated data validation subcontractor) identifies a situation requiring corrective action, WSP's project manager will be responsible for approving the implementation of corrective action. The QAO or WSP's project manager will document all corrective actions of this type in the project file.

11 References

NYSDEC. 2010. DER-10 Technical Guidance for Site Investigation and Remediation. Prepared by the Division of Environmental Remediation. May 3.

U.S. EPA. 1998. Guidance for Data Quality Assessment: Practical Methods for Data Analysis. EPA QA/G-9, QA97 version. January.

U.S. EPA. 1986. Test Methods for Evaluating Solid Waste, Third Edition SW-846, including all promulgated updates. Prepared by the Office of Solid Waste and Emergency Response.

U.S. EPA. 2002. U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. EPA-540-R-01-008. July.

U.S. EPA. 1999. U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. EPA540/R-99/008). October.

Figures

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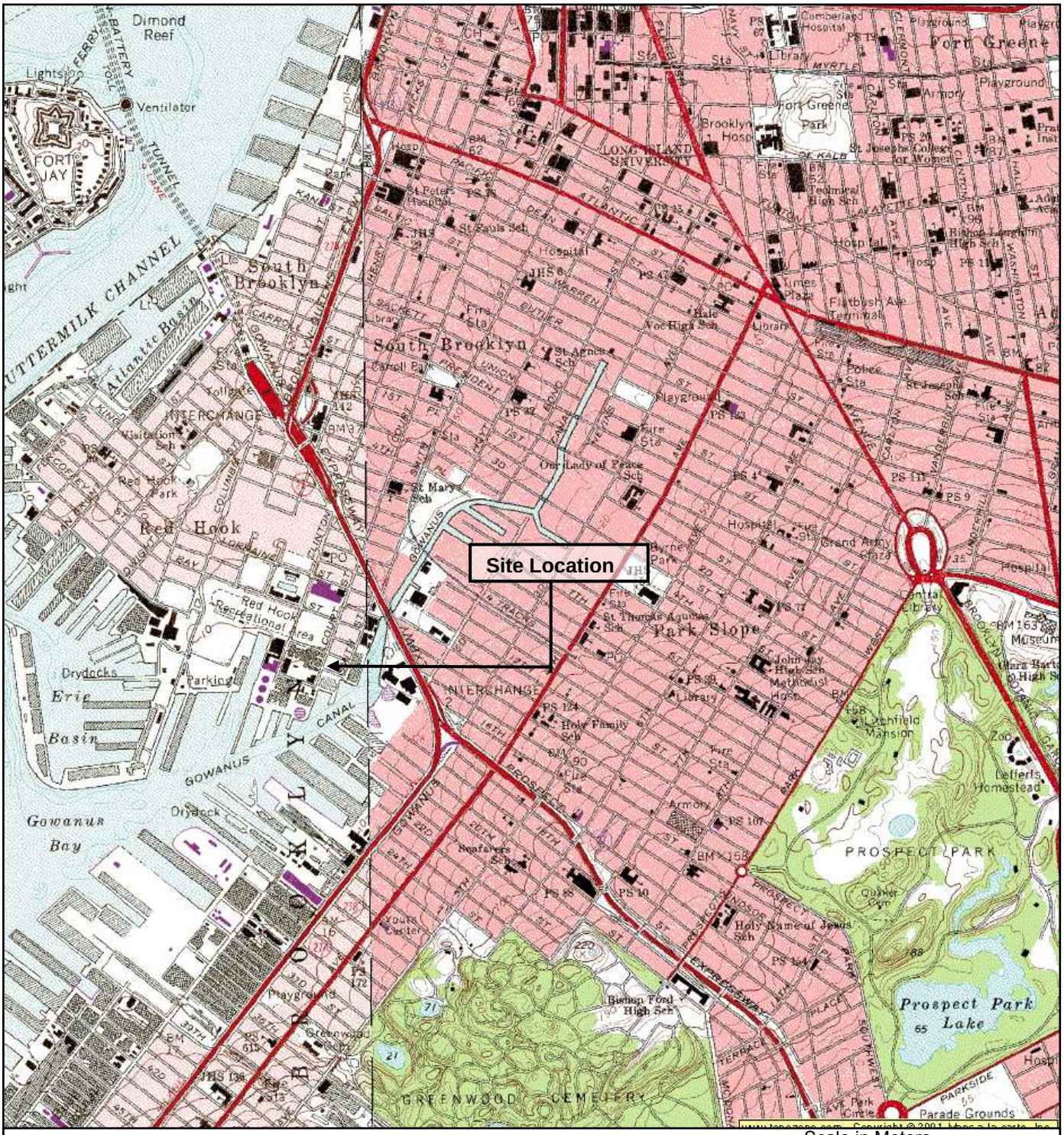


Reference
7.5 Minute Series Topographic Quadrangle
Jersey City, New York – New Jersey
Photorevised 1976 Scale 1:25,000 Metric

N

NEW YORK

Quadrangle Location

Scale in Meters
0 500 1000

0 1000 2000
Scale in Feet

WSP Engineering of New York P.C.
11190 SUNRISE VALLEY
SUITE 300
RESTON, VIRGINIA 20191
703-709-6500

Figure 1
Site Location
Chemtura Corporation
Brooklyn, New York

Tables

Table 1

Names, Addresses, and Telephone Numbers of Key Personnel
Chemtura Corporation
688 Court Street
Brooklyn, New York

Name	Contact Information
George Collentine	Chemtura Corporation 199 Benson Road, #2-4 Middlebury, CT 06749 (203) 573-2825
Kevin Sarnowicz, Project Manager	NYSDEC Division of Environmental Remediation 625 Broadway, 11th Floor Albany, NY 12233-7016 (518) 402-9774
John Simon, Client Manager **Todd Waldrop, Quality Control**	WSP Engineering of New York, P.C. 11190 Sunrise Valley Drive Suite 300 Reston, VA 20191 (703) 709-6500
Kevin Sullivan, Project Manager	WSP Engineering of New York, P.C. 2360 Sweet Home Road Suite 3 Amherst, NY 14228 (716) 691-5232
Tammy McCloskey, Quality Assurance Manager	Accutest Laboratories 2235 Route 130 Dayton, NJ 08810 (732) 329-0200

Table 2

Analytical Methods/Quality Assurance Summary
Chemtura Corporation
688 Court Street
Brooklyn, New York

Matrix Type	Sample Locations or Collection Rate	Equipment Blanks	Blind Duplicates	MS/MSD Samples	Trip Blanks	Analytical Parameters	Analytical Methods	Preservatives	Sampling Volume	Maximum Holding Time
Water										
Groundwater (Monitoring Wells)	22 monitoring wells	1 per event	1 per 20 samples	1 per 20 samples	1 per cooler per event	TCL Volatiles	EPA Method 8260B	HCL to pH< 2; Cool to 4°C	120 mL (3x40mL VOA vials)	14 days from collection
						TCL Semivolatiles	EPA Method 8270C	Cool to 4°C	1L Amber Glass	7 days from collection
						TAL Metals (filtered and unfiltered)	EPA Method 6010B	HNO_3 to pH< 2; Cool to 4°C	300 mL	6 months from VTSR
						Pesticides/ PCBs	EPA Method 8080	Cool to 4°C	1L Amber Glass	7 days from collection
Air										
Sub-Slab Vapor	6 locations	N/A	1 per 20 samples	N/A	N/A	TCL Volatiles	EPA Method TO-15	N/A	1.5 L Summa Canister	14 days from collection
Solids (b,c)										
Soil	PCB Offsite Delineation Samples (approx. 120 samples)	N/A	1 per 20 samples	N/A	N/A	Polychlorinated Biphenyls (PCBs)	EPA Method 8082/3540C	Cool to 4°C	4-oz. glass jar with Teflon-lined cap	7 days extraction from VTSR. 40 days analysis from extraction.
	Organic and InorganicContaminant Delineation (approx. 150 samples)	N/A	1 per 20 samples	N/A	N/A	TCL Volatiles	EPA Method 8260B	Cool to 4°C	4-oz. glass jar with Teflon-lined cap	14 days from collection
						TCL Semivolatiles	EPA Method 8270C	Cool to 4°C	4-oz. glass jar with Teflon-lined cap	7 days extraction from VTSR. 40 days analysis from extraction.
						TAL Metals (Includes Mercury and Total Cyanide)	EPA Method 6010B (Metals except Mercury); EPA Method 7471 (Mercury); EPA Method 9010 (Total Cyanide)	Cool to 4°C	4-oz. glass jar with Teflon-lined cap	6 months from VTSR. 26 days from VTSR for Mercury. 12 Days from VTSR for Cyanide

N/A = not applicable; VTSR = Verified Time of Sample Receipt; PCB - Polychlorinated Biphenyl; TCL = Target Compound List
b/ Unless requested by the NYSDEC, separate matrix spike/matrix spike duplicate samples will not be collected but rather laboratory batch spike data will be used.
c/ Only disposable equipment will be used to collect samples; therefore, no equipment blanks will be collected.

Table 3

Target Compound List Reporting Limits
Chemtura Corporation
688 Court Street
Brooklyn, New York

Parameter (a)	Water (µg/l)	Soil (mg/kg)
Volatile Organics		
Dichlorodifluoromethane	5	5
Chloromethane	5	5
Vinyl Chloride	5	5
Bromomethane	5	5
Chloroethane	5	5
Trichlorofluoromethane	5	5
1,1-Dichloroethene	5	5
1,1-2-Trichloro-1,2,2-trifluoroethane	5	5
Acetone	10	10
Carbon disulfide	5	5
Methyl acetate	5	10
Methylene Chloride	5	5
trans-1,2-Dichloroethane	5	5
Methyl tert-butyl ether	5	5
1,1-Dichloroethane	5	5
cis-1,2-Dichloroethene	5	5
2-Butanone	10	10
Bromochloromethane	5	5
Chloroform	5	5
1,1,1-Trichloroethane	5	5
Cyclohexane	5	5
Carbon Tetrachloride	5	5
Benzene	5	5
1,2-Dichloroethane	5	5
1,4-Dioxane	100	100
Trichloroethene	5	5
Methylcyclohexane	5	5
1,2-Dichloropropane	5	5
Bromodichloromethane	5	5
cis-1,3-Dichloropropene	5	5
4-Methyl-2-pentanone	10	10
Toluene	5	5
trans-1,3-Dichloropropene	5	5
1,1,2-Trichloroethane	5	5
Tetrachloroethene	5	5
2-Hexanone	10	10
Dibromochloromethane	5	5
1,2-Dibromoethane	5	5
Chlorobenzene	5	5
Ethylbenzne	5	5
m,p-Xylene	5	5
o-Xylene	5	5

Table 3

Target Compound List Reporting Limits
Chemtura Corporation
688 Court Street
Brooklyn, New York

Parameter (a)	Water (µg/l)	Soil (mg/kg)
Styrene	5	5
Bromoform	5	5
Isopropylbenzene	5	5
1,1,2,2-Tetrachloroethane	5	5
1,3-Dichlorobenzene	5	5
1,4-Dichlorobenzene	5	5
1,2-Dichlorobenzene	5	5
1,2-Dibromo-3-Chloropropane	5	5
1,2,4-Trichlorobenzene	5	5
1,2,3-Trichlorobenzene	5	5
Semivolatile Organics		
Benzaldehyde	5	170
Phenol	5	170
bis-(2-chloroethyl) ether	5	170
2-Chlorophenol	5	170
2-Methylphenol	5	170
2,2'-Oxybis (1-chloropropane)	5	170
Acetophenone	5	170
4-Methylphenol	5	170
N-Nitroso-di-n propylamine	5	170
Hexachloroethane	5	170
Nitrobenzene	5	170
Isophorone	5	170
2-Nitrophenol	5	170
2,4-Dimethylphenol	5	170
Bis (2-chloroethoxy) methane	5	170
2,4-Dichlorophenol	5	170
Napthalene	5	170
4-Chloronaniline	5	170
Hexachlorobbutadiene	5	170
Caprolactam	5	170
4-Chloro-3-methylphenol	5	170
2-Methylnapthalene	5	170
Hexachlorocyclo-pentadiene	5	170
2,4,6-Trichlorophenol	5	170
2,4,5-Trichlorophenol	5	170
1,1'-Biphenyl	5	170
2-Chloronapthalene	5	170
2-Nitroaniline	10	330

Table 3

Target Compound List Reporting Limits
Chemtura Corporation
688 Court Street
Brooklyn, New York

Parameter (a)	Water (µg/l)	Soil (mg/kg)
Dimethylphthlate	5	170
2,6-Dinitrotoluene	5	170
Acenaphthylene	5	170
3-Nitroaniline	10	330
Acenapthene	5	170
2,4-Dinotrophenol	10	330
4-Nitrophenol	10	330
Dibenzofuran	5	170
2,4-Dinitrotoluene	5	170
Diet;hylphthalate	5	170
Fluorene	5	170
4-Chlorophenyl-phenyl ether	5	170
4-Nitroaniline	10	330
4,6-Dinitro-2-methylphenol	10	330
N-Nitrosodiphenylamine	0	170
1,2,4,5-Tetrachlorobenzene	5	170
4-Bromophenyl-phenylether	5	170
Hexachlorobenzene	5	170
Atrazine	5	170
Pentachlorophenol	10	330
Phenathrene	5	170
Anthracene	5	170
Carbazole	5	170
Di-n-butylphthalate	5	170
Fluoranthene	5	170

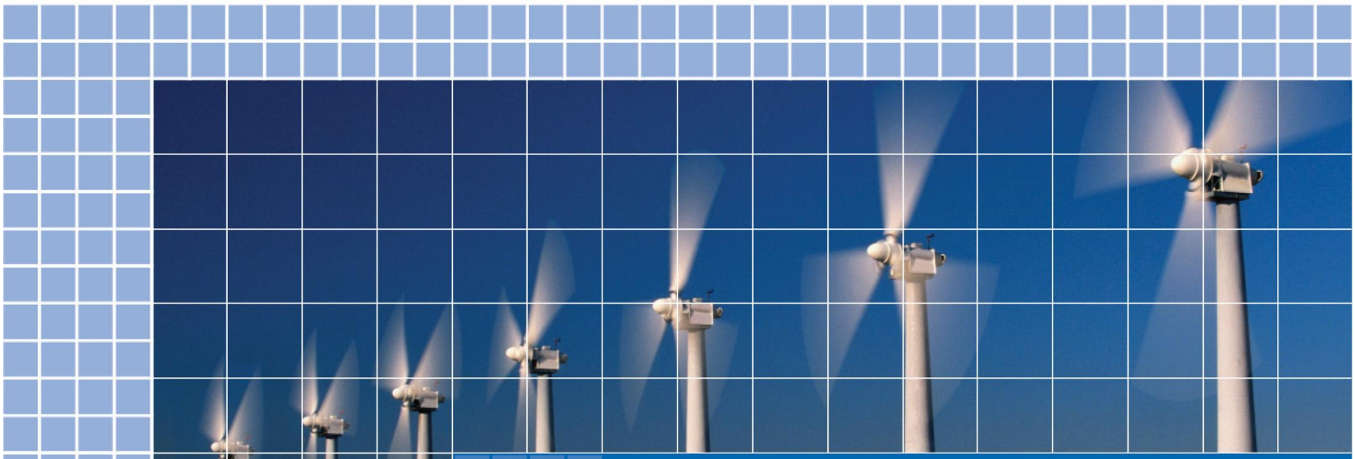
Table 3

Target Compound List Reporting Limits
Chemtura Corporation
688 Court Street
Brooklyn, New York

Parameter (a)	Water (µg/l)	Soil (mg/kg)
Pyrene	5	170
Butylbenzylphthalate	5	170
3,3'-Dichlorobenzidine	5	170
Benzo (a) anthracene	5	170
Chrysene	5	170
Bis (2-ethylhexyl) phthalate	5	170
Di-n-octylphthalate	5	170
Benzo (b) fluoroanthene	5	170
Benzo (k) fluoroanthene	5	170
Benzo (a) pyrene	5	170
Indeno (1,2,3-cd)-pyrene	5	170
Dibenzo (a,h)-anthracene	5	170
Benzo (g,h,i) perylene	5	170
2,3,4,6-Tetrachlorophenol	5	170
Metals		
Aluminum	200	20
Antimony	60	6
Arsenic	10	1
Barium	200	20
Beryllium	5	0.5
Cadmium	5	0.5
Calcium	5000	500
Chromium	10	1
Cobalt	50	5
Copper	25	2.5
Iron	100	10
Lead	10	1
Magnesium	5000	500
Manganese	15	1.5
Mercury	0.2	0.1
Nickel	40	4
Potassium	5000	500
Selenium	35	3.5
Silver	10	1
Sodium	5000	500
Thallium	25	2.5
Vanadium	50	5
Zinc	60	6
Cyanide	10	2.5
PCBs		
Aroclor 1016	1	33
Aroclor 1221	1	33
Aroclor 1232	1	33
Aroclor 1242	1	33
Aroclor 1248	1	33
Aroclor 1254	1	33

a\TCL constituents and quantitation limits from the US EPA Superfund Analytical Serivces/Contract Laboratory Program website: http://www.epa.gov/superfund/programs/clp/target.htm

Appendix B – Health and Safety Plan



HEALTH AND SAFETY PLAN
REMEDIAL INVESTIGATION WORK PLAN
688-700 COURT STREET
BROOKLYN, NEW YORK
Case No.: D2-03811-10-08

September 2011

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WSP Engineering of New York, P.C.

