

470 Manhattan Avenue

BROOKLYN, NEW YORK

REMEDIAL ACTION WORK PLAN

OER Project Number: 16EH-A093K

NYC VCP Number: 16CVCP030K

Prepared For:

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LIST OF ACRONYMS

Acronym	Definition
AOC	Area of Concern
AS/SVE	Air Sparging/Soil Vapor Extraction
BOA	Brownfield Opportunity Area
CAMP	Community Air Monitoring Plan
C&D	Construction and Demolition
CEQR	City Environmental Quality Review
CFR	Code of Federal Regulations
CHASP	Construction Health and Safety Plan
COC	Certificate of Completion
CQAP	Construction Quality Assurance Plan
CSOP	Contractors Site Operation Plan
DCR	Declaration of Covenants and Restrictions
ECs/ICs	Engineering Controls and Institutional Controls
ELAP	Environmental Laboratory Accreditation Program
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations Emergency Response
IRM	Interim Remedial Measure
MNA	Monitored Natural Attenuation
NOC	Notice of Completion
NYS DEC	New York State Department of Environmental Conservation
NYC DEP	New York City Department of Environmental Protection
NYC DOHMH	New York State Department of Health and Mental Hygiene
NYC OER	New York City Office of Environmental Remediation
NYC VCP	New York City Voluntary Cleanup Program
NYCRR	New York Codes Rules and Regulations
NYS DEC	New York State Department of Environmental Conservation
NYS DEC DER	New York State Department of Environmental Conservation Division of Environmental Remediation
NYS DOH	New York State Department of Health
NYS DOT	New York State Department of Transportation
ORC	Oxygen-Release Compound
OSHA	United States Occupational Health and Safety Administration
PCBs	Polychlorinated Biphenyls
PE	Professional Engineer

Acronym	Definition
PID	Photoionization Detector
QEP	Qualified Environmental Professional
QHHEA	Qualitative Human Health Exposure Assessment
RAOs	Remedial Action Objectives
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan or Plan
RCA	Recycled Concrete Aggregate
RD	Remedial Design
RI	Remedial Investigation
RMZ	Residual Management Zone
SCOs	Soil Cleanup Objectives
SCG	Standards, Criteria and Guidance
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SSDS	Sub-Slab Depressurization System
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
USGS	United States Geological Survey
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VOC	Volatile Organic Compound

CERTIFICATION

I, Michelle Lapin, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for designing the remedial program for the 470 Manhattan Avenue site, Site Number 16CVCP030K. I certify to the following:

- I have reviewed this document and the Stipulation List, to which my signature and seal are affixed.
- Engineering Controls developed for this remedial action were designed by me or a person under my direct supervision and designed to achieve the goals established in this Remedial Action Work Plan for this site.
- The Engineering Controls to be constructed during this remedial action are accurately reflected in the text and drawings of the Remedial Action Work Plan and are of sufficient detail to enable proper construction.
- This Remedial Action Work Plan (RAWP) has a plan for handling, transport and disposal of soil, fill, fluids, and other materials removed from the property in accordance with applicable city, state, and federal laws and regulations. Importation of all soil, fill, and other material from off-site will be in accordance with all applicable city, state, and federal laws and requirements. This RAWP has provisions to control nuisances during the remediation and all invasive work, including dust and odor suppression.

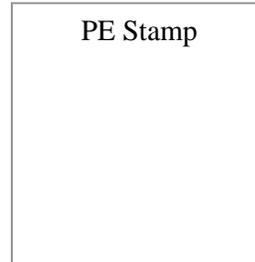
Michelle Lapin, P.E. _____

Name

PE License Number

Signature

Date



EXECUTIVE SUMMARY

470 Manhattan Ave LLC is working with the NYC Office of Environmental Remediation (OER) to investigate and remediate a 31,450-square foot site located at 470 Manhattan Avenue in Brooklyn, New York, herein referred to as “the Site”. A Remedial Investigation (RI) was performed to compile and evaluate data and information necessary to develop this Remedial Action Work Plan (RAWP). The remedial action described in this document provides for the protection of public health and the environment consistent with the intended property use, complies with applicable environmental standards, criteria, and guidance, and conforms with applicable laws and regulations.