Contents

Contents

Figures

Contents

1 Introduction

On behalf of Chemtura Corporation (Chemtura), WSP Engineering of New York, P.C. (WSP), has prepared this Health and Safety Plan (HASP) for the Remedial Investigation (RI) related for the former Chemtura facility (Site) located at 688-700 Court Street, in Brooklyn, New York (Figure 1). The HASP was prepared in accordance with requirements outlined in the November 30, 2010, Amended Order on Consent (Case No.: D2-03811-10-08) entered into by Chemtura and the New York State Department of Environmental Conservation (NYSDEC) for the Site. Refer to the RI Work Plan for background information pertaining to the transfer of the Site into the New York State Superfund Program.

1.1 SITE LOCATION AND DESCRIPTION

The Site is located at 688-700 Court Street in Brooklyn, New York, and consists of numerous occupied, vacant, and/or partially demolished buildings located on approximately 5.5 acres. Figure 1 illustrates the Site Location and Figure 2 illustrates the Site Layout. The Site, which is generally impervious to surface water infiltration (covered with concrete, asphalt, or buildings), has been used for industrial and commercial purposes since approximately 1904.

The Site is located within 10 feet above mean sea level (amsl) and is generally flat. Access to the Site is available on the east side, via Court Street.

The former chemical manufacturing facility has been completely decommissioned and all former chemical storage and process tanks were decontaminated and removed from the facility as described in the document entitled “Closure Plan, Crompton Corporation, Former Witco Facility, Brooklyn, New York”, dated May 2001.

The property is in a heavily industrialized area in the Red Hook section of Brooklyn, New York. The Site is bordered to the east by Court Street then National Grid USA and Hornbeck Offshore Transportation, LLC; to the west by Clinton Street then Sunlight Clinton Realty, LLC; and to the south by Bryant Street then Patchogue Oil Terminal Corporation (Figure 2). Red Hook Recreational Park is located immediately north of the Site. All of the adjacent and contiguous properties perform heavy industrial operations including petroleum terminals, machining and manufacturing, and waterfront industries. The Site is also located within 0.5 mile of the Gowanus Canal, a major industrial shipping waterway into the New York City area, and the location of the Gowanus Canal Superfund Site. In addition, the NYSDEC has provided information to WSP showing the Patchogue Oil Terminal Corporation located south of the Site under a spill response action (Spill #90-02896).

The surrounding area including the Site is largely zoned for manufacturing. The nearest residential zoned area is the Red Hook Recreational Area which begins on the opposite side of Halleck Street from the Site. However, the nearest residential structure in the westerly direction is across the park, approximately 2,400 feet away. The nearest residential zoned areas to the north, east, and south are on the opposite side of the Gowanus Expressway, approximately 1,800 feet, 2,400 feet, and 4,200 feet away, respectively .

1.2 ENVIRONMENTAL CONCERNS IDENTIFIED AT THE SITE

Several investigations have been conducted at the facility to identify areas of potential concern and to delineate the nature and extent of contamination.

A Phase I Environmental Site Assessment (Phase I) was completed for the Site in 1998. The results of the Phase I were presented in the Phase I Site Assessment report prepared by Fluor Daniel GTI, Inc., dated March 1998 (GTI, 1998). The Phase I identified areas of potential environmental concern based

on a review of the Site history and operations that were conducted at that time, and provided recommendations for further investigation.

A Phase II Site Investigation (Phase II) was performed in May 1999 to evaluate the areas of potential environmental concern outlined in Phase I. Phase II included the collection and analyses of over 100 soil samples and the installation and groundwater sampling of over 15 monitoring wells. A summary of the Phase II investigation activities is provided in the report titled "Results of Phase II Site Investigation" (Phase II Report) prepared by Enviro-Sciences, Inc. (ESI, 1999). The Phase II Investigation and the subsequent Phase II Report included the properties located at both 633 Court Street and 688 Court Street. The Phase II Report concluded that the Potential Constituents of Concern (COCs) for the Site should be limited to toluene, xylenes (total), acetone, phenol, barium, cadmium, and lead. Inorganic COCs were located in shallow soils at the Site and remediated by WSP through soil excavation and offsite disposal. The soil excavation activities are detailed in a letter report submitted by WSP on March 17, 2003.

WSP operated a steam enhanced dual-phase extraction (DPE) with steam injection system at the Site from July 16, 2004 through July 30, 2007 to remediate the primary organic COCs identified in soil and groundwater. On July 25, 2007, approximately 468 gallons of liquid from the oil-water separator and product tank were removed by Phillip Services Corporation (PSC) as part of routine cleaning and system maintenance activities. The sample of the light non-aqueous phase liquid (LNAPL)/water mixture collected by PSC contained 788 parts per million (ppm) polychlorinated biphenyls (PCBs). Immediately following the detection of PCBs in the LNAPL, WSP collected LNAPL samples from extraction wells E-2, E-5, E-16, E-19, and E-42, which had been in operation immediately prior to the PCB detection in the recovered LNAPL. Wells E-16 and E-19 were found to contain 94.7 and 35.8 milligrams per kilogram (mg/kg) of PCBs, respectively.

Subsequently, WSP conducted three iterative rounds of soil/LNAPL investigations in response to the detection of PCBs in the LNAPL between October 2007 and May 2009 and PCBs (primarily Aroclor 1248) were detected in both unsaturated and saturated soil samples at concentrations ranging from non-detect to 850 mg/kg.

1.3 SCOPE OF THE HEALTH AND SAFETY PLAN

This HASP provides safety procedures to be followed by WSP employees while conducting activities associated with the RI at the Site, and has been prepared to address potential threats to the health and safety of WSP field personnel during implementation of the field activities. The plan details protocols to be followed during routine activities and during emergencies, assigns lines of authority, lines of responsibilities, and lines of communication, and establishes personal protection requirements. The following applicable standards and guidelines were consulted in preparation of this HASP.

- Occupational Safety and Health Act, Title 29, Code of Federal Regulations (CFR) 1910.120
- Standard Operating Safety Guidelines, EPA Office of Emergency and Remedial Response, EPA (1988)
- Occupational Health and Safety Guidelines for Hazardous Waste Site Activities, National Institute of Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard, and EPA (October 1985)
- NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services (2011; http://www.cdc.gov/niosh/npg)
- American Conference of Governmental Industrial Hygienists Threshold Limit Values (2008)

1.4 APPLICABILITY OF THE HEALTH AND SAFETY PLAN

The purpose of this HASP is to define the requirements and designate protocols to be followed by WSP Site project personnel during implementation of the RI. The HASP will be used to ensure that adequate Site safety practices are used during these field activities:

- monitoring well installation
- soil sampling
- groundwater sampling
- sub-slab vapor sampling
- decontamination

All WSP Site project personnel will be informed of the Site emergency response procedures and any potential fire, explosion, health, or safety hazards of field activities. All WSP Site project personnel must review the HASP and sign an agreement to comply with its requirements before initiating any work within on-Site work zones. All WSP Site project personnel will be briefed daily by the Site Health and Safety Coordinator (SHSC) and will be required to become familiar with all aspects of this HASP.

The WSP SHSC will brief all visitors of the potential hazards associated with the areas of their visit. Additionally, all visitors will be escorted by qualified WSP personnel at all times and visitors will be escorted away from the site in case of emergency.

Contractor employees have the potential to experience hazards much different than those of WSP employees. Therefore, contractors will develop and implement their own HASP for the work their employees perform at the Site. Contractor-specific plans will be at least as protective as this HASP. The SHSC or Corporate Health and Safety Officer (CHSO) will make such determination of equivalency. Employees of firms other than WSP shall follow their own company's health and safety protocols.

1.5 REVISIONS AND AMENDMENTS TO THE HEALTH AND SAFETY PLAN

This HASP may be modified if it becomes evident to the CHSO, project manager, or SHSC that the provisions specified are not feasible or are no longer adequate to protect the health and safety of field personnel based on site conditions. Modification may be necessitated by changes in the planned activities and tasks; changes in the project personnel or personnel responsibilities; and encounters with unexpected or changing site conditions. In order for a change to be formalized, approved, and implemented, the change must be prepared in the proper format and signed by the CHSO and/or the project manager. A copy of each approved modification will be included in each copy of the HASP, in the project files. Additionally, the SHSC will ensure that all contractors will be informed of the modifications in case site conditions change potential exposure risks to contractor personnel. The SHSC will be responsible for informing WSP's contractors and staff of all changes to the HASP during the daily briefing meetings. Also, this HASP may be revised be the CHSO based on proposed changes in the scope of work, before Site work commences, that may present hazards not originally anticipated.

2 Project Organization

A number of personnel roles are required for the efficient implementation of the RI and the HASP. These roles include the Project Manager (PM), CHSO, SHSC, and task/field team leaders, and field technicians. A field team member may take on more than one role; however, the roles must be clearly assigned in order to ensure that work is conducted safely and efficiently. The following sections outline the assignment (where applicable) or role of personnel responsibilities for the implementation of the RI.

2.1 PROJECT MANAGER

The PM for implementation of the RI will be Kevin D. Sullivan, P.E. The PM is responsible for the day-to-day progress of the project. These responsibilities include organizing field activities, complying with the provisions of the RI Work Plan, field documentation, and record keeping, and ensuring quality control of field activities. The PM has the authority to expend company resources to ensure that field personnel have the appropriate safety equipment and tools to perform their duties according to this HASP and the RI Work Plan. The PM and the SHSC must also ensure that subcontractors and visitors comply with applicable safety protocols and to ensure that contractors have the site-specific HASPs before the work begins.

2.2 CORPORATE HEALTH AND SAFETY OFFICER

WSP's CHSO is Keith Green, CIH, CSP. The CHSO is knowledgeable in occupational health and safety related to Site operations. The CHSO responsibilities for the safe implementation of the RI includes (but is not limited to):

- prediction, recognition, and preparation of plans to control the potential hazards onsite
- approval of the health and safety program for the project
- revising the HASP
- ensuring all onsite WSP employees meet WSP corporate health and safety training requirements and are knowledgeable of the safety policies and procedures that apply to proposed work
- assigning a qualified SHSC
- verifying compliance with all applicable health and safety requirements

For the implementation of the RI, the CHSO will work with the SHSC to ensure that the HASP is implemented properly and will report directly to the PM.

2.3 SITE HEALTH AND SAFETY COODINATOR

The SHSC, or their designated representative, will be present at all times when work is being performed, and will ensure that the provisions of the HASP are followed during all field activities. The SHSC is responsible for:

- implementing the procedures in the HASP
- daily personnel safety briefings
- personal and work zone monitoring
- conducting and documenting training as detailed in HASP
- establishing work zones (i.e., exclusion, contaminant reduction, and support zones)

- ensuring the HASP requirements for levels of personal protection needed during field tasks are followed
- conducting air monitoring to determine implementation of the established action levels
- controlling movement of visitors onto and off the Site
- keeping necessary logs and records as detailed in the HASP
- briefing the field team on decontamination procedures
- maintaining decontamination stations
- monitoring the field team for signs of stress or exposure
- initiating emergency procedures as necessary
- ensuring that a currently certified first aid responder (with qualification in cardiopulmonary resuscitation [CPR]) is onsite during all hours of operation
- verifying that WSP field team members have met the HASP requirements
- keeping the PM informed of health and safety issues

For the implementation of the RI Work Plan, the SHSC will work with the CHSO to ensure that the HASP remains applicable to all site conditions. The SHSC will report directly to the PM.

2.4 FIELD STAFF ROLES AND RESPONSIBILITIES

2.4.1 Field Task Leader

The Field Task Leader will be a full time Site worker, who is familiar with all aspects of the Remedial Investigation fieldwork. The Field Task Leader will direct the day-to-day Site activities, and will report directly to the Project Manager. All field staff, including the Field Technicians, will report all accidents, issues, and concerns to the Field Task Leader. The Field Task Leader may perform the duties of Field Technician as well as this primary role.

2.4.2 Field Technicians

The Field Technicians will be responsible for the day-to-day fieldwork implementation. The Field Technicians will supervise the work of subcontractors, will be thoroughly familiar with the scope of their assigned work, and will report directly to the Field Task Leader.

2.5 REQUIRED PERSONNEL DOCUMENTATION

Before commencing work on any project, WSP employees must have documentation for the following training:

- initial 40-hour OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) training
- up-to-date OSHA HAZWOPER 8-hour refresher training
- up-to-date American Heart Association-compliant first aid and CPR training
- annual qualitative fit test results for half-face or full-face respirators
- annual medical monitoring, physician's authorization to work, or equivalent documents

Failure to produce these documents will prevent such employees from participating in Site activities.

Site visitors may be required to have OSHA HAZWOPER 24-hour training if they are to be unescorted at all times. Determination of training requirements for visitors will be made on a case-by-case basis by the SHSC.

Contractor employees are required to maintain training certificates as required by their employers; however, all must, at a minimum, maintain up-to-date OSHA HAZWOPER training.

3 Hazard Communication Plan

This Hazard Communication Plan (HCP) provides training, labeling, and communication procedures to be followed during implementation of the RI Work Plan. The HCP was prepared in accordance with the requirements of OSHA's Hazard Communication Standard under 29 CFR 1910.1200.

3.1 SITE SECURITY CONTROL AND COMMUNICATION PROCEDURES

Several procedures will be implemented at the Site to control the movement of personnel and equipment during field activities to increase the security of the Site and to minimize drum and container movement, workers in contamination areas, and the migration of contaminated materials into uncontaminated areas. Figures 3 and 4 illustrate the locations of the proposed activities. A SHSC will be present during all fieldwork.

3.1.1 Site Work Zones

At each borehole and sampling location, a temporary work zone will be established. Work zones typically extend in a 20-foot radius around each location. Based on currently available soil and groundwater data and on the type of work being performed, the use of additional protection zones is not required at this time. Therefore, all work and decontamination will be conducted with a 20-foot radius of the sampling point. All other areas will be considered a support zone and no contaminated material will leave the combined work and contamination reduction zones

If it becomes necessary to further restrict access while sampling or performing other field activities, three general work zones will be established at the Site: Exclusion Zone (EZ), Contaminant Reduction Zone (CRZ), and a safety zone (SZ). The need for these work zones will be based on Site conditions, air monitoring data in excess of established action levels, type of activities to be performed, and will be determined by the SHSC. To ensure flexibility during the field investigation, the work zones, if necessary, will be established in the field. A general description of each of these work zones is presented below:

- EZ – The EZ is defined as the area where contamination is either known or likely to be present, or because of planned activity, will provide a potential for exposure to chemical or physical hazards to WSP personnel. Entry into the EZ will likely require the donning of PPE. The purpose of this EZ is to minimize dispersion of contaminated material, as well as control the transfer of contamination from one area to another. If necessary, an EZ will be established around each intrusive activity using air-monitoring results or by determining safe distances based on visual observations. Personnel in this area will wear the appropriate protective clothing as specified by the HASP and the SHSC.
- CRZ – The CRZ is the area where personnel conduct personal and equipment decontamination. It is essentially a buffer zone between contaminated areas and clean areas. Activities to be conducted in this zone will require donning PPE. The CRZ is established at a convenient location along the perimeter of the EZ and will be equipped with washtubs, brushes, cleaning solutions and additional PPE.
- SZ – The SZ is situated in clean areas where the chance to encounter hazardous materials or conditions is minimal. Therefore, PPE is not required. Permission to enter the SZ only will be granted to authorized persons, including visitors, after they have received the information listed in this section and have signed the HASP certification.

In the event that work zones are established, only those visitors who are authorized by the CHSO or the SHSC will be allowed to enter the CRZ or EZ. All visitors who enter the CRZ or EZ at the Site will be accompanied by a field team member and must first:

- Submit documentation demonstrating current OSHA HAZWOPER 40-hour hazardous waste Site training certification and up-to-date refresher training.
- Submit documentation that the visitors have been trained in the PPE required in these areas
- Submit documentation demonstrating current medical clearance for work on hazardous waste Sites and ability to work while wearing a respirator.
- Review and agree to follow the procedures and requirements specified in the HASP.
- Sign the HASP certification.
- Follow all OSHA requirements including medical monitoring, training, and respiratory protection procedures. Any visitor who does not comply with the HASP will be requested to leave the zone. All violations of the HASP will be recorded in the Site logbook by the SHSC.

3.1.2 Site Maps

A Site map delineating routes into and out of the work areas will be posted at the Site. The SHSC will be responsible for updating these maps as site conditions and proposed work changes.

3.1.3 Communication

Verbal and line-of-site communication will be implemented for all proposed activities onsite. If direct verbal communication is not possible either due to site conditions or PPE, the following standard hand signals will be used in case of failure of radio communications:

- hand gripping throat – out of air, cannot breathe
- grip partners wrist or both hands around waist – leave area immediately
- hands on top of head – need assistance
- thumbs up – okay, I am all right, I understand
- thumbs down – no, negative

In addition, a series of three extended horn blasts will be the emergency signal to indicate that all personnel should leave the work area. A working cell phone will be available during all proposed RI activities.

3.1.4 Site Security

WSP will coordinate with the contractors to minimize work area access to personnel other than authorized project team employees. No visitor will be permitted to enter the work areas unless accompanied by an authorized representative of WSP. The SHSC is responsible for all visitors to the Site; however, all Site personnel are instructed to question people inside the perimeter who they do not recognize or who lack proper PPE.

4 General Site Procedures

The following Site procedures will be implemented during the RI activities. Specific work activities are detailed in Section 5.3 of this HASP.

4.1 STANDARD OPERATING PROCEDURES

All WSP personnel will comply with the following standard operating procedures during implementation of the RI Work Plan:

- There will be no smoking, eating, or drinking, except in designated areas of the Site.
- The buddy system requiring a minimum two-person team will be maintained at all times.
- Line of sight procedures will be implemented at all times.
- All personnel shall have written proof of complying with training, medical clearance, and respiratory training requirements in accordance with 29 CFR 1910.120 and 29 CFR 1910.134.
- All personnel must don the appropriate PPE before entering the work area.
- No open flames, welding equipment (e.g., propane & acetylene torches), or open fires will be permitted onsite without the approval of the SHSC.

Appendix A contains the standard safety rules and personal hygiene requirements. Appendix B contains WSPs field standard operating procedures for donning and doffing personal protective equipment.

4.2 SITE ENTRY AND EXIT

To maintain a safe working environment, each person who enters the Site work zones as established daily by the SHSC shall be informed of the following:

- the presence of potentially hazardous materials onsite
- the Site emergency response procedures
- the potential fire, explosion, health, or safety hazards
- the protective measures planned for the Site
- the methods used to designate the boundaries of the work zone, the SZ, the CRZ, and the EZ, if necessary
- WSP standard health and safety operating procedures
- the names of personnel responsible for the Site safety and health program
- the additional task-specific requirements outlined in the HASP

4.3 MATERIAL HANDLING AND LABELING PROCEDURES

All chemicals used in equipment decontamination and/or sample preservation will be properly labeled and stored. All stored chemicals will be labeled with the chemical name, hazard warning, PPE needed for protection, and handling precautions. Material safety data sheets (MSDSs) will be available for all hazardous chemicals used and/or stored at the Site. All WSP Site personnel will be briefed by the SHSC on the proper handling and the hazards posed by the chemicals.

4.4 ILLUMINATION

No work will be performed without adequate daylight or sufficient work lighting. Site activities will be limited to the hours between one hour after sunrise and one hour before sunset unless adequate lighting is provided.

4.5 BUDDY SYSTEM

The implementation of a buddy system is mandatory for all activities performed onsite. A buddy system requires teams consisting of at least two people to maintain constant sight or voice (including radio) contact with each other.

5 Hazard Assessment

The following sections describe the known and suspected sources of contamination at the Site and health effects associated with the handling of waste and potentially contaminated materials. Physical hazards of the tasks to be performed are also addressed. Included is a task-by-task hazard assessment of all proposed field activities to be performed during implementation of the RI Work Plan.

5.1 SUSPECTED HAZARDOUS MATERIALS EXPECTED ONSITE

Based on prior investigations and remediation activities conducted at the Site, the primary COCs are benzene, toluene, xylenes, acetone, naphthalene, phenol, and PCBs. These COCs may be found at varying concentrations in soil, groundwater, and LNAPL at the Site.

Benzene was detected in isolated locations in soil at concentrations ranging from 0.88 milligrams per kilogram (mg/kg) to 50 mg/kg. Toluene was detected in soil at concentrations ranging from 0.003 mg/kg to 140 mg/kg. Xylene was found to be wide spread across the Site, ranging in concentration from 0.30 mg/kg to 13,336 mg/kg. Acetone and naphthalene were detected at concentrations ranging from 0.07 mg/kg to 450 mg/kg, and 14 mg/kg to 90 mg/kg respectively. Similar to xylene, phenol was found to be wide spread across the Site, ranging in concentration from 0.4 mg/kg to 4,200 mg/kg, with the highest concentrations located toward the center of the Site. As noted previously, PCBs have been detected in soils across the Site at concentrations ranging from laboratory detection limits to 850 mg/kg.

A separate-phase hydrocarbon plume exists beneath the center and northern portions of the site. High concentrations of petroleum hydrocarbons are expected to be present in the plume, in addition to PCBs. Outside of the plume, benzene was detected in groundwater from onsite and offsite monitoring wells at concentrations ranging from laboratory detection limits to 1.2 milligrams per liter (mg/L). Toluene was detected in groundwater at concentrations ranging from laboratory detection limits to 0.14 mg/L. Xylene was detected in groundwater at concentrations ranging from laboratory detection limits to 4.9 mg/L. Acetone was detected in groundwater at concentrations ranging from laboratory detection limits to 0.019 mg/L. Naphthalene was detected in groundwater at concentrations ranging from laboratory detection limits to 0.810 mg/L. Phenol was detected in groundwater at concentrations ranging from laboratory detection limits to 0.06 mg/L.

The primary concern of these potential hazards is dermal contact with soil, groundwater, or LNAPL, inhalation of vapors and particulate matter, and ingestion of airborne dust.

A literature review was conducted to find ionization potentials (IPs), exposure limits, and concentrations immediately dangerous to life and health (IDLH) for the COCs in environmental media at the Site (Appendix C). The exposure levels, IPs, and IDLH levels are used to establish which monitoring instruments will be needed. These date are also used to determine the appropriate PPE for each task, and to establish action levels when upgrading from Level D PPE (i.e., no respiratory protection) to Level C PPE (i.e., dual-canister full-face, tight-fitting air-purifying respirator) to Level B (i.e., self-contained breathing apparatus or supplied air) and select the appropriate types of outer garments, gloves, and respiratory cartridges.

The volatile organic compounds (VOCs) of concern (i.e. benzene, toluene, acetone, and xylene) have IPs ranging from 8.56 to 9.69. Therefore, a photo-ionization detector (PID) with a 10.6 electron volt (eV) lamp will be used to monitor the breathing zone of onsite personnel during all tasks.

PCBs do not volatilize under ambient conditions. However, particulate aerosols may be generated during onsite activities. To assign appropriate PPE for sampling activities, a surrogate airborne particulate value was developed that incorporates the maximum concentration of PCBs (and other COCs) identified in the sampled media and the PEL or TLV for those non-volatile compounds. These values are then used to

establish an action level for PPE upgrades. For sampling activities where particulate may be generated, an effective dust monitoring tool such as the TSI SidePak personal air monitor (PAM) (Model AM510 or equivalent) will be used to determine the instantaneous particulate levels in the work zone.

Appropriate particulate respirator cartridges (Mine Safety Appliances [MSA] GME-P100) will be worn if respirators are required. These cartridges provide protection against particulate above the PEL. Additionally, workers must be protected from dermal contact with soil and groundwater that may contain COCs above acceptable exposure criteria. Appropriate dermal protection, such as gloves and safety glasses, will be provided during all field tasks.

Personnel performing onsite activities may be handling equipment that contacts contaminated soil, groundwater, and LNAPL during field activities. Workers may be exposed to airborne dust or groundwater that may contain some hazardous materials that will be used in decontamination procedures. To protect these workers from eye and skin contact, skin adsorption, inhalation of fumes, and ingestion of airborne dust, they may be required to use Level C protection.

5.2 SUMMARY OF FIELD ACTIVITIES

This HASP has been developed for work activities to be conducted at the Site. Current anticipated activities include the following:

- monitoring well installation and direct-push borings
- groundwater sampling and well development
- sub-slab vapor sampling
- decontamination

If additional work activities are assigned or proposed work activities are changed, the HASP will be reviewed and modified by the PM and CHSO as necessary to ensure appropriate personnel protection and contaminant control.

5.3 ACTIVITY-SPECIFIC HAZARD REVIEW

5.3.1 Monitoring Well Installation and Direct Push Borings

Before ANY intrusive work is conducted, the sample/well/investigation locations will be cleared for overhead and underground utilities according to WSP SOP number 23. Soil borings and samples will be installed and collected using direct-push sampling equipment to further refine the spatial distribution of PCBs in offsite areas of the property. These borings will be installed in areas where soil samples from previous PCB investigations have contained total PCB concentrations greater than 0.1mg/kg. All sample handling will be performed in strict accordance with relevant WSP procedures, including chain-of-custody procedures, and analyzed in accordance with the Quality Assurance Project Plan (QAPP) for the RI.

In addition to the PCB direct-push investigation, 66 additional boring locations will be installed and approximately 132 soil samples will be collected to provide a complete characterization of the soil at the Site. Field sampling procedures, analyses, laboratory handling, analytical protocols, data reduction, validation, and reporting will be conducted in accordance with the QAPP for the Site.

Four new monitoring wells will be installed following borehole sampling. To ensure safety during drilling, all proposed locations will be marked in the field, and evaluated for utility interferences or obstructions by a private utility locator using ground penetrating radar or other necessary means. Soil borings in locations selected for monitoring well installation will be performed using hollow-stem auger (HSA) techniques, with continuous split spoon sampling. Well boring and installation will be performed by a NYSDEC-registered groundwater well driller (in accordance with NYS Water Well Driller Registration,

ECL § 15-1525) under the full time supervision of a WSP geologist. For boring locations through surficial concrete, each location will be cored with a concrete coring machine or appropriate drilling equipment, to provide a clean penetration through the concrete.

All borings not intended for completion, as a monitoring well will be advanced to the groundwater level. Borings intended for monitoring wells will be advanced from the ground surface down to the underlying silt and clay layer. The soil samples will be logged in the field for color, texture, and moisture content in accordance with the USCS and screened for organic vapors using a photo-ionization detector (PID). Samples will be collected for analysis in accordance with the procedures outlined in the RI Work Plan.

In accordance with the Amended Order, all new wells will be screened from 2-ft above the static groundwater table down to the clay and silt layer that underlies the Site, to facilitate measurement and/or collection of LNAPL as well as dense non-aqueous phase liquid (DNAPL). Wells will be constructed using 2-inch polyvinyl chloride (PVC) well casing, 2-inch PVC well screen (0.010-inch slot size), and a filter pack using #2 silica sand. Well construction, sand pack and well seal, and well flush-mount finish will be performed in strict accordance with WSP standard operating procedures (SOPs).

Due to the long period of inactivity at the Site, the existing condition of several of the wells could not be confirmed during the initial Site visit. As part of the RI, all existing wells will be identified, inspected, and scheduled for redevelopment or replacement as discussed above. Redevelopment, purging, and sampling will be performed as described in the following section. The inspection will include the condition of the flush mount well cover, and the condition of the top of the well casing and well cap/seal. If repairs are deemed necessary, these repairs will be completed during the well drilling mobilization.

The physical hazards of this operation are primarily associated with operation of the drilling rig or direct push rig and contact with soils and water containing elevated levels of the COCs. There may be underground utilities in the area where drilling is being performed. Moving parts of the drill rig may catch clothing. High-pressure hydraulic lines and airlines used on the drill rig can be hazardous when they are in disrepair or incorrectly assembled. Noise levels may exceed the OSHA PEL of 90 dBA. There is the potential for dust to be released during the drilling activities.

The initial level of protection will be Modified Level D. Personnel must wear safety glasses, steel-toed boots, hard hats and earplugs when working near heavy machinery. Coveralls for field clothing will be worn during drilling and when there is a need to handle or work near the drill rig.

WSP personnel will perform oversight of these activities only and will attempt to remain upwind from the drill rig unless required by sampling work. If downwind work is required, continuous air monitoring using a PID and aerosol dust monitor will be used.

5.3.2 Groundwater Sampling and Well Development

Upon completion of new well installations, all new and existing wells will be developed (or redeveloped) to ensure low turbidity samples that are representative of the surrounding aquifer. Well development will be accomplished, in general, by repeated surging and pumping until the well yields water of acceptable turbidity at the beginning of a pumping cycle. Well development will be performed in accordance with SOPs as well as ASTM D5521-05, Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers. All development and purge water will be collected and managed in accordance with SOPs.

In addition, two wells will be selected for performance of aquifer testing. Unless redevelopment, purging, and sampling indicates that these wells will require replacement, MW-9 (southwest corner of the Site) and MW-19 (north of the Site near Red Hook Park) will be performance tested in accordance with WSP SOPs. The objective of performance testing is to measure the hydraulic characteristics of the aquifer (water-bearing zone) in the immediate vicinity of the monitoring well for aquifer characterization. The hydraulic conductivity test will be documented as described in the SOP. Field sampling procedures,

laboratory handling, analytical protocols, data reduction, validation, and reporting will be conducted in accordance with the QAPP for the Site.

Prior to collecting groundwater samples, a complete round of water level measurements will be obtained for all onsite-monitoring wells, offsite monitoring wells, and selected onsite remediation extraction wells. At each location, the static water level will be measured and recorded, relative to the north edge of the top of the well casing.

In addition, each well will be inspected for the presence of LNAPL and DNAPL. Depth and thickness measurements will be performed for all wells in which LNAPL or DNAPL is identified. All inspections and measurements, laboratory handling, analytical protocols, data reduction, validation, and reporting will be conducted in accordance with the QAPP for the Site.

All new and existing monitoring wells, as well as a set of 11 remediation extraction wells, will be sampled by bailing or low-flow pumping in accordance with WSP SOPs. The Field Task Leader will determine the methods to be used for sampling based on well development and purging results. Sampling will be limited to those wells that do not exhibit characteristics of free-phase organics (LNAPL or DNAPL). All groundwater samples will be collected, handled, preserved, shipped and analyzed in accordance with the QAPP and SOPs.

The primary hazard that could be encountered during groundwater sampling is exposure to contaminated groundwater and LNAPL or DNAPL. Other hazards generally encountered during groundwater sampling and monitoring well development include improper lifting of buckets, bailers, and pumps or from moving equipment between locations. There is also the potential for water or soil splashing into the eyes during sampling.

Initially, Modified Level D PPE to prevent contact with contaminated groundwater will be provided. Workers must wear inner and outer nitrile gloves when collecting samples. If LNAPL or DNAPL is encountered, the SHSC will determine the appropriate level of PPE to be employed.

5.3.3 Sub-slab Soil Vapor Sampling

Before ANY intrusive work is conducted, the sample/well/investigation locations will be cleared for overhead and underground utilities according to WSP SOP number 23.

Sub-slab vapor samples will be collected from beneath the two active buildings located at the Site. Sub-slab vapor samples will be collected by installing permanent vapor sampling probes in accordance with the procedures contained in the following guidance documents:

- Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006, New York State Department of Health, Center for Environmental Health.
- Standard Operating Procedure (SOP) for Installation of Sub-Slab Vapor Probes and Sampling Using EPA Method TO-15 to Support Vapor Intrusion Investigations.

Sub-Slab vapor probes will be constructed using ¼" stainless steel tubing with Swagelok® fittings installed within a 3/8" pilot hole drilled with and electric concrete core drill entirely through the slab and into the sub-slab material. All sub-slab vapor probe installation and sampling will be performed in accordance with the guidance documents noted above. Sub-slab vapor samples will be collected after purging 3-liters of vapor from each sampling location. The purge volume will be measured using tedlar bags and the volumes will be evacuated using a peristaltic pump and dedicated tubing. The final volume of purged vapor will be analyzed using the PID. Following purging, sub-slab vapor samples will be collected using summa canisters, and will be analyzed for Target Compound List (TCL) VOCs. One background sample will be collected of the ambient air on the upwind side of the property.

The physical hazards of this operation are primarily associated with operation of the electric concrete core drill. There may be underground utilities in the area where drilling is being performed. Moving parts

of the drill may catch clothing. There is the potential for dust to be released during the drilling activities. There is a potential for electric shock using a drill in damp/wet locations. All electric drilling will be conducted using a ground fault interruptor (GFCI).

The initial level of protection will be Modified Level D. Personnel must wear safety glasses, steel-toed boots, hard hats, work gloves, and earplugs when working near heavy machinery. Coveralls for field clothing will be worn during drilling and when there is a need to handle or work near the drill rig.

5.3.4 Decontamination

All down-hole and well sampling/development equipment such as direct-push rods, support vehicles, hand tools, and sampling equipment will be decontaminated onsite as needed. The drilling equipment, support vehicles, and hand tools will be cleaned upon entering the Site and before exiting the Site. Decontamination rinsate will be collected, contained, and analyzed. Hazards associated with these activities include potential contact with contaminated environmental media and wash water, slips, trips, falls, cuts, and equipment accidents.