Site Location and Background

The Site is located at 470 Manhattan Avenue in the Greenpoint section in Brooklyn, New York and is identified as Block 2714 Lots 1, 30, 32, and 33 on the New York City Tax Map. A map showing the Site location is provided as Figure 1. The Site is approximately 31,450 square feet. A map showing the Site boundary is provided as Figure 2.

Summary of Redevelopment Plan

The proposed development project consists of the demolition of the remaining Site buildings and the construction of a seven-story building with mechanical space, amenities, and a lobby on the first floor, and 135 residential units above. The 142,115-square foot proposed building will occupy the southern and western portion of the Property with 57 tenant parking spaces on the northern and eastern portions of the Site. Excavation is expected to extend to approximately 4 feet below grade at the location of the proposed building, to approximately 6 feet below grade at the location of the proposed covered parking garage, and to approximately 8 feet in the central portion of the Site for the installation of an elevator pit. A small landscaped area is proposed along the Eckford Street frontage of the building. The current zoning designation is M1-2/R6A (light manufacturing and residential), which is consistent with the proposed use. The remedial action contemplated under this RAWP may be implemented independently of the proposed redevelopment plan.

Summary of Surrounding Property

The Site is 31,450 square feet and is bounded by residential buildings to the northeast, Eckford Street to the northwest, residential buildings to the east, Newton Street to the south, and Manhattan Avenue to the west. The current zoning designation of the Site is M1-2/R6A (light manufacturing and residential). The surrounding area is primarily developed with residential, commercial, and manufacturing properties. Ericsson Playground and McCarren Park are located west of the Site across Manhattan Avenue. John Ericsson Middle School 126, Magnet School for Environmental Engineering, at 424 Leonard Street, is located approximately 270 feet southwest of the Site. Figure 3 shows the surrounding land use.

Summary of Past Site Uses and Areas of Concern

Historic uses at the Site include unspecified manufacturing, sash and door storage and a woodworking shop associated with I. Feldman & Son Inc. Sash & Door Manufacturing, a metal container manufacturer, and an enameling works with a baking oven and spray booths on Lot 1; a garage and an unspecified factory on Lot 30; freight and motor freight storage with a gasoline tank on Lot 32; and a barrel shed, a carriage garage, and a coopeage on Lot 33. The surrounding area was developed historically with residential, commercial, educational, manufacturing, automotive, and woodworking uses.

The areas of concern (AOCs) identified for the Site include:

1. Lots 30, 32, and 33 contain (E) Designations for hazardous materials listed in the Department of City Planning (E) Designation database established as part of the rezoning of Williamsburg and Greenpoint.

2. A vent and fill pipe were observed on the northeastern exterior wall of the three-story residential building on Lot 1 fronting Eckford Street. A vaulted 3,000-gallon No. 2 fuel oil AST was observed in the basement of the residential building on Lot 1.
3. Historic fill may be present at the Site.
4. The surrounding area was developed historically with residential, commercial, educational, manufacturing, automotive, and woodworking uses, including the Joseph Goetz Manhattan Cabinet Works, I. Feldman Sash and Door Manufacturing, unspecified manufacturing and warehouses, textile printing, cloth combining, a wire spring manufacturer, a cabinet finisher, a tin smith, a fuel oil company, a blacksmith, George N. Gardiner & Son Marine Paint Manufacturing, a beverage bottling, junk storage, Mesisel Danowitz & Company with associated planing and molding facilities, lumber storage and yards, kilns, cooperages, Atlantic Hardwood Company, an iron pipe warehouse, a metal works, lacquer spraying, a machine shed and shop, a motor grinder, a motor freight station, garages with gasoline tanks, trucking and parking facilities, tractor storage, a truck bay, and automotive repair, washing, and filling stations. Additionally, several properties in the surrounding area were listed in the Resource Conservation Recovery Act (RCRA), Petroleum Bulk Storage (PBS), Spills, (E) Designation, and Leaking Underground Storage Tank (LUST) databases. A groundwater monitoring well was observed east of the Site on the Graham Avenue sidewalk. The purpose of the monitoring well is not known, but may be related to current or historical off-site uses.
5. Historic on-site and off-site uses may have affected subsurface conditions at the Site.