5.4 ACTION LEVELS

A determination of employee exposures will be conducted during Site activities with continuous and constant real time dust monitoring using a TSI SidePak PAM (Model AM510 or equivalent) for non-volatile monitoring and a PID with a 10.6 eV lamp for volatile constituent monitoring. Action levels for the known and suspected onsite contaminants have been calculated to determine the appropriate level of personnel protective equipment for Site activities.

5.4.1 Calculation of Action Levels

An action level for an upgrade in levels of respiratory protection is determined using the PEL or threshold limit value (TLV), whichever is lower, of a substance. The NIOSH pocket guide pages for the COCs are included as Appendix C.

5.4.2 Particulate Monitoring

For particulate and PCBs, the action level will be based on an equivalent surrogate value calculated using known analytical data. The general equation for determining a surrogate total particulate value is as follows:

$$\left(\frac{mg\ Chemical}{m^3}\right) = \left(\frac{mg\ Dust}{m^3}\right)\left(\frac{mg\ Chemical}{kg\ soil}\right)\left(\frac{1\,kg\ soil}{1\times 10^6\ mg\ soil}\right)$$

A surrogate PCB value of 588 milligrams per cubic meter (mg/m^3) was derived by assuming that each soil particle contains the maximum concentration of PCBs identified in the analytical results (850 mg/kg). OSHA provides a PCB PEL of 1 mg/m^3. As corporate policy, WSP considers half the OSHA PEL in determining appropriate action levels (i.e. 0.5 mg/m^3 for PCBs).

The equivalent surrogate PAM reading that will be used as an action level during soil sampling and drilling activities is based on the OSHA nuisance dust standard PEL of 5.0 mg/m^3. Level D will be used when the PAM measures dust concentrations below half of this level (i.e. 2.5 mg/m^3). An upgrade to Level C will be implemented when a sustained reading of greater than the equivalent surrogate value (i.e. 0.735 mg/ m^3) is measured for a period of 5 minutes. If sustained PAM readings of 36 mg/m^3 (50 times the PEL; assigned protection factor for an air-purifying respirator for the surrogate PEL for cadmium) for 5 minutes are recorded, the work area will be evacuated and dust control measures put into place.

5.4.3 Volatile Monitoring

Benzene, toluene, ethylbenzene, xylene, and acetone have been detected in soil and groundwater at the Site. A PID or equivalent with a 10.6 eV lamp will be used to take readings in the work areas to measure the vapor levels in the breathing zone of onsite personnel.

Breathing zone PID readings will be used to establish the level of PPE required for organic vapor protection. Action levels for VOC monitoring will be based on one-half the PEL established for Benzene (i.e. 0.5 ppm), which is the lowest PEL established by OSHA for the volatile COCs identified at the Site. If sustained readings of 0.5 ppm are monitored for a period of 5 minutes, a colorimetric or length of stain tube will be used to determine the concentration of benzene in the worker-breathing zone. If the colorimetric screening shows that benzene is present at concentrations above 0.5 ppm, workers will upgrade to level C PPE. If colorimetric screening shows that benzene concentrations are below 0.5 ppm, breathing zone monitoring will continue with a PID. The new action level, in the absence of benzene, will be 50 ppm, which is half of the PEL for ethylbenzene. However, colorimetric tube screening will continue periodically throughout the work shift to ensure the absence of benzene in the breathing zone. Engineering controls may be implemented at any time to reduce the concentration of benzene or other VOCs in the breathing zone. To implement engineering controls, work shall cease until engineering controls are instituted. Controls can be accomplished by increasing the air speed (mechanical fans), improving ventilation, or changing work activities (more personnel farther away). If engineering controls cannot reducing breathing zone readings to below the action levels specified above, Level C protection will be required.

The PID will be calibrated at least once at the start of each day or when the instrument displays erratic readings. In case of malfunction, a backup PID will be available at all times during fieldwork.

5.5 PHYSICAL HAZARDS

The potential for injuries is inherent in areas where heavy equipment is operating. Climatic variables also represent hazard. In these situations hazards may be magnified because operators may be wearing restrictive clothing. The use of excavation and drilling equipment creates the potential for noise and contact with overhead electrical and underground utility lines.

Slip, trip, and fall hazards are associated with work performed on uneven terrain. Workers will be cautioned to inspect boots before entering exclusion areas and to use caution on wet, slippery, or uneven terrain.

Onsite work may occur during periods of extreme hot or cold weather. Site personnel must be aware of hazards associated with heat and cold stress while conducting sampling activities in PPE. Appendices D and E provide further details for recognizing and preventing heat stress and cold stress.

6 Personal Protective Equipment

In Section 5.0 of this HASP, the hazards associated with each of the tasks to be performed at the Site were analyzed. This assessment was based on a hazard evaluation of the known and suspected materials present onsite. Based on the risk analysis, PPE has been identified that is protective of worker health and safety.

The purpose of PPE is to reduce the risk of exposure and protect individuals from hazards potentially encountered in the course of the Site activities. PPE includes both protective clothing and respiratory equipment. This section of the HASP describes the levels of PPE to be used by Site personnel during field activities.

6.1 PERSONAL PROTECTIVE CLOTHING PROGRAM

A variety of disposable, chemically-resistant coveralls may be used during selected field activities at the Site. The type of coveralls appropriate for each task is described later in this section. Primary inspection of PPE will be the responsibility of the user. Thus, the user must examine each specific article before donning. PPE that is damaged will be immediately replaced. All chemical protective coveralls, inner gloves, and disposable booties will be disposed of after use in the work areas. Outer boots and gloves may be decontaminated and stored for further use. Hardhats and eye-face protection may be decontaminated and re-used.

6.2 RESPIRATORY PROTECTION PROGRAM

All WSP personnel who may be required to wear a respirator during any task will participate in the WSP a respiratory protection program, which satisfies the requirements of 29 CFR 1910.134. These personnel must have successfully participated in WSP's a medical clearance and monitoring program to determine their ability to wear a respirator.

The final decision as to the level of respiratory protection will be made by the SHSOSHSC. Because the respiratory hazards vary according to the field activity and the concentrations of the various constituents in that area, respiratory PPE will be chosen based on the known and unknown hazards associated with each particular activity and the changing site conditions as shown by continuous monitoring of the breathing zone with a PID and an aerosol particulate monitor.

All Site project WSP personnel will have must have passed a qualitative fit test within one year of initiation of the field activities. The fit test is will have been performed using an irritant smoke as required by the WSP respiratory protection program. Records of the most recent fit tests, if performed by the SHSO, will be maintained in the WSP's project file.

Beards, long sideburns, and mustaches, which interfere with contact the face-seal to face sealing surface of the respirator, are prohibited. Persons with such facial hair will not be given a qualitative fit test, and records of previous qualitative fit tests will not be considered valid. A respirator will be assigned to each WSP employee who may require its use during field activities. Each WSP employee will be responsible for maintaining and inspecting the assigned respirator before and after use. Contractors working at the Site will be individually responsible for providing Site workers with respiratory protection.

6.3 MODIFIED LEVEL D PROTECTION

Level D is the lowest level of PPE to be used by persons entering one of the designated work zones. This level of protection will consist of the following:

- steel-toe safety boots

- latex or polyvinyl chloride (PVC) surgical inner gloves
- outer gloves chemically resistant gloves, if deemed necessary by SHSC
- safety glasses
- hardhat and hearing protection, as needed around heavy equipment

Splash resistant coveralls (tyvek) may be used during activities involving the potential for exposure to splashed groundwater containing LNAPL or DNAPL. The determination for use of coveralls with level D PPE shall be made by the SHSC based on site knowledge and historic data. The presence of LNAPL and DNAPL at the site is well documented and can be predicted during the implementation.

6.4 LEVEL C PROTECTION

Level C is the lowest level at which protective respiratory equipment is used. The respirator used for Level C is an air purifying respirator that filters the air, but does not provide an alternate source of air. This level of protection consists of the following:

- full-face air purifying respirator equipped with P100 particulate cartridges
- Tyvek or Saranex chemically-resistant coveralls, when deemed necessary by the SHSC
- steel-toe and -shank safety boots
- disposable booties or overboots
- latex or vinyl surgical inner gloves
- chemically resistant outer gloves
- hardhat and hearing protection, as necessary around heavy equipment
- taped seals

6.5 LEVEL B PROTECTION

In the event that Level B respiratory protection is required, WSP personnel will not enter the work area. An upgrade to Level B respiratory protection is not anticipated; however, this HASP will be revised to address such conditions if they become present.

6.6 INITIAL LEVELS OF PROTECTION

Based on the risk analysis in Section 5, levels of respiratory protection and PPE can be selected for each of the activities to be performed during implementation of the RI Work Plan. All onsite activities shall be initiated at Modified Level D protection. This level of protection will be upgraded as necessary, based on the results of ongoing monitoring and the predetermined action levels specified in Section 5.4.

Decontamination of non-disposable equipment and personnel in Level C will be performed in Level D PPE.

The minimum level of PPE to start a task is prescribed in the following table.

PPE

Task	Minimum PPE Level	Upgrade PPE Level
Monitoring Well Installation and Direct Push Borings	Modified D	C
Groundwater Sampling and Well Development	Modified D	C
Sub-slab Soil Vapor Sampling	Modified D	C
Decontamination	Modified D	C

7 Medical Monitoring Program

All employees that may be exposed to potentially hazardous chemicals, regardless of the level of exposure predicted, are required to participate in the medical monitoring program established by WSP Environment & Energy. OSHA regulations state that employees involved in certain activities that may expose them to hazardous materials at or above permissible exposure limits (PELs) or above the published exposure limit for greater than 30 days per year, or all employees who wear a respirator are required to participate in the monitoring program.

The purposes of the medical monitoring program are to identify any illness or condition that might be aggravated by exposure to hazardous materials or work conditions; to determine if site work has had an adverse effect to employees' health; to certify that each employee can use negative-pressure respirators as required by OSHA and withstand heat or cold stress; to ensure that employees are able to physically perform their assigned tasks and to establish and maintain a medical record to monitor for abnormalities that may be related to work exposure that could increase injury risk for the employee. WSP Environment & Energy's medical monitoring program includes the following:

- a baseline physical examination
- a medical determination of fitness for duty by a licensed physician, including work restrictions after any injury or illness that may affect employee safety
- a review of potential project-specific exposures to determine the need for specific biological and medical monitoring
- annual and exit physical examinations with attention given to specific exposures or symptoms

7.1 BASELINE PHYSICAL EXAMINATION

A baseline physical examination will be performed on each employee engaged in hazardous site activities as outlined above before any assignment with the potential for exposure to hazardous chemicals. The purposes of this examination are to identify any illness or condition that might be aggravated by exposure to hazardous materials or work conditions; to certify the safe use of negative-pressure respirators (29 CFR 1910.134); and to develop a medical record for the assessment of exposure-related risk. Variable data, such as age, sex, race, smoking, previous employment, and exposure history, that may have a bearing on future examinations after employment begins will be gathered.

The baseline physical examination will include the following:

- a medical and occupational histories including completion of a written questionnaire
- a complete physical examination, stressing the central and peripheral nervous system; cardiopulmonary system, spine and other musculoskeletal system, abdomen, rectum, and genitourinary system; and skin, including but not limited to an examination of:
  - height, weight, temperature, pulse, respiration rate, and blood pressure
  - head, nose, neck, and throat
  - chest (heart and lungs)
- a resting 12-lead electrocardiogram.
- chest X-ray (posterior-anterior view)
- a pulmonary function test (FEV_1, FVC, and FEV_1/FEV ration)

- an otoscopic examination and an audiogram at 500, 1,000, 2,000, 3,000, 4,000, and 6,000 hertz pure tone in an approved booth, administered by a qualified technician, and the results read by a qualified physician
- a multichemistry blood panel (e.g., Chem 24), including kidney and liver function tests, complete blood count (CBC) with differential, and urinalysis with microscopic examination of centrifuged sediment
- a red blood cell cholinesterase
- visual acuity testing
- Hepatitis B vaccination series. The vaccination series can be declined by the employee; however, a vaccination declination form, as described in OSHA regulation 29 CFR 1910.1030 Appendix A, must be completed and submitted to the human resources department.
- Combined Tetanus, Diphtheria and Pertussis (Tdap) Vaccine. The vaccine will be made available for employees who have not received a vaccination in 10 years or for those that may have been exposed before the 10 year booster recommendation. The employee may decline the vaccine.
- any other tests deemed necessary by the physician due to symptoms, or exposure, or medical history (e.g., blood lead level; urine screen for arsenic, mercury, chromium, and cadmium)

The following information will also be obtained from the employee by the physician to assist in the examination:

- history of respiratory disease
- work history
  - previous occupations
  - problems associated with breathing during normal work activities
  - past problems with respirator use
- any other medical information, such as:
  - psychological problems or symptoms including claustrophobia
  - any known physical deformities or abnormalities including those that may interfere with respirator use
  - past and current use of medication
  - tolerance to increased heart rate, which can be produced by extra weight, increased workload, and heat stress associated with wearing respirators and protective clothing

For all employees who are or will be exposed to airborne concentrations of asbestos fibers, the physical examination will also include completion of a respiratory disease standardized questionnaire per 29 CFR 1910.1001 Appendix D.

7.1.1 Annual Physical Examination

An examination and updated occupational history will be performed annually during the anniversary month of the baseline physical examination. This annual examination serves to recertify that the employee is able to conduct work activities at hazardous waste and similar sites. The content of the examination may vary based on the nature of the work and potential exposure since the previous exam.

The annual physical examination will include the following:

- medical and occupational histories including completion of a written questionnaire

- a complete physical examination, stressing the central and peripheral nervous system; cardiopulmonary system, spine and other musculoskeletal system, abdomen, rectum, and genitourinary system; and skin, including but not limited to an examination of:
  - height, weight, temperature, pulse, respiration rate, and blood pressure
  - head, nose, neck, and throat
  - chest (heart and lungs)
- resting 12-lead electrocardiogram for employees over 40 years of age at the time of the annual physical
- chest X-ray (posterior-anterior view) every 5 years or as deemed necessary by a qualified physician. The employee may decline the X-ray unless it is deemed medically necessary by a qualified physician.
- a pulmonary function test (FEV_1, FVC, and FEV_1/FEV ration)
- an otoscopic examination and an audiogram at 500, 1,000, 2,000, 3,000, 4,000, and 6,000 hertz pure tone in an approved booth, administered by a qualified technician, and the results read by a qualified physician
- a multichemistry blood panel (e.g., Chem 24), including kidney and liver function tests, complete blood count (CBC) with differential, and urinalysis with microscopic examination of centrifuged sediment
- a red blood cell cholinesterase
- visual acuity testing
- any other tests deemed necessary by the physician due to symptoms, or exposure, or medical history (e.g., blood lead level; urine screen for arsenic, mercury, chromium, and cadmium)

For all employees who are or may be exposed to airborne concentrations of asbestos fibers, the physical examination will also include completion of a respiratory disease standardized questionnaire per 29 CFR 1910.1001 Appendix D.

7.1.2 Return to Work Examination

Any job-related illness or injury will be followed by a medical examination to determine fitness for duty or possible job restrictions based on the physical findings of the medical examiner.

7.1.3 Exit Physical Examination

When an employee terminates employment with WSP Environment & Energy, that employee is required to have an exit physical examination. The content of the exit physical examination will include the following:

- a personal work history (based on specific project histories)
- medical, exposure, and fertility histories
- a complete physical examination, stressing the central and peripheral nervous systems; cardiopulmonary system; spine and other musculoskeletal system; abdomen, rectum, and genitourinary system; and skin, including but not limited to an examination of:
- height, weight, temperature, pulse, respiration rate, and blood pressure
- head, nose, neck, and throat
- chest (heart and lungs)

- resting 12-lead electrocardiogram
- chest X-ray (posterior-anterior view)
- a pulmonary function test (FEV_1, FVC, and FEV_1/FVC ratio)
- an otoscopic examination and an audiogram at 500, 1,000, 2,000, 3,000, 4,000, and 6,000 hertz pure tone in an approved booth, administered by a qualified technician, and the results read by a qualified physician
- a multichemistry blood panel (e.g., Chem 24), including kidney and liver function tests, complete blood count (CBC) with differential, and urinalysis with microscopic examination of centrifuged sediment
- a red blood cell cholinesterase
- visual acuity testing
- any other tests deemed necessary by the physician due to symptoms, or exposure, or medical history (e.g., blood lead level; urine screen for arsenic, mercury, chromium, and cadmium)

For all employees who were potentially exposed to airborne concentrations of asbestos fibers, the physical examination will also include completion of a respiratory disease standardized questionnaire per 29 CFR 1910.1001 Appendix D.

7.1.4 Other Examinations

Medical examinations in addition to those described above may be required by the corporate health and safety officer. Additional examinations could be required before or after a project of long duration or after work at a site with particular exposure concerns. In addition, an employee may request a medical examination at their discretion based on potential exposure history, potential illness, or any condition, which may produce a potential health hazard during work activities.