Summary of Work Performed under the Remedial Investigation

AKRF performed the following scope of work on behalf of 470 Manhattan Ave LLC:

1. Conducted a Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Installed 10 soil borings across the Site, and collected 20 soil samples for chemical analysis from the soil borings to evaluate soil quality;
3. Installed five groundwater monitoring wells at the Site and collected five groundwater samples for chemical analysis to evaluate groundwater quality; and
4. Installed seven soil vapor probes at the Site and collected seven soil vapor samples and one ambient air sample for chemical analysis.

Summary of Findings of Remedial Investigation

1. The Site is relatively level and lies at an elevation of approximately 16 feet above sea level.
2. Depth to groundwater ranges from 10.0 to 12.3 feet below grade at the Site.
3. Groundwater is expected to flow generally from east to west towards the East River.
4. Bedrock was not encountered during the RI.
5. The stratigraphy of the Site, from the surface down, consists of approximately 12 feet of historic fill, characterized by sand, gravel, silt, concrete, asphalt, brick, and ash. Below the historic fill is a sand, gravel, and silt stratum to the termination of each boring.
6. Twenty soil samples were collected for laboratory analysis from soil borings SB-1 through SB-10. Soil sample analytical results were compared to NYSDEC 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (UUSCOs) and Part 375 Soil Cleanup Objectives for Restricted Residential Soil Cleanup Objectives (RRSCO). VOCs were detected in 16 of the 20 samples analyzed during the investigation. Acetone and benzene were detected above the respective UUSCOs but below the

RRSCOs in two soil samples. No other VOCs were detected above UUSCOs or RRSCOs in any of the soil samples analyzed as part of the investigation.

SVOCs were detected in 19 of the 20 soil samples analyzed during the investigation. Total SVOC concentrations ranged between an estimated concentration of 1.98 mg/kg in soil sample SB-4 (4-6) and an estimated concentration of 291 mg/kg in soil sample SB-10 (4-6). Four SVOCs [3-methylphenol/4-methylphenol, benzo(k)fluoranthene, chrysene, and phenol] were detected in at least one soil sample at concentrations exceeding the respective UUSCOs, but below the respective RRSCOs. Seven SVOCs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected at concentrations ranging between 0.62 mg/kg and 21 mg/kg, exceeding the respective UUSCOs and RRSCOs. The SVOC exceedances were generally polycyclic aromatic hydrocarbons (PAHs), which are a class of compounds found in some petroleum products, coal ash, and in other combustion products that are commonly found in urban fill, which was observed in each of the soil borings advanced during the investigation.

Metals were detected in each of the 20 soil samples analyzed during the investigation. Metals exceedances of UUSCOs and RRSCOs were not detected in soil samples SB-4 (4-6) or SB-5 (4-6). Up to six metals were detected in 18 of the soil samples at concentrations exceeding respective UUSCOs, but below respective RRSCOs. The metals arsenic (maximum concentration of 39 mg/kg), cadmium (maximum concentration of 5.1 mg/kg), copper (maximum concentration of 8,500 mg/kg), lead (maximum concentration of 14,000 mg/kg), and mercury (maximum concentration of 7.6 mg/kg), were detected at concentrations exceeding respective UUSCOs and RRSCOs. The metals exceedances are most likely attributable to historic fill material observed in each of the soil borings during the investigation, which often contain highly variable concentrations of metals.

One PCB, Aroclor 1254, was detected at a low-level estimated concentration of 0.012 mg/kg, below the total PCB UUSCO and RRSCO. No other PCBs were detected in any of the soil samples analyzed during the investigation. The presence of Aroclor 1254 is most likely attributable to the presence of historic fill material observed in the soil boring, and is not indicative of a spill or a release.

Pesticides were detected in 10 of the 20 soil samples analyzed during the investigation. One pesticide, 4,4',-DDD, was detected at a concentration of 0.00434 mg/kg, exceeding the respective UUSCO, but below the respective RRSCO. No other pesticides were detected above the respective UUSCOs or RRSCOs in any of the soil samples. The presence of 4,4',-DDD is most likely attributable to the presence of historic fill material observed in the soil boring, and is not indicative of a spill or a release.

7. Five groundwater samples were collected for laboratory analysis from temporary groundwater monitoring wells GW-1 through GW-5. Groundwater sample analytical results were compared to the New York State 6 NYCRR Part 703.5 Class GA Ambient Water Quality Standards (AWQS). VOCs were detected in each of the five groundwater samples analyzed during the investigation. 1,1-Dichlorethane was detected in groundwater sample GW-4 at a concentration of 14 µg/L, above the respective AWQS of 5 µg/L. Methyl tert-butyl ether (MTBE) was detected in groundwater samples GW-1 and GW-5 at concentrations of 20 µg/L and 48 µg/L, respectively, which exceeded the AWQS of 10 µg/L. No other VOCs were detected above AWQS in any of the groundwater samples analyzed during the investigation.

SVOCs were detected in four of the five groundwater samples analyzed during the investigation. SVOCs were not detected in groundwater sample GW-4. Three SVOCs [benzo(a)anthracene, benzo(b)fluoranthene, and chrysene] were detected in groundwater sample GW-2 at estimated concentrations between 0.05 µg/L and 0.18 µg/L, exceeding the AWQS of 0.002 µg/L for these

compounds. No other SVOCs were detected above AWQS in any of the groundwater samples analyzed during the investigation.

Metals were detected in each of the five groundwater samples analyzed during the investigation. Five metals (lead, magnesium, mercury, nickel, and sodium) were detected in the unfiltered samples at concentrations exceeding the respective AWQS. Of these, magnesium and sodium were detected in the filtered groundwater samples exceeding the respective AWQS. The presence of the metals in the unfiltered groundwater samples is likely a result of sediment entrained in the samples, which was observed during groundwater sampling at each of the five groundwater monitoring well sampling locations. The presence of these metals in the filtered groundwater samples are typical of groundwater quality in Brooklyn and do not appear to be related to a spill or release at the Site.

PCBs were not detected in any of the groundwater samples analyzed during the investigation.

Pesticides were detected in two of the five groundwater samples analyzed during the investigation. 4,4'-DDT was detected at a low-level estimated concentration in groundwater sample GW-2. Chlordane was detected at an estimated concentration of 0.116 µg/L in groundwater sample GW-4, above the respective AWQS of 0.05 µg/L. No other pesticides were detected in the groundwater samples analyzed during the investigation.

8. Seven soil vapor samples were collected for laboratory analysis from soil vapor points SV-1 through SV-7. Soil vapor sample analytical results were compared to the NYSDOH 2006 Guidance for Evaluating Soil Vapor Intrusion soil vapor intrusion air guidance values (AGVs) and matrices, the September 2013 NYSDOH Fact Sheet update for tetrachloroethene (PCE), and the August 2015 NYSDOH Fact Sheet update for trichloroethene (TCE).

A review of the soil vapor sample analytical results identified 31 VOCs detected in the seven soil vapor samples. VOCs associated with petroleum [including benzene, toluene, ethylbenzene, xylenes (collectively referred to as BTEX), 1,3-butadiene, 2-butanone, 1,3-dichlorobenzene, 1,2,4- and 1,3,5-trimethylbenzene, 2-hexanone, chloroethane, chloromethane, cyclohexane, ethyl alcohol, heptane, tert-butyl alcohol, hexane, styrene, 4-ethyltoluene, and 2,2,4-trimethylpentane] were detected at individual concentrations up to 279 micrograms per cubic meter (µg/m³). Solvent-related VOCs [including acetone, carbon disulfide, carbon tetrachloride, chloroform, dichlorodifluoromethane, isopropyl alcohol, PCE, TCE, trans-1,2-dichloroethene, trichlorofluoromethane, 1,1,1-trichloroethane, and 1,1-dichloroethane] were detected at individual concentrations up to 2,580 µg/m³.

PCE was detected in six of the seven soil vapor samples at concentrations up to 22.4 µg/m³, below the respective AGV of 30 µg/m³. TCE was detected in soil vapor samples SV-1 and SV-6 at concentrations of 14.6 µg/m³ and 46 µg/m³, respectively, above the AGV of 2 µg/m³.

Summary of the Remedial Action

The proposed remedial action achieves protection of public health and the environment for the intended use of the property. The proposed remedial action achieves all of the remedial action objectives established for the project and addresses applicable standards, criterion, and guidance; is effective in both the short-term and long-term; reduces mobility, toxicity, and volume of contaminants; is cost effective and implementable; and uses standards methods that are well established in the industry.