7.1.5 Medical Records

All medical records will be maintained by the examining physician. Copies of these records are typically transmitted directly to employees shortly after their annual physicals are completed. WSP Environment & Energy's human resources department will maintain the certification of fitness provided by the physician, and the exposure records. Employee medical and exposure records will be made available by either verbal or written request by the employee or an authorized representative of the employee. OSHA compliance officers do not need to write a request for records that are required for them to evaluate compliance. When records are requested by employees, WSP Environment & Energy will provide this information within 24 hours of the request during normal business hours. Requests made before a weekend or holiday will be provided the next full business day. If OSHA requests records in writing, the written request will be posted in a visible location for at least 15 days (29 CFR 1910.20). Medical records will be kept on file for at least 30 years. If WSP Environment & Energy ceases to do business without a successor, then OSHA will be notified and may require transfer of the records.

7.1.6 First Aid

All WSP Environment & Energy personnel who perform work where there is a potential for exposure to physical and chemical hazards are required to have current American Red Cross certifications in first aid and cardio-pulmonary resuscitation (CPR). Training and certification are provided by WSP Environment & Energy at no charge to the employees. WSP Environment & Energy's Human Resources department is responsible for ensuring that initial and required refresher training is provided to staff as necessary and for maintaining documentation of the training provided.

At all field sites where the response time from the local fire and rescue squad may exceed four minutes, the WSP Environment & Energy supervisor and/or project manager responsible for the project must designate an individual to render first aid in the event of an emergency. In addition, the location of the nearest medical facility, the directions from the site to the facility, and the telephone number of the facility and the local rescue squad will be identified in every site-specific HASP.

It is the responsibility of the designated first aid provider to ensure a standard first aid kit is available at the site, for use in the event of an emergency. Such kits will be contained in weatherproof containers with individual sealed packages for each type of item. The kits will contain, as a minimum, the items specified in Appendix A of 29 CFR 1910.151, which are as follows:

- gauze roller bandages, 1 inch and 2 inch
- gauze compress bandages, 4 inch
- adhesive bandages, 1 inch
- triangular bandages, 40 inch
- ammonia inhalants and ampoules
- antiseptic applicators or swabs
- burn dressing
- eye dressing
- wire or thin board splints
- forceps and tourniquet

The designated first aid provider is responsible for checking the kits prior to bringing them to the site to ensure they are fully stocked. On sites where there is a potential for the eyes or body to be exposed to injurious corrosive materials, a means to flush the eyes and/or body will be provided. If a plumbed-in-place eye wash fountain/shower is not available, the designated first aid provider will ensure that a portable, gravity feed eye wash fountain is brought to the site along with the standard first aid kit.

7.2 MEDICAL EMERGENCIES

All injuries either resulting from exposure to onsite contamination or physical injury will be reported promptly to the SHSC, the CHSO, and the PM. The Chemtura Environmental Manager (George Collentine) will also be notified. If necessary, an ambulance or paramedic team will be summoned. Emergency first aid will be administered, as appropriate. Injured workers will proceed through decontamination. If this is not possible, the injured worker will remain in the work zone to await medical assistance. Emergency medical personnel responding to the Site will be informed of the potential chemical hazards present at the employee's present location and when the employee was injured.

In non-life-threatening situations, the ambulance, and patient handling and treatment equipment will be protected from contamination through the use of clean plastic sheeting and unused trash bags.

A full accident and exposure report will be prepared by the SHSC for any accident or medical emergency that occur onsite. These reports will be kept on file in both the onsite and the employee's company file. The supervisor of the affected individual will also provide a completed incident report to the SHSC within the next work shift.

8 Decontamination Procedures

All personnel involved in activities resulting in potential exposure to contaminants must complete decontamination activities before leaving the Site. No smoking, eating, or drinking will be permitted in any area of the Site except at designated break area as defined by the SHSC.

8.1 DECONTAMINATION SEQUENCE

Personnel decontamination facilities will be established onsite, if necessary, to ensure that personnel maintain a high degree of personal hygiene and minimize the possibility of exposure to chemical hazards. These facilities will be setup in the CRZ. The SHSC shall conduct inspections to assure that proper decontamination procedures are followed.

Within the CRZs, which will be located at the entry/exit point of the EZs, personnel decontamination areas will be established to facilitate controlled removal of contamination and protective clothing. These CRZs will be clearly identified using signage. All personnel exiting the EZ will pass through the decontamination area to remove contaminated PPE. Used gloves, boot covers, and Tyvek® will be collected in suitable trash containers. Potable water will be available for washing hands and face. Personnel are required to wash hands, face, and other exposed skin areas prior to leaving for breaks or lunch.

Instruments used in potentially contaminated areas should be protected from contamination by plastic wrap to the extent feasible (take care not to cover air inlets or exhaust ports). Decontamination of instruments is to be conducted using appropriate solvents (alcohol, distilled water, etc.) so that the instruments are visually clean.

Equipment used in potentially contaminated areas (e.g., bucket augers, trowels, heavy equipment) will be decontaminated prior to entering the Site. Upon completion of the project, or before leaving the Site, the equipment will be cleaned with a sequential wash/rinse procedure to remove potentially contaminated media.

Wastes generated during personnel and equipment decontamination (e.g., water, solvents, rags, paper towels) shall be collected and containerized. Decontamination wastes will be disposed of in accordance with the RI work plan.

8.2 LEVEL D DECONTAMINATION SEQUENCE

Decontamination for Level D activities will proceed in the following steps:

- segregated equipment drop
- outer glove removal
- inner glove removal

8.3 LEVEL C DECONTAMINATION SEQUENCE

Level C decontamination will proceed in the following steps:

- segregated equipment drop
- boot cover, outer glove, and safety suit wash
- boot cover, outer glove and safety suit rinse

- tape removal
- boot cover removal
- outer glove removal
- safety suit removal
- inner glove wash
- inner glove rinse
- respirator removal
- inner glove removal
- field wash

8.4 EQUIPMENT DECONTAMINATION

Equipment must be decontaminated, if necessary, before exiting the Site. The drilling equipment will be driven to or placed directly in a decontamination area, cleaned with a pressure washer, and then driven to the clean area. Decontamination rinsate will be properly characterized, stored, and ultimately disposed of.

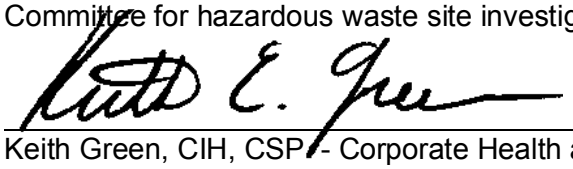
9 Logs and Record Keeping

The SHSC will maintain the records generated during implementation of the HASP for the Site through the duration of the project. The records will include employee training logs, confirmation of participation in a medical monitoring program, fit test records, and incident reports. The records will be maintained at the Site during field activities or at WSP's offices in Reston, Virginia.

All Site personnel and visitors will be provided a copy of the HASP to review. Signed statements will be maintained at the Site confirming that the HASP has been reviewed by all workers who enter the Site. A copy of the HASP will remain onsite during all associated field activities.

10 Certification

This HASP has been reviewed and approved by the WSP Health and Safety Officer. The plan satisfies the requirements of OSHA 1910.120 as implemented by the WSP Engineering Health and Safety Committee for hazardous waste site investigations.



Keith Green, CIH, CSP - Corporate Health and Safety Officer

August 1, 2011
Date

All site personnel have read the Health and Safety Plan and are familiar with its provisions.

NAME	SIGNATURE

Figures

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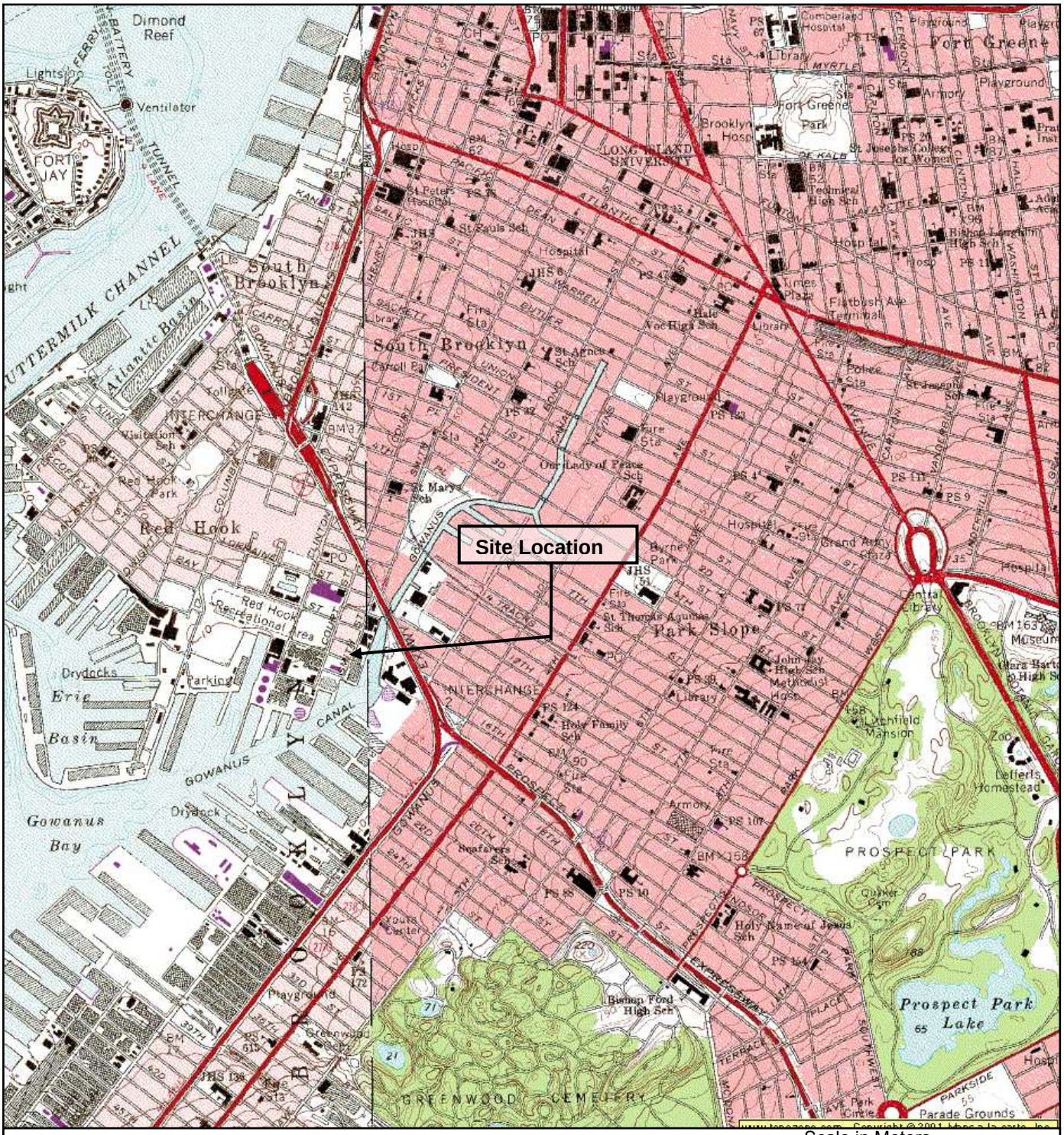


Reference
7.5 Minute Series Topographic Quadrangle
Jersey City, New York – New Jersey
Photorevised 1976 Scale 1:25,000 Metric

N

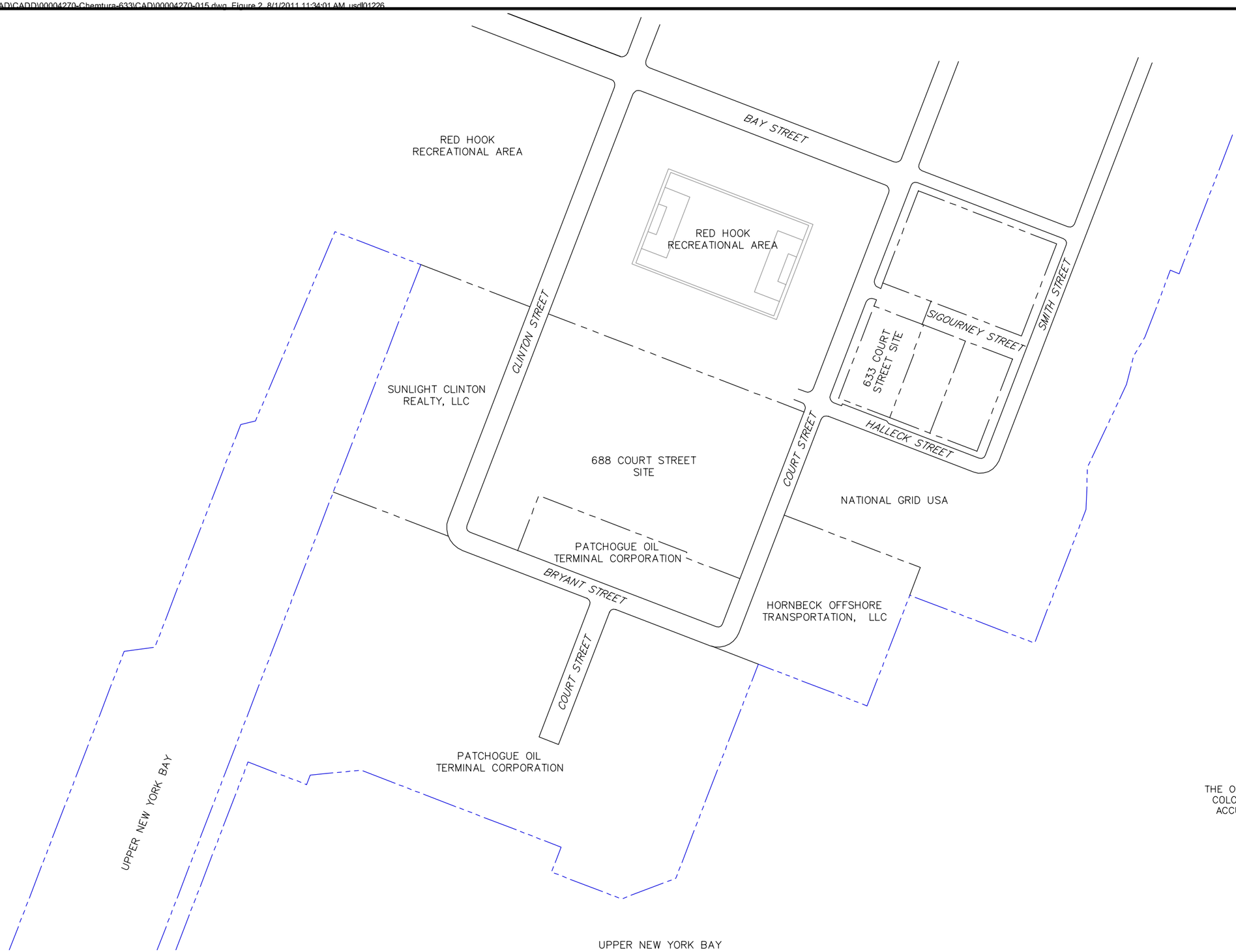
Quadrangle Location

Scale in Meters
0 500 1000
0 1000 2000
Scale in Feet

WSP Engineering of New York P.C.
11190 SUNRISE VALLEY
SUITE 300
RESTON, VIRGINIA 20191
703-709-6500

Figure 1
Site Location
Chemtura Corporation
Brooklyn, New York

R:\ACAD\CADD\00004270-Chemtura-633\CAD\00004270-015.dwg, Figure 2, 8/1/2011 11:34:01 AM, usdl01226



REFERENCE: 1. ENVIRO-SCIENCES, INC FIGURE PREPARED FOR WITCO CORPORATION DATED MAY 15, 1999, FIGURE 19, DRAWING NO. WBR-002D, TITLED METALS DETECTED IN GROUNDWATER EXCEEDING NYS CLASS GA STANDARDS FOR MARCH 24, 1999

2. SURROUNDING AREAS FROM GOOGLE EARTH PRO.

B

THE ORIGINAL VERSION OF THIS DRAWING IS IN COLOR. BLACK AND WHITE COPIES MAY NOT ACCURATELY DEPICT CERTAIN INFORMATION.