The proposed remedial action will consist of:

1. Preparation of a Community Protection Statement and performance of all required NYC VCP Citizen Participation activities according to an approved Citizen Participation Plan (CPP).
2. Performance of a Community Air Monitoring Plan (CAMP) for particulates and volatile organic compounds (VOCs).

3. Establishment of Track 4 Site-specific Soil Cleanup Objectives (SSSCOs).
4. Site mobilization involving Site security setup, equipment mobilization, utility mark outs, and marking & staking excavation areas.
5. Performance of a geophysical survey to identify underground utilities and/or underground storage tanks (USTs).
6. Performance of additional Site characterization sampling/delineation of soil at the locations of the four hotspot removal areas to confirm that elevated contaminant levels are removed.
7. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency dictated by disposal facility(s).
8. Excavation and removal of soil/fill exceeding Track 4 SSSCOs. Excavation is expected to extend to approximately 4 feet below grade at the location of the proposed building, to approximately 6 feet below grade at the location of the proposed covered parking garage, and to approximately 8 feet in the central portion of the Site for the installation of an elevator pit. Confirmatory endpoint sampling will be conducted at the location of the four hotspots identified during the RI. Soil will be excavated at those locations until analytical data meets Track 4 SSSCOs.
9. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a photoionization detector (PID). Appropriate segregation of excavated media on-site.
10. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent comingling of contaminated material and non-contaminated material.
11. Removal of all USTs that are encountered during soil/fill removal actions.
12. Registration of tanks and reporting of any petroleum spills and appropriate closure of these petroleum spills in compliance with applicable local, state, and federal laws and regulations.
13. Transportation and off-site disposal of all soil/fill material at licensed or permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Sampling and analysis of excavated media as required by disposal facilities. Appropriate segregation of excavated media on-site.
14. Collection and analysis of post-excavation samples at the bottom of the excavation to determine the performance of the remedy with respect to attainment of SCOs.
15. Demarcation of residual soil/fill in landscaped areas.
16. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.
17. Installation of an active sub-slab depressurization system (SSDS) consisting of a network of horizontal pipe set in the middle of a gas permeable layer immediately beneath the building slab and vapor barrier system. Four legs of horizontal piping will consist of slotted schedule 40 4-inch PVC pipe each connecting to solid schedule 40 PVC pipe underground and penetrating the slab, 4-inch galvanized steel above the slab and manifolded to a 6-inch galvanized steel riser pipe that travels through the building to the roof. The gas permeable layer will consist of a 6-inch thick layer of 2-inch trap rock stone. The riser will terminate on elevator bulkhead roof and connect to a blower and exhaust stack. The exhaust stack will terminate 10 feet above the roof and at least 12 inches above the parapet, and at least 15 feet from all windows, openings, air intakes, outdoor occupied spaces, etc.

- The SSDS blower and alarm system will be hard-wired into the building. Vacuum indicators and pressure gauges will be installed at the slab penetration and blower inlet. Flow meters will be installed at the manifold.
18. Installation of a vapor barrier system consisting of vapor barrier beneath the building slab and outside of sub-grade foundation sidewalls to grade to mitigate soil vapor migration into the building. The vapor barrier system will consist of a Grace Florprufe® 120R (21 mil) or equivalent membrane that meets or exceeds ASTM's E-1745 standard below the slab throughout the full building area and outside all sub-grade foundation sidewalls. All welds, seams, and penetrations will be properly sealed to prevent preferential pathways for vapor migration. The vapor barrier system is an Engineering Control (EC) for the remedial action. The remedial engineer will certify in the RAR that the vapor barrier system was designed and properly installed to mitigate soil vapor migration into the building.
 19. Construction of an engineered composite cover consisting of a concrete building slab beneath the proposed building foundation, asphalt/concrete pavement at the location of the proposed covered parking lot, and two feet of clean fill/topsoil in the proposed landscaped area along Eckford Street.
 20. Construction and operation of a grade-level covered parking garage with high volume air exchange in conformance with NYC Building Code.
 21. Performance of all activities required for the remedial action, including acquisition of required permits and attainment of pretreatment requirements, in compliance with applicable laws and regulations.
 22. Dewatering is not expected to be necessary during redevelopment at the Site. If dewatering becomes necessary, it will be conducted in compliance with city, state, and federal laws and regulations. Extracted groundwater will either be containerized for off-site licensed or permitted disposal or will be treated under a permit from New York City Department of Environmental Protection (NYCDEP) to meet pretreatment requirements prior to discharge to the sewer system.
 23. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
 24. Submission of a RAR that describes the remedial activities, certifies that the remedial requirements have been achieved, defines the Site boundaries, lists any changes from this RAWP, and describes all ECs and Institutional Controls (ICs) to be implemented at the Site.
 25. Submission of an approved Site Management Plan (SMP) in the RAR for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.
 26. The property will continue to be registered with an E-Designation with the NYC DOB. Establishment of ECs and ICs in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. ICs will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER-approval.