N

0 50 100

SCALE IN FEET

Drawn By: 08/01/2011

Checked: 08/01/2011

Approved: 08/01/2011

DWG Name: 00004270-015

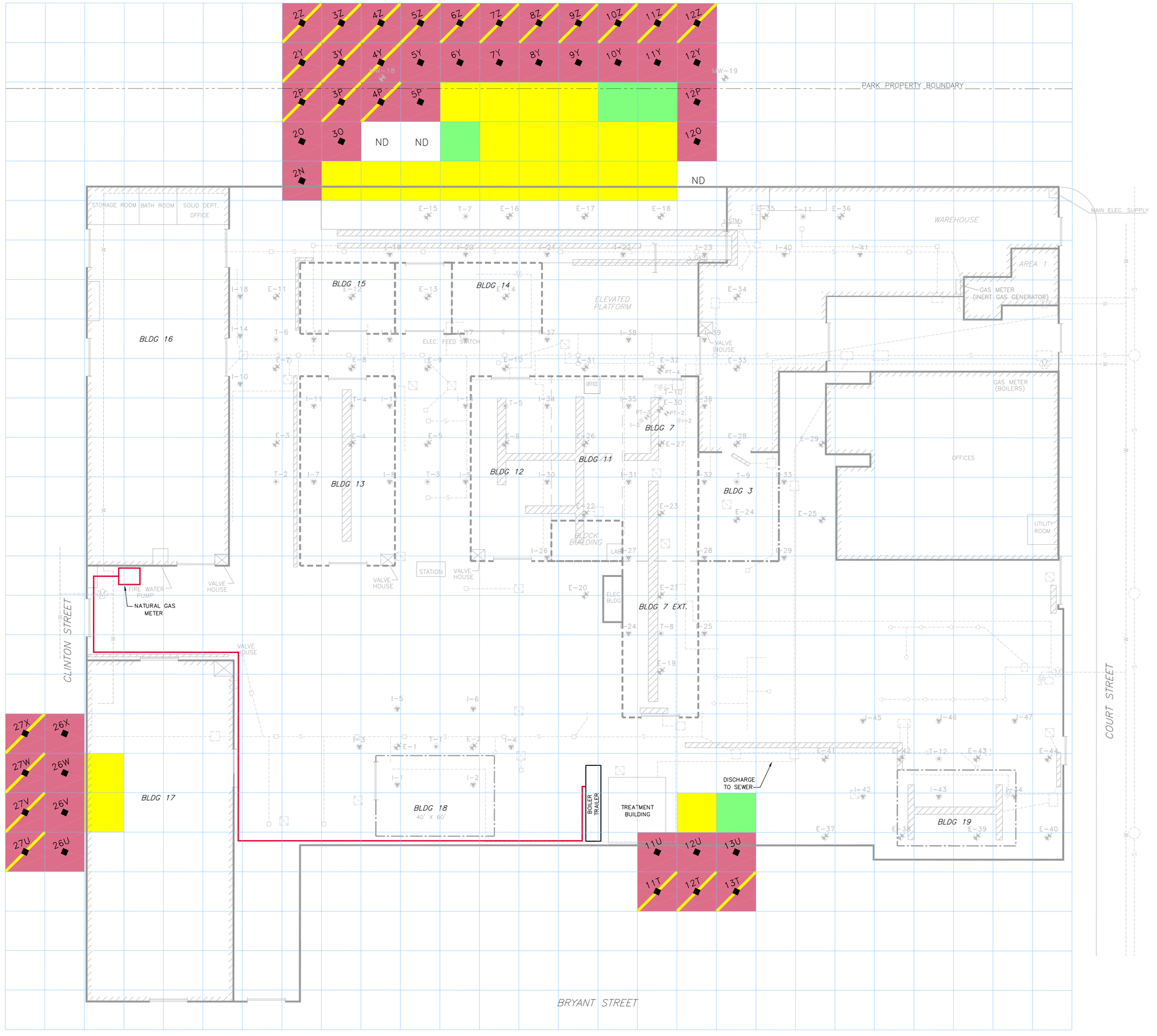
CHEMTURA CORPORATION
688 COURT STREET
BROOKLYN, NEW YORK
PREPARED FOR
CHEMTURA CORPORATION

Figure 2

SITE LAYOUT

WSP
Engineering of
New York, P.C.
2360 Sweet Home Road, Suite 3
Amherst, New York 14228
(716) 691-5232
www.wspenvironmental.com/usa

C:\Documents and Settings\usd01226\Desktop\00004270-016.dwg, Figure 3, 8/1/2011 12:22:47 PM, usd01226



GENERAL NOTES:

1. WELL AND THERMOCOUPLE LOCATIONS ARE APPROXIMATE.
2. PCB SAMPLE LOCATIONS ARE APPROXIMATE.

LEGEND

- PILOT–SCALE PIEZOMETER TEMPERATURE WELL
- PILOT–SCALE INJECTION WELL
- FULL–SCALE EXTRACTION WELL
- FULL–SCALE INJECTION WELL
- THERMOCOUPLE
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE–EXISTING TRENCH
- PRE–EXISTING SEWER LINE
- PRE–EXISTING WATER LINE
- PRE–EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)

20' / 20' — TOTAL PCB CONCENTRATION OF AT LEAST ONE SOIL SAMPLE COLLECTED WITHIN GRID >1 mg/kg

20' / 20' — TOTAL PCB CONCENTRATION OF AT LEAST ONE SOIL SAMPLE COLLECTED WITHIN GRID >0.1 mg/kg

ND — TOTAL PCB CONCENTRATION OF ALL SAMPLES COLLECTED WITHIN GRID LESS THAN 0.1 mg/kg

20' / 20' — PROPOSED OFFSITE SAMPLE LOCATION (EXPEDITED ANALYSIS)

20' / 20' — PROPOSED OFFSITE SAMPLE LOCATION (EXTRACT AND HOLD)

NOTE:
ONLY SAMPLE RESULTS FROM GRIDS LOCATED OFFSITE OR ON THE PROPERTY BOUNDARY ARE SHOWN, IE COLUMN 23 AND ROWS N, O, P, AND V.

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0 25 50 75
SCALE IN FEET

REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO–SCIENCES, INC.

REVISIONS

REV	DESCRIPTION	
1	Revised	Chkd: Appr.:
2	Revised	Chkd: Appr.:
3	Revised	Chkd: Appr.:

SEAL

DATE

DRAWN BY — date
CHECKED — date
APPROVED — date

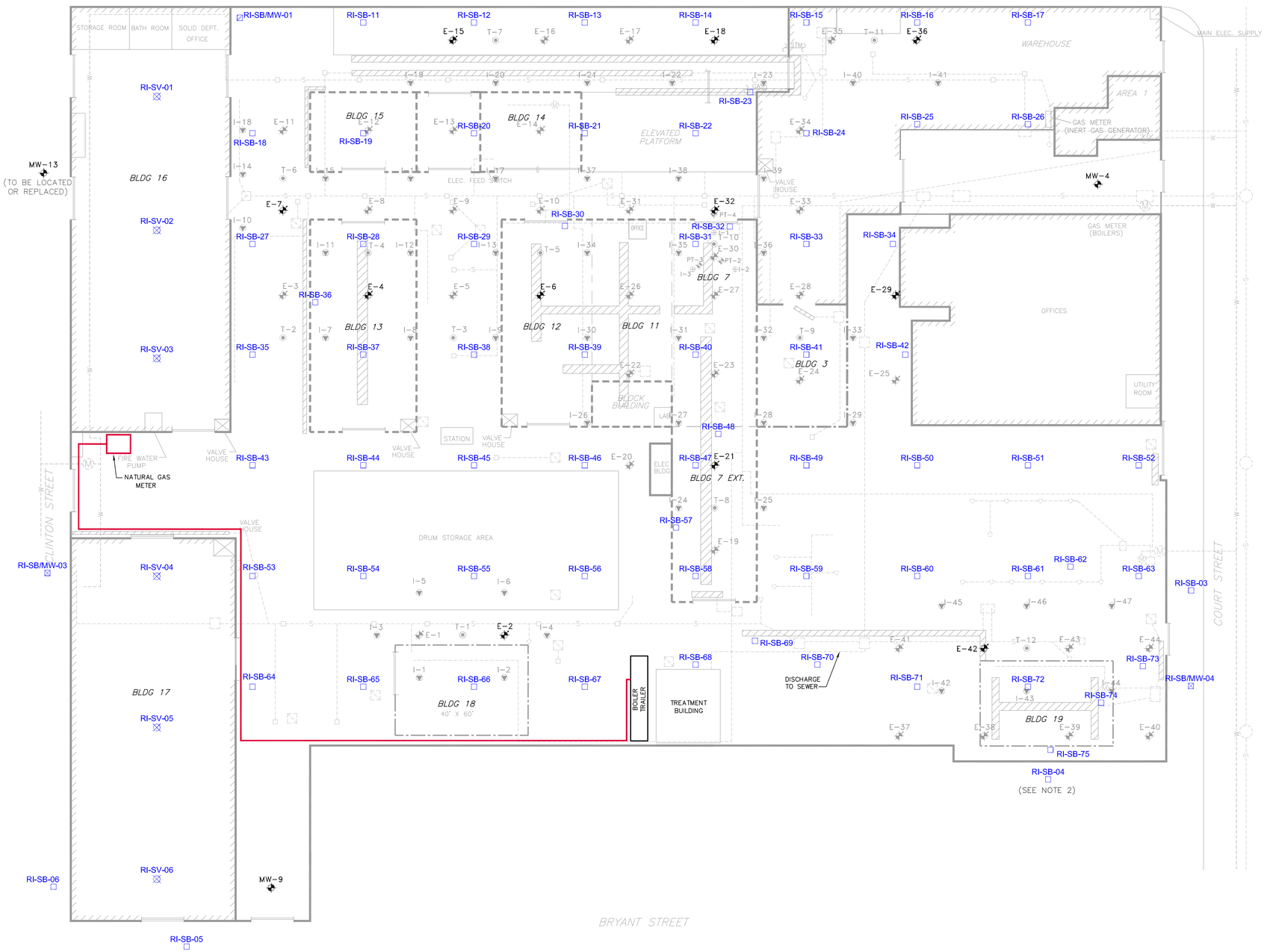
PROPOSED WORK
PCB INVESTIGATION

CHEMTURA CORPORATION
688–700 COURT STREET
BROOKLYN, NEW YORK
PREPARED FOR
CHEMTURA CORPORATION

WSP Engineering of New York, P.C.
2360 Sweet Home Road, Suite 3
Amherst, New York 14228
(716) 691-5232
www.wspenvironmental.com/usa

FIGURE 3

Drawing Number
00004270–016



LEGEND

- PILOT-SCALE PIEZOMETER TEMPERATURE WELL
- PILOT-SCALE INJECTION WELL
- FULL-SCALE EXTRACTION WELL
- FULL-SCALE INJECTION WELL
- THERMOCOUPLE
- MONITORING WELL
- MONITORING WELL TO BE SAMPLED
- EXTRACTION WELL TO BE SAMPLED
- RI-SB □ SOIL BORING TO BE COMPLETED AS PART OF THE RI ACTIVITIES
- RI-SB/MW ⊠ SOIL BORING/MONITORING WELL TO BE COMPLETED AS PART OF THE RI ACTIVITIES
- RI-SV ⊠ SOIL VAPOR SAMPLING LOCATION
- NATURAL GAS SUPPLY LINE (ELEVATED)
- PRE-EXISTING TRENCH
- PRE-EXISTING SEWER LINE
- PRE-EXISTING WATER LINE
- PRE-EXISTING BUILDING
- PARTIALLY DEMOLISHED BUILDING (STEEL FRAME AND ROOF PRESENT)
- FORMER BUILDING LOCATION (FOUNDATION PRESENT)

NOTES:

1. SOIL BORING LOCATION TO BE FIELD LOCATED BASED ON DEBRIS/SOIL PILES.
2. SOIL BORING PROPOSED INSIDE OF GARAGE.
3. THIS SAMPLE IS LOCATED WHERE TAR-LIKE LIQUIDS WERE OBSERVED ON COBBLE STONE SURFACE.

REFERENCE: BASEMAP FROM REMEDIAL ACTION WORKPLAN, REVISED MAY 2001, PREPARED FOR WITCO CORPORATION BY ENVIRO-SCIENCES, INC.

THE ORIGINAL VERSION OF THIS DRAWING IS IN COLOR. BLACK AND WHITE COPIES MAY NOT ACCURATELY DEPICT CERTAIN INFORMATION.

SCALE IN FEET: 0 25 50 75

REVISIONS

REV	DESCRIPTION	
1	Revised	Chkd: Appr:
2	Revised	Chkd: Appr:
3	Revised	Chkd: Appr:

SEAL

DATE

DRAWN BY

CHECKED

APPROVED

PROPOSED SOIL BORINGS AND GROUNDWATER MONITORING

CHEMTURA CORPORATION
688-700 COURT STREET
BROOKLYN, NEW YORK
PREPARED FOR
CHEMTURA CORPORATION

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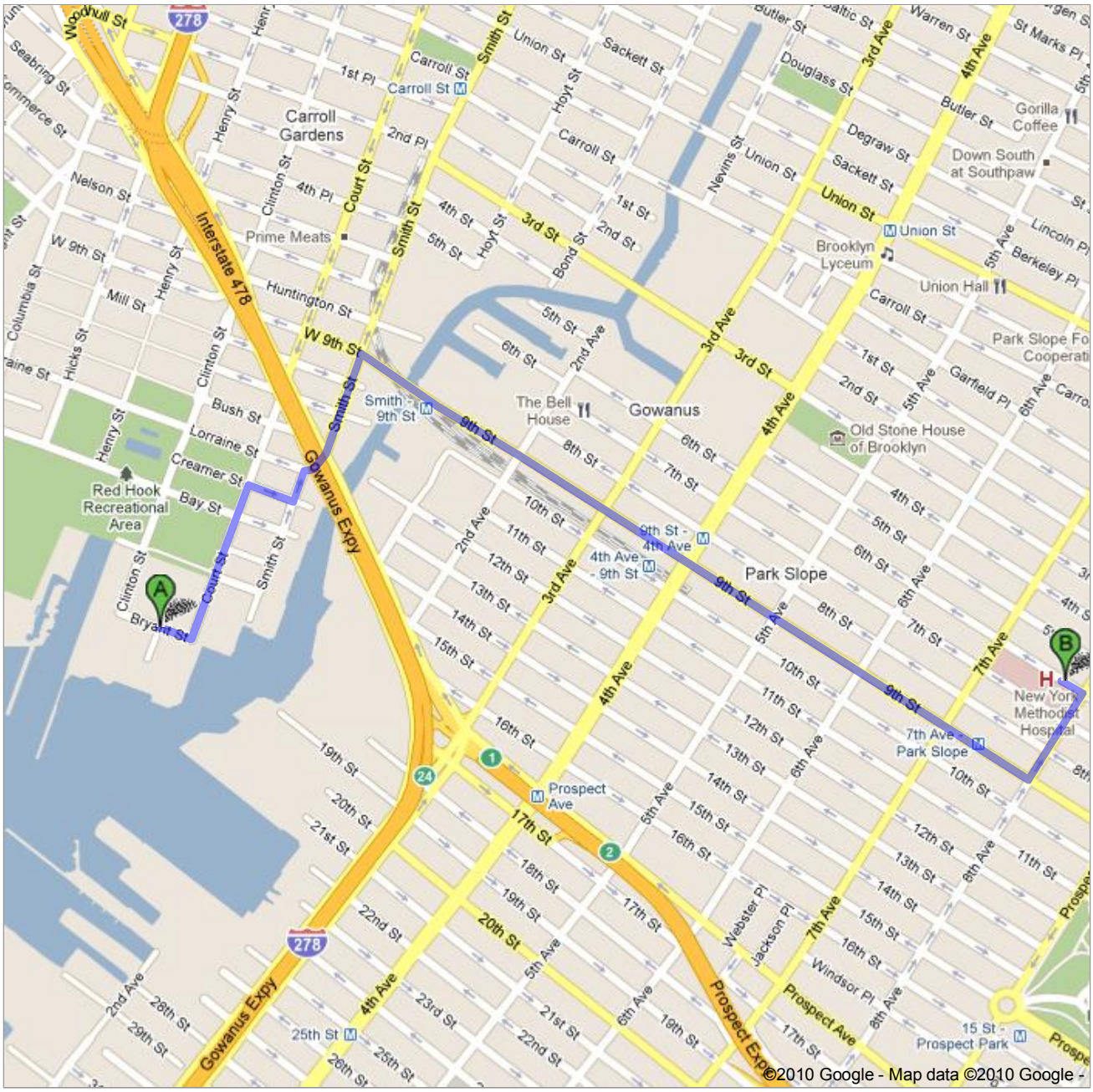
(716) 691-5232
www.wspenvironmental.com/usa

FIGURE 4

Drawing Number
00004270-017

Google maps

Directions to 506 6th St, Brooklyn, NY 11215
1.9 mi – about **8 mins**



688 Court St, Brooklyn, NY 11231

1.	Head **east** on **Bryant St** toward **Court St**	go 262 ft total 262 ft
2.	**Bryant St** turns left and becomes **Court St** About 1 min	go 0.2 mi total 0.3 mi
3.	Turn right at **Creamer St**	go 367 ft total 0.4 mi
4.	Take the 1st left onto **Smith St**	go 249 ft total 0.4 mi
5.	Turn right to stay on **Smith St** About 1 min	go 0.2 mi total 0.6 mi
6.	Turn right at **9th St** About 4 mins	go 1.2 mi total 1.8 mi
7.	Turn left at **8th Ave** About 1 min	go 0.1 mi total 1.9 mi
8.	Turn left at the 3rd cross street onto **6th St** Destination will be on the left	go 194 ft total 1.9 mi

506 6th St, Brooklyn, NY 11215

Tables

Table 1

Emergency Telephone Numbers
688-700 Court Street
Chemtura Corporation
Brooklyn, NY

Initial Notification:

Ambulance and Paramedics:	Emergency: 911
Police Department:	Emergency: 911
NYC Police Department 76th Precinct	718-834-3211
Fire Department:	Emergency: 911
Fire and Emergency Services	718-999-2457
Poison Control Center	800 222-1222

WSP

Kevin Sullivan, Project Manager	Office: 716-691-5232
	Cell: 716-713-8688
Hospital:	
New York Methodist Hospital	718-780-3000
506 Sixth Street	
Brooklyn, NY 11215	

Table 2

Directions to the Hospital
688-700 Court Street
Chemtura Corporation
Brooklyn, NY

Directions to New York Methodist Hospital from the Site are as follows (Figure 5):

- Head North on Court St
- Turn Right at Creamer St
- Take the 1st left onto Smith St
- Turn right to stay on Smith St.
- Turn right at 9th St.
- Turn Left at 8th Ave.
- Turn left at the 3rd cross street onto 6th St.

Appendix A – Safety Rules and Personal Hygiene

Safety Rules and Personal Hygiene

1. Remove all facial hair that interferes with a satisfactory fit of respiratory protective equipment.
2. Do not wear contact lenses while wearing full-face respirators.
3. Do not take prescribed drugs unless specifically approved by a physician.
4. In the work zone, do not eat, drink, smoke, chew gum or tobacco, or engage in any other practice that increases the probability of hand-to-mouth transfer or ingestion of material.
5. Wash hands and face thoroughly after leaving the work area and before eating, drinking, or any other activities.
6. Thoroughly wash entire body as soon as possible after removing Level C protective garments.
7. Whenever possible, avoid contact with contaminated or suspected contaminated surfaces.

Appendix B – Field Standard Operating Procedures for Putting on and Decontaminating Personal Protective Equipment

Field Standard Operating Procedures for Putting on and Decontaminating Personal Protective Equipment

1. Park vehicles outside the Site boundaries.
2. During the pre-work safety meeting, the Site manager will provide the following information:
    a. a description of the Site and known problem areas
    b. the level of protection required
    c. emergency medical information
    d. the locations of the first aid kit, showers, telephones, nearest water supply, ice, and lavatory
3. Use the nearest lavatory.
4. Lay out and check safety gear.
5. Put on safety gear in the following order:
    a. Saranex or Tyvek coveralls.
    b. Steel-toed work boots.
    c. Connect suits and boots with tape.
    d. Outer booties, if used.
    e. Air purifying respirators (APRs), if required.
6. Put on APRs as follows:
    a. Inspect.
        i. Inspect before each use to ensure that they have been cleaned adequately.
        ii. Check material conditions for signs of pliability, deterioration, or distortion.
        iii. Examine cartridges and ensure that they are the correct type for the intended use, that the expiration date has not passed, and that they have not been opened or used previously.
        iv. Check face shields for cracks or fogginess.
    b. Loosen all harness strap adjustments.
    c. Place chin in chin cup and draw back evenly on strap adjustments – the two bottom straps first, then the two top straps, and the center top strap last.
    d. Check that the respirator is centered evenly on the face and that the straps are not uncomfortably tight.
    e. Check for leaks or proper facial seals.
        i. To conduct a negative-pressure test, close the inlet part with the palm of the hand so it does not pass air, and gently inhale for about 10 seconds. Any inward rush of air indicates a poor fit. Note that a leaking facepiece may be drawn tightly to the face to form a good seal, giving a false indication of adequate fit.
        ii. To conduct a positive-pressure test, gently exhale while covering the exhalation valve to ensure that a positive pressure can be built up. Failure to build a positive pressure indicates a poor fit.

7. Put on the rest of the gear in the following order:
    a. Raise hoods.
    b. Hardhat.
    c. Surgical gloves.
    d. Outer gloves.
    e. Connect gloves and suit with tape.
8. Select a buddy to act as a safety backup.
9. Check your buddy's equipment and have your buddy check yours for rips, tears, or malfunctions. Pay special attention to respirators, making sure that seals are good and that cartridges are securely in place.
10. If any equipment or gear gets damaged or if your suit tears badly, GO BACK.
11. If you experience physical discomfort, breathing difficulties, light-headedness, dizziness, or other abnormalities, GO BACK.
12. When you return, have your buddy check for external accumulation of contamination and remove it. Also check gear for damage.
13. Decontamination will be performed in steps as follows:

Step 1 – Segregated Equipment Drop: Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, clipboards, etc.) in different containers with plastic liners. Each may be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination. This equipment may be reused if properly decontaminated.

Equipment: various sizes of containers, plastic drop cloths

Step 2 – Boot Cover and Outer Glove Wash and Rinse: (Optional – will be used at the Site Health and Safety Coordinator's discretion.)

- Equipment: pesticide sprayer with nozzle, two wash basins or tubs, scrub brush, water, liquinox non-phosphate soap solution (1%)

Step 3 – Tape Removal: Remove tape around boots and gloves, and deposit in container with plastic liner. Remove boot covers, then outer gloves, and place them in the container.

- Equipment: container (30-50 gallons), plastic liners, folding chairs

Step 4 – Safety Boot Wash and Rinse: (Optional – will be used at discretion of WSP field team members.)

- Equipment: two wash basins or tubs, scrub brush, water, liquinox solution (1%)

Step 5 – Protective Coverall Removal: With the assistance of a helper, remove protective coverall. Deposit in container with plastic liner.

- Equipment: container (30-50 gallons), folding chairs, plastic liners

Step 6 – Respirator Removal: Remove face piece. Avoid touching face with gloves. If work is completed for the day, discard cartridges in lined container, and wash and rinse respirator following the procedures on page B-5.

- Equipment: container (30-50 gallons), plastic liners

Step 7 – Inner Glove Removal: Remove inner gloves and deposit in container with plastic liner.

- Equipment: container (20-30 gallons), plastic liners

14. Respirators will be cleaned daily by hand washing with MSA cleaner-sanitizer solution followed by a thorough rinse and air-drying. NEVER ALLOW A RESPIRATOR TO DRY WITH THE STRAPS PLACED FORWARD ACROSS THE FACESHIELD BECAUSE THIS MAY CAUSE CHANGES IN THE FACE-TO-RESPIRATOR SEAL SURFACE. The specific procedures to be employed are as follows:

    a. Remove all cartridges (canisters) and filters plus gaskets and seals not permanently affixed to their seats.

    b. Loosen harnesses adjustment straps.

    c. Remove exhalation valve cover.

    d. Remove inhalation and exhalation valves.

    e. Remove protective faceshield cover.

    f. Wash facepiece in MSA cleaner/sanitizer powder mixed with warm water, preferably at a temperature of 120 F. Wash components separately from facepiece. Heavy soil may be removed from the facepiece surface using a medium-soft handbrush.

    g. Remove all parts from the wash solution, and rinse twice in clean, warm water.

    h. Air dry all parts in a designated clean area.

    i. Pat facepiece, valves, and seats to remove any remaining soap residue, water, or other foreign material with a clean, damp, lint-free cloth.

    j. Reassemble respirator.

    k. Place respirator in a plastic bag and the respirator box or otherwise store the respirator to prevent exposure to dust, moisture, sunlight, damaging chemicals, extreme temperatures, and impact.

15. Investigation-derived waste material will be handled as follows:

    a. Expendable material, such as tape, boot covers, inner and outer gloves, coveralls, and expendable sampling items, will be placed in a lined 30- to 33-gallon garbage can. When the container is full, the garbage sack will be removed and promptly placed in a contaminated soil stockpile or placed directly into licensed hazardous waste hauler trucks for offsite disposal.

    b. Wash and rinse waters from personal and equipment decontamination will be containerized in 55-gallon drums.

    c. All drummed wastes will be labeled "Property of [company name]". Drummed liquids will be pumped into a tank truck approved for hazardous waste transport if it is cost effective to do so. If drums must be transported offsite, they will be labeled in accordance with DOT shipping regulations contained in 49 CFR Parts 171-179 and transported offsite by a licensed waste hauler.

Appendix C – NIOSH Pocket Guide Pages for COCs

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Benzene

Synonyms & Trade Names Benzol, Phenyl hydride

CAS No. 71-43-2	RTECS No. CY1400000 (/niosh-rtecs/CY155CC0.html)	DOT ID & Guide 1114 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130)
Formula C_6H_6	Conversion 1 ppm = 3.19 mg/m^3	IDLH Ca [500 ppm] See: 71432 (/niosh/idlh/71432.html)
Exposure Limits NIOSH REL : Ca TWA 0.1 ppm ST 1 ppm See Appendix A (nengapdxa.html) OSHA PEL : [1910.1028] TWA 1 ppm ST 5 ppm See Appendix F (nengapdxf.html)		Measurement Methods NIOSH 1500 (/niosh/docs/2003-154/pdfs/1500.pdf) , 1501 (/niosh/docs/2003-154/pdfs/1501.pdf) , 3700 (/niosh/docs/2003-154/pdfs/3700.pdf) , 3800 (/niosh/docs/2003-154/pdfs/3800.pdf) ; OSHA 12 (http://www.osha.gov/dts/sltc/methods/organic/org012/org012.html) , 1005 (/niosh/docs/2003-154/pdfs/1005.pdf) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

Physical Description Colorless to light-yellow liquid with an aromatic odor. [Note: A solid below 42°F.]

MW: 78.1	BP: 176° F	FRZ: 42°F	Sol: 0.07%	VP: 75 mmHg	IP: 9.24 eV
Sp.Gr: 0.88	Fl.P: 12° F	UEL: 7.8%	LEL: 1.2%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers, many fluorides & perchlorates, nitric acid

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, blood, central nervous system, bone marrow

Cancer Site [leukemia]

Personal Protection/Sanitation (See protection codes (protect.html)) Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable)	First Aid (See procedures (firstaid.html)) Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Change: No recommendation
Provide: Eyewash, Quick drench

Respirator Recommendations
(See Appendix E) (nengapdxe.html)

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0015 (/niosh/ipcsneng/neng0015.html) See MEDICAL TESTS: 0022 (/niosh/docs/2005-110/nmed0022.html)

Page last reviewed: February 3, 2009
Page last updated: November 18, 2010
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Acetone

Synonyms & Trade Names Dimethyl ketone, Ketone propane, 2-Propanone

CAS No. 67-64-1	RTECS No. AL3150000 (/niosh-rtecs/AL3010B0.html)	DOT ID & Guide 1090 127 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=127)
Formula $(CH_3)_2CO$	Conversion 1 ppm = 2.38 mg/m³	IDLH 2500 ppm [10%LEL] See: 67641 (/niosh/idlh/67641.html)
Exposure Limits NIOSH REL : TWA 250 ppm (590 mg/m³) OSHA PEL † (nengapdxg.html) : TWA 1000 ppm (2400 mg/m³)		Measurement Methods NIOSH 1300 (/niosh/docs/2003-154/pdfs/1300.pdf) , 2555 (/niosh/docs/2003-154/pdfs/2555.pdf) , 3800 (/niosh/docs/2003-154/pdfs/3800.pdf) ; OSHA 69 (http://www.osha.gov/dts/sltc/methods/organic/org069/org069.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

Physical Description Colorless liquid with a fragrant, mint-like odor.

MW: 58.1	BP: 133° F	FRZ: -140° F	Sol: Miscible	VP: 180 mmHg	IP: 9.69 eV
Sp.Gr: 0.79	Fl.P: 0° F	UEL: 12.8%	LEL: 2.5%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Oxidizers, acids

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system

Personal Protection/Sanitation (See protection codes (protect.html)) Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation	First Aid (See procedures (firstaid.html)) Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

Up to 2500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0087 (/niosh/ipcsneng/neng0087.html) See MEDICAL TESTS: 0002 (/niosh/docs/2005-110/nmed0002.html)

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Ethyl benzene

Synonyms & Trade Names Ethylbenzol, Phenylethane

CAS No. 100-41-4	RTECS No. DA0700000 (/niosh-rtecs/DAAAE60.html)	DOT ID & Guide 1175 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130)
Formula $CH_3CH_2C_6H_5$	Conversion 1 ppm = 4.34 mg/m³	IDLH 800 ppm [10%LEL] See: 100414 (/niosh/idlh/100414.html)
Exposure Limits NIOSH REL : TWA 100 ppm (435 mg/m³) ST 125 ppm (545 mg/m³) OSHA PEL † (nengapdxg.html) : TWA 100 ppm (435 mg/m³)		Measurement Methods NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf) ; OSHA 7 (http://www.osha.gov/dts/sltc/methods/organic/org001/org001.html) , 1002 (/niosh/docs/2003-154/pdfs/1002.pdf) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

Physical Description Colorless liquid with an aromatic odor.

MW: 106.2	BP: 277° F	FRZ: -139°F	Sol: 0.01%	VP: 7 mmHg	IP: 8.76 eV
Sp.Gr: 0.87	Fl.P: 55° F	UEL: 6.7%	LEL: 0.8%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma

Target Organs Eyes, skin, respiratory system, central nervous system

Personal Protection/Sanitation (See protection codes (protect.html)) Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation	First Aid (See procedures (firstaid.html)) Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations
NIOSH/OSHA

Up to 800 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0268 (/niosh/ipcsneng/neng0268.html) See MEDICAL TESTS: 0098 (/niosh/docs/2005-110/nmed0098.html)

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Naphthalene

Synonyms & Trade Names: Naphthalin, Tar camphor, White tar

CAS No. 91-20-3	RTECS No. QJ0525000 (/niosh-rtecs/QJ802C8.html)	DOT ID & Guide 1334 133 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=133) (crude or refined) 2304 133 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=133) (molten)
Formula $C_{10}H_8$	Conversion 1 ppm = 5.24 mg/m^3	IDLH 250 ppm See: 91203 (/niosh/idlh/91203.html)
Exposure Limits NIOSH REL : TWA 10 ppm (50 mg/m^3) ST 15 ppm (75 mg/m^3) OSHA PEL † (nengapdxg.html) : TWA 10 ppm (50 mg/m^3)		Measurement Methods NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf) ; OSHA 35 (http://www.osha.gov/dts/sltc/methods/organic/org035/org035.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

Physical Description: Colorless to brown solid with an odor of mothballs. [Note: Shipped as a molten solid.]

MW: 128.2	BP: 424° F	MLT: 176°F	Sol: 0.003%	VP: 0.08 mmHg	IP: 8.12 eV
Sp.Gr: 1.15	Fl.P: 174° F	UEL: 5.9%	LEL: 0.9%		

Combustible Solid, but will take some effort to ignite.

Incompatibilities & Reactivities: Strong oxidizers, chromic anhydride

Exposure Routes: inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms: irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage

Target Organs: Eyes, skin, blood, liver, kidneys, central nervous system

Personal Protection/Sanitation (See protection codes (protect.html)) Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: Daily	First Aid (See procedures (firstaid.html)) Eye: Irrigate immediately Skin: Molten flush immediately/solid-liquid soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations
NIOSH/OSHA

Up to 100 ppm:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.*
(APF = 10) Any supplied-air respirator*

Up to 250 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 25) Any powered, air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0667 (/niosh/ipcsneng/neng0667.html) See MEDICAL TESTS: 0152 (/niosh/docs/2005-110/nmed0152.html)

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Chlorodiphenyl (42% chlorine)

Synonyms & Trade Names Aroclor® 1242, PCB, Polychlorinated biphenyl		
CAS No. 53469-21-9	RTECS No. TQ1356000 (/niosh-rtecs/TQ14B0E0.html)	DOT ID & Guide 2315 171 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=171)
Formula $C_6H_4ClC_6H_3Cl_2$ (approx)	Conversion	IDLH Ca [5 mg/m³] See: 53469219 (/niosh/idlh/53469219.html)
Exposure Limits NIOSH REL *: Ca TWA 0.001 mg/m³ See Appendix A (nengapdxa.html) [*Note: The REL also applies to other PCBs.] OSHA PEL : TWA 1 mg/m³ [skin]		Measurement Methods NIOSH 5503 (/niosh/docs/2003-154/pdfs/5503.pdf) ; OSHA PV2089 (http://www.osha.gov/dts/sltc/methods/partial/t-pv2089-01-8812-ch/t-pv2089-01-8812-ch.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

Physical Description Colorless to light-colored, viscous liquid with a mild, hydrocarbon odor.					
MW: 258 (approx)	BP: 617-691°F	FRZ: -2°F	Sol: Insoluble	VP: 0.001 mmHg	IP: ?
Sp.Gr(77° F): 1.39	Fl.P: NA	UEL: NA	LEL: NA		

Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans & chlorinated dibenzo-p-dioxins.