COMMUNITY PROTECTION STATEMENT

The NYC Office of Environmental Remediation (OER) provides governmental oversight for the cleanup of contaminated property in NYC. This Remedial Action Work Plan (“cleanup plan”) describes the findings of prior environmental studies, shows the location of identified contamination at the Site, and describes the plans to clean up the Site to protect public health and the environment.

This cleanup plan provides a very high level of protection for neighboring communities and also includes many other elements that address common community concerns, such as community air monitoring, odor, dust and noise controls, hours of operation, good housekeeping and cleanliness, truck management and routing, and opportunities for community participation. The purpose of this Community Protection Statement is to explain these community protection measures in non-technical language to simplify community review.

Project Information:

- Site Address: 470 Manhattan Avenue, Brooklyn, New York 11222
- NYC Voluntary Cleanup Program Project Number: 16CVCP030K
- Project Contacts:
 - OER Project Manager: Isabel McRae, (212) 341-2034
 - Site Project Manager: John Petrocelli, (631) 981-5200
 - Site Safety Officer: TBD
- Online Document Repository: TBD

Remedial Investigation and Cleanup Plan: Under the oversight of OER, a thorough study of this Site (called a remedial investigation) has been performed to identify past property usage; to sample and test soils, groundwater, and soil vapor; and to identify contaminant sources present on the property. The cleanup plan has been designed to address all contaminant sources that have been identified during the study of this Site.

Identification of Sensitive Land Uses: Prior to selecting a cleanup, the neighborhood was evaluated to identify sensitive land uses nearby, such as schools, day care facilities, hospitals, and residential areas. The cleanup program was then tailored to address the special conditions of this community.

Qualitative Human Health Exposure Assessment: An important part of the cleanup planning for the Site is a study to find all of the ways that people might come in contact with contaminants at the property now or in the future. This study is called a Qualitative Human Health Exposure Assessment (QHHEA). A QHHEA was performed for this project. This assessment has considered all known contamination at the Site and evaluated the potential for people to come in contact with this contamination. All identified public exposures will be addressed under this cleanup plan.

Health and Safety Plan: This cleanup plan includes a Construction Health and Safety Plan (CHASP) that is designed to protect community residents and on-site workers. The elements of this RAWP are in compliance with applicable safety requirements of the United States Occupational Safety and Health Administration (OSHA). This RAWP includes many protective elements including those discussed below.

Site Safety Coordinator: This project has a designated Site safety coordinator to implement the CHASP. The Site safety coordinator maintains an emergency contact sheet and protocol for management of emergencies. The Site safety coordinator is identified at the beginning of this Community Protection Statement.

Worker Training: Workers participating in cleanup of contaminated material on this project are required to be trained in a 40-hour hazardous waste operators training course and to take annual refresher training. This pertains to workers performing specific tasks including removing contaminated material and installing cleanup systems in contaminated areas.

Community Air Monitoring Plan: Community air monitoring will be performed during this cleanup project to ensure that the community is properly protected from contaminants, dust, and odors. Air samples will be tested in accordance with a detailed plan called the Community Air Monitoring Plan (CAMP). Results will be regularly reported to OER. This cleanup plan also has a plan to address any unforeseen problems that might occur during the cleanup (called a 'Contingency Plan').

Odor, Dust, and Noise Control: This cleanup plan includes actions for odor and dust control. These actions are designed to prevent off-site odor and dust nuisances and includes steps to be taken if nuisances are detected. Generally, dust is managed by application of physical covers and by water sprays. Odors are controlled by limiting the area of open excavations, physical covers, spray foams, and by a series of other actions called operational measures. The project is also required to comply with applicable NYC noise control standards. If you observe problems in these areas, please contact the on-site Project Manager or the OER Project Manager listed on the first page of this Community Protection Statement document.