Incompatibilities & Reactivities Strong oxidizers

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes; chloracne; liver damage; reproductive effects; [potential occupational carcinogen]

Target Organs Skin, eyes, liver, reproductive system

Cancer Site [in animals: tumors of the pituitary gland & liver, leukemia]

Personal Protection/Sanitation (See protection codes (protect.html)) Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated	First Aid (See procedures (firstaid.html)) Eye: Irrigate immediately Skin: Soap wash immediately

Remove: When wet or contaminated Change: Daily Provide: Eyewash, Quick drench	Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See MEDICAL TESTS: 0175 (/niosh/docs/2005-110/nmed0175.html)

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Phenol

Synonyms & Trade Names Carbolic acid, Hydroxybenzene, Monohydroxybenzene, Phenyl alcohol, Phenyl hydroxide

CAS No. 108-95-2	RTECS No. SJ3325000 (/niosh-rtecs/SJ32BC48.html)	DOT ID & Guide 1671 153 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=153) (solid) 2312 153 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=153) (molten) 2821 153 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=153) (solution)
Formula C_6H_5OH	Conversion 1 ppm = 3.85 mg/m³	IDLH 250 ppm See: 108952 (/niosh/idlh/108952.html)
Exposure Limits NIOSH REL : TWA 5 ppm (19 mg/m³) C 15.6 ppm (60 mg/m³) [15-minute] [skin] OSHA PEL : TWA 5 ppm (19 mg/m³) [skin]		Measurement Methods NIOSH 2546 (/niosh/docs/2003-154/pdfs/2546.pdf) ; OSHA 32 See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

Physical Description Colorless to light-pink, crystalline solid with a sweet, acrid odor. [Note: Phenol liquefies by mixing with about 8% water.]

MW: 94.1	BP: 359° F	MLT: 109° F	Sol(77°F): 9%	VP: 0.4 mmHg	IP: 8.50 eV
Sp.Gr: 1.06	Fl.P: 175° F	UEL: 8.6%	LEL: 1.8%		

Combustible Solid

Incompatibilities & Reactivities Strong oxidizers, calcium hypochlorite, aluminum chloride, acids

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching

Target Organs Eyes, skin, respiratory system, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html)) Skin: Prevent skin contact Eyes: Prevent eye contact	First Aid (See procedures (firstaid.html)) Eye: Irrigate immediately Skin: Soap wash immediately

Wash skin: When contaminated Remove: When wet or contaminated Change: Daily Provide: Eyewash, Quick drench	Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations

NIOSH/OSHA

Up to 50 ppm:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 125 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.

Up to 250 ppm:
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge (s) in combination with a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0070 (/niosh/ipcsneng/neng0070.html) See MEDICAL TESTS: 0182 (/niosh/docs/2005-110/nmed0182.html)

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Toluene

Synonyms & Trade Names: Methyl benzene, Methyl benzol, Phenyl methane, Toluol

CAS No. 108-88-3	RTECS No. XS5250000 (/niosh-rtecs/XS501BD0.html)	DOT ID & Guide 1294 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130)
Formula $C_6H_5CH_3$	Conversion 1 ppm = 3.77 mg/m³	IDLH 500 ppm See: 108883 (/niosh/idlh/108883.html)
Exposure Limits NIOSH REL : TWA 100 ppm (375 mg/m³) ST 150 ppm (560 mg/m³) OSHA PEL † (nengapdxg.html) : TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)		Measurement Methods NIOSH 1500 (/niosh/docs/2003-154/pdfs/1500.pdf) , 1501 (/niosh/docs/2003-154/pdfs/1501.pdf) , 3800 (/niosh/docs/2003-154/pdfs/3800.pdf) , 4000 (/niosh/docs/2003-154/pdfs/4000.pdf) ; OSHA 111 (http://www.osha.gov/dts/sltc/methods/organic/org111/org111.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

Physical Description: Colorless liquid with a sweet, pungent, benzene-like odor.

MW: 92.1	BP: 232° F	FRZ: -139°F	Sol(74° F): 0.07%	VP: 21 mmHg	IP: 8.82 eV
Sp.Gr: 0.87	Fl.P: 40° F	UEL: 7.1%	LEL: 1.1%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities: Strong oxidizers

Exposure Routes: inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms: irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage

Target Organs: Eyes, skin, respiratory system, central nervous system, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html)) Skin: Prevent skin contact Eyes: Prevent eye contact	First Aid (See procedures (firstaid.html)) Eye: Irrigate immediately Skin: Soap wash promptly

Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation	Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

Up to 500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0078 (/niosh/ipcsneng/neng0078.html) See MEDICAL TESTS: 0232 (/niosh/docs/2005-110/nmed0232.html)

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m-Xylene

Synonyms & Trade Names 1,3-Dimethylbenzene; meta-Xylene; m-Xylol

CAS No. 108-38-3	RTECS No. ZE2275000 (/niosh-rtecs/ZE22B6B8.html)	DOT ID & Guide 1307 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130)
Formula $C_6H_4(CH_3)_2$	Conversion 1 ppm = 4.34 mg/m³	IDLH 900 ppm See: 95476 (/niosh/idlh/95476.html)

Exposure Limits

NIOSH REL : TWA 100 ppm (435 mg/m³) ST 150 ppm (655 mg/m³)

OSHA PEL † (nengapdxg.html) : TWA 100 ppm (435 mg/m³)

Measurement Methods

NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf) , 3800 (/niosh/docs/2003-154/pdfs/3800.pdf) ;
OSHA 1002 (/niosh/docs/2003-154/pdfs/1002.pdf)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

Physical Description Colorless liquid with an aromatic odor.

MW: 106.2	BP: 282° F	FRZ: -54°F	Sol: Slight	VP: 9 mmHg	IP: 8.56 eV
Sp.Gr: 0.86	Fl.P: 82° F	UEL: 7.0%	LEL: 1.1%		

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities Strong oxidizers, strong acids

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH/OSHA

Up to 900 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0085 (/niosh/ipcsneng/neng0085.html)

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Particulates not otherwise regulated

Synonyms & Trade Names "Inert" dusts, Nuisance dusts, PNOR [Note: Includes all inert or nuisance dusts, whether mineral, inorganic, not listed specifically in 1910.1000.]

CAS No.	RTECS No.	DOT ID & Guide
	Conversion	IDLH N.D. See: IDLH INDEX (/niosh/idlh/intridl4.html)

Exposure Limits

NIOSH REL : See Appendix D (nengapdxd.html)
OSHA PEL : TWA 15 mg/m³ (total) TWA 5 mg/m³ (resp)

Measurement Methods

NIOSH 0500 (/niosh/docs/2003-154/pdfs/0500.pdf) , 0600 (/niosh/docs/2003-154/pdfs/0600.pdf)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

Physical Description Dusts from solid substances without specific occupational exposure standards.

Properties vary depending upon the specific solid.

Incompatibilities & Reactivities Varies

Exposure Routes inhalation, skin and/or eye contact

Symptoms irritation eyes, skin, throat, upper respiratory system

Target Organs Eyes, skin, respiratory system

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: No recommendation
Eyes: No recommendation
Wash skin: No recommendation
Remove: No recommendation
Change: No recommendation

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately

Breathing: Fresh air

Respirator Recommendations

Not available.

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html)

Appendix D – Heat Stress and Heat Monitoring

Heat Stress

Heat is one of the most common (and potentially serious) illnesses at outdoor work sites especially when PPE is worn; therefore, regular monitoring and other preventive precautions are vital. The following describes signs and symptoms of heat-related illness. However, work schedules will be adjusted based on the assessment procedure provided below and, at a minimum, a review by the Site Health and Safety Coordinator. Monitoring for heat stress will be conducted by tracking the heat stress index and by visual observation of the individual team members through the buddy system.

Signs and Symptoms of Heat Stress

Heat rash may result from continuous exposure to heat or humid air.

Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:

- muscle spasms
- pain in the hands, feet, and abdomen

Heat exhaustion occurs from increased stress on various body organs, including inadequate blood circulation caused by cardiovascular insufficiency or dehydration. Signs and symptoms include:

pale, cool, moist skin
heavy sweating
dizziness
nausea
fainting

Heat stroke is the most serious form of heat stress. Temperature regulation fails, and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms include:

red, hot, usually dry skin
lack of or reduced perspiration
nausea
dizziness and confusion
strong, rapid pulse
coma

First-aid remedies for heat stress and heat stroke include removing the worker to a cool place, providing cool water or a commercial sport drink, loosening tight clothing, and calling for an ambulance if victim vomits or starts to lose consciousness.

Heat Stress Monitoring

In order to prevent heat-related injuries, it is WSP policy to schedule regular breaks into the work day, especially when outdoor temperatures are 80° Fahrenheit (° F) and higher. Generally, initial work schedules will be approximately 90 minutes of work followed by 15 minutes of rest; however, this schedule should be adjusted based on the information provided in the next section. Shelter from the sun, water, and/or electrolytic drinks will be provided during rest periods. If necessary, work will be performed during the cooler night hours.

In the table below, the values are a reference index of the environment known as the Wet Bulb Globe Temperature (WBGT). The WBGT index combines air temperature, humidity, air flow and radiant heat. Generally, this is the “feels like” temperature reported by weather agencies. Although the WBGT does

not exactly represent the heat stress index, it is a helpful guide. The heat stress index calculation is quite complex, and the following table provides ranges that can be used to further evaluate the potential for heat stress.

		Environmental Temperature (Fº)					
		70º	75º	80º	85º	90º	95º
Relative Humidity	0%	64º	69º	73º	78º	83º	87º
	10%	65º	70º	75º	80º	85º	90º
	20%	66º	72º	77º	82º	87º	93º
	30%	67º	73º	78º	84º	90º	96º
	40%	68º	74º	79º	86º	93º	101º
	50%	69º	75º	81º	88º	96º	107º
	60%	70º	76º	82º	90º	100º	114º
	70%	70º	77º	85º	93º	106º	124º
	80%	71º	78º	86º	97º	113º	136º
	90%	71º	79º	88º	102º	122º	--
	100%	72º	80º	91º	108º	--	--

****Exposure to full sunshine will increase the values in red by up to 15° F**
Keep in mind the following cautionary guidelines for heat indexes: 90º to 104º F Heat cramps or heat exhaustion possible.

Calculating Alternate Work Schedules
The ambient temperature and/or heat stress index may require calculating alternate work schedules in order to prevent heat-related illnesses. The following table and correction factor should be used to determine the appropriate work schedule. Obtain a corrected temperature from the table above or use the "feels like" temperature found in local weather reports. In order to get a factor that fits in the table below, multiply the corrected temperature or "feels like" temperature by 0.247[1]. Use the resultant factor in the chart below above to determine work and rest cycles.

Initial work schedules will be as follows:

[1]The Canadian Saskatchewan Department of Labor provided the conversion factor between WBGT and heat index.

	Unacclimatized (a)			
Work Demands	Light (b)	Moderate (c)	Heavy (d)	Very Heavy (e)
100% Work	27.5	25	22.5	--
75% Work 25% Rest	29	26.5	24.5	--
50% Work 50% Rest	30	28	26.5	25
25% Work 75% Rest	31	29	28	26.5

a/ Unacclimatized based on less than five consecutive days work in outdoor heat
b/ Moderate arm and leg movement; Some walking about
c/ Moderate walking about on level surfaces; moderate lifting or pushing
d/ Intermittent heavy lifting with pushing or pulling; continuous walking about
e/ Heavy lifting; continuous pushing or pulling heavy weights

The above resultant schedules can also be modified based on the following monitoring stated in NIOSH, et al. (1985).

- Heart rate. Heart rate will be measured during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, the next work cycle will be shortened by one-third without changing the rest period. If the heart rate still exceeds 110 beats per minute at the next rest period, the following work cycle will be shortened by one-third.
- Oral temperature. A clinical thermometer (three minutes under the tongue) or similar device will be used to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6° F (37.6° C), the next work cycle will be reduced by one-third without changing the rest period. If oral temperature still exceeds 99.6° F (37.36° C) at the beginning of the next rest period, the following work cycle will be shortened by one-third. A worker will not be permitted to wear a semipermeable or impermeable garment when his or her oral temperature exceeds 100.6° F (38.1° C).
- Body water loss, if possible. Weight will be measured on a scale accurate to $\pm$0.25 lb. at the beginning and end of each work day to see if enough fluids are being taken to prevent dehydration. The body water loss should not exceed 1.5 percent total body weight loss in a work day.

Each site-specific health and safety plan will include the above information and a comprehensive work schedule plan.

Appendix E – Cold Stress Prevention for Winter Months

Cold Stress Prevention for Winter Months

The types of cold-related stress are frostbite, hypothermia, and immersion or trench foot. Personnel performing field tasks in the winter months should be aware of the signs and symptoms of cold-related stress so they can take precautionary measures to avoid cold-induced injury and illness. The following is a brief synopsis of each type of cold-related stress.

Frostbite results when cells are cooled until ice crystals form inside them. Most injuries from frostbite are localized to the exposed part of the body. First degree frostbite or frostnip usually strikes the tips of fingers, toes, ears, nose, and chin or cheeks. It is usually painless, and the victim is often unaware of it. The skin turns pale or white from first degree frostbite. Second degree frostbite can occur in skin and its underlying tissue. The skin becomes firm and white, waxy, or translucent. As the injured area warms, it will become numb, and then will turn blue or purple and swell. The superficial capillaries have been injured, and edema fluid will leak out into the tissue. Stinging and burning pain and superficial blisters may develop. The throbbing, aching, and burning may last for some weeks, and the body part may become permanently red and be extremely sensitive if again exposed to the cold. Third degree frostbite involves freezing not only the skin and subcutaneous tissue but even muscle and bone. This serious injury usually involves the hands and feet. The tissues are cold, pale, and frozen to the touch. The injured area usually turns purple or blue and is extremely painful after thawing. Large blisters and tissue death (gangrene) may occur within the first day or two.

Generalized, severe, progressive body cooling is known as systemic hypothermia. This may occur at outside temperatures above freezing as well as below freezing. It occurs when the core temperature of the body falls below 95° F (35° C) and results when the body temperature controlling mechanism is overwhelmed. At 96.8° F, the body attempts to compensate for the cold. As core temperatures fall below 95° F, the body is unable to rewarm itself without outside assistance because of the failure of the temperature control system.

Hypothermia may be of acute duration if someone is suddenly immersed in cold water. Subacute hypothermia may occur in otherwise healthy people, such as skiers, mountain climbers, or lost hunters, subject to prolonged cold exposure and physical exertion. Chronic hypothermia may occur in old people or those who are ill.

Hypothermia may be mild to moderate, when the core temperature is between 81° and 95° F and the patient is conscious, or it may be severe, when the core temperature is below 80° F and the patient is unconscious.

The symptoms of hypothermia depend on the core temperature and become progressively more severe as the core temperature drops. Between 95° and 98.6° F, the first symptom is shivering, a subconscious attempt of the body to generate more heat through muscular action. In addition, certain semiconscious activities will occur, such as stamping the foot and dancing up and down. Below 95° F, difficulty in speaking, coordination, stumbling, falling, and an inability to use the hands are seen. It is at this point that the loss of temperature control occurs and the body is unable to rewarm itself. Below 90° F, shivering decreases and the muscles become progressively rigid. Below 85° F, the victim becomes irrational and may fall into a coma. The pulse and respiration slow. Below 80° F, unconsciousness occurs. The pulse is weaker, and cardiac arrhythmia may be noted. Below 78° F, the respiratory and cardiovascular centers fail, with resulting pulmonary edema and ventricular fibrillation and then cardiac standstill. Ventricular fibrillation is the usual cause of death in these victims.

Even without a thermometer, the level of hypothermia may be noted by observing the victim's mental state. With a few degrees' drop in core temperature, the victim may become withdrawn, discouraged, or mildly depressed. As the temperature drops a few degrees more, to 94° F or below, the victim may become indecisive, confused, or disoriented and may make incorrect decisions. Below 86° F, sleepiness, lethargy, and confusion are obvious. These progressively become more severe until coma

occurs. The comatose state, if allowed to continue, results in death. The stages of hypothermia may progress rapidly after the victim's temperature falls below 90° F.

Trench foot or immersion foot occurs from the wet cooling of an extremity over hours or days at a temperature just above freezing while remaining relatively immobile. It used to be seen commonly in shipwrecked sailors or soldiers forced to remain in trenches for days at a time. The extremity is cold, swollen, waxy, mottled, and may be numb.

Preventive Work Guidelines

1. Exposure to cold will be terminated immediately when severe shivering becomes evident.
2. When air temperature falls below 30° F, dry bulb temperature and wind speed should be measured periodically and the wind chill factor should be calculated. (Weather radios are an adequate substitute.)
3. All work except for emergencies will be terminated when the wind chill is below -18°F.
4. Metal tool handles should be covered with thermal insulating material at temperatures below 30° F.
5. When work is performed continuously in the cold at a wind chill of below 20° F, heated shelter should be made available. A vehicle can be used for shelter if it is kept idling with the heater on.
6. Work will be arranged in such a way that sitting or standing still for long periods of time is minimized.
7. Keep warm, dry, and keep moving, but do not become overheated while working in the cold. Exercise fingers and toes

Appendix F – Community Air Monitoring Plan

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

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

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

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

Community Air Monitoring Plan

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

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

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

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

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

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

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

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

Particulate Monitoring, Response Levels, and Actions

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

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

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

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

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