Quality Assurance: This cleanup plan requires that evidence be provided to illustrate that all cleanup work required under the plan has been completed properly. This evidence will be summarized in the final report, called the Remedial Action Report (RAR). This report will be submitted to OER and will be thoroughly reviewed.

Stormwater Management: To limit the potential for soil erosion and discharge, this cleanup plan has provisions for stormwater management. The main elements of the stormwater management include physical barriers such as tarp covers and erosion fencing, and a program for frequent inspection.

Hours of Operation: The hours of operation of Site work will comply with the NYC Department of Buildings (DOB) construction code requirements or according to specific variances issued by that agency. For this cleanup project, the hours of operation will conform to requirements of the DOB.

Signage: While the cleanup is in progress, a placard will be prominently posted at the main entrance of the property with a laminated project Fact Sheet that states that the project is in the VCP and provides project contact names and numbers, and a link to the document repository where project documents can be viewed.

Complaint Management: The contractor performing this cleanup is required to address all complaints. If you have any complaints, you can call the facility Project Manager or the OER Project Manager listed on the first page of this Community Protection Statement document, or call 311 and mention the Site is in the VCP.

Utility Mark-Outs: To promote safety during excavation, the contractor is required to first identify all utilities and must perform all excavation and construction work in compliance with DOB regulations.

Soil and Liquid Disposal: All soil and liquid material removed from the Site as part of the cleanup will be transported and disposed of in accordance with all applicable city, state, and federal regulations. All required permits will be obtained.

Soil Chemical Testing and Screening: All excavations will be supervised by a trained and properly qualified environmental professional. In addition to extensive sampling and chemical testing of soils on the Site, excavated soil will be screened continuously using hand-held instruments, by sight, and by smell to ensure proper material handling and management and community protection.

Stockpile Management: Soil stockpiles will be kept covered with tarps to prevent dust, odor, and erosion. Stockpiles will be frequently inspected. Damaged tarp covers will be promptly replaced. Stockpiles will be protected with silt fences. Hay bales will be used, as needed, to protect storm water catch basins and other discharge points.

Trucks and Covers: Loaded trucks leaving the Site will be covered in compliance with applicable laws and regulations to prevent dust and odor. Trucks will be properly recorded in logs and records and placarded in compliance with applicable city, state, and federal laws, including those of the New York State Department of Transportation (DOT). If trucks hauling soil off-site contain wet material that can leak, truck liners will be used. All transport of materials will be performed by licensed truckers and in compliance with applicable laws and regulations.

Imported Material: All fill materials proposed to be brought onto the Site will comply with rules outlined in this cleanup plan and will be inspected and approved by a qualified worker located on the Site. Waste materials will not be brought onto the Site. Trucks entering the Site with imported clean materials will be covered in compliance with applicable laws and regulations.

Equipment Decontamination: All equipment used for cleanup work will be inspected and washed, if needed, before it leaves the Site. Trucks will be cleaned at a truck inspection station on the property before leaving the Site.

Housekeeping: Locations where trucks enter or leave the Site will be inspected every day and cleaned regularly to ensure that they are free of dirt and other materials from the Site.

Truck Routing: Truck routes have been selected to: (a) limit transport through residential areas and past sensitive nearby properties; (b) maximize use of city-mapped truck routes; (c) limit total distance to major highways; (d) promote safety in entry to highways; (e) promote overall safety in trucking; and (f) minimize off-site line-ups (queuing) of trucks entering the property. Operators of loaded trucks leaving the Site will be instructed not to stop or idle in the local neighborhood.

Final Report: The results of all cleanup work will be fully documented in a final report [called the Remedial Action Report (RAR)] that will be available for public review online. A link to the online document repository and the public library with internet access nearest the Site are listed on the first page of this Community Protection Statement document.

Long-Term Site Management: If long-term protection is needed after the cleanup is complete, the property owner will be required to comply with an ongoing Site Management Plan (SMP) that calls for continued inspection of protective controls, such as Site covers. The SMP is evaluated and approved by OER. Requirements that the property owner must comply with are defined either in the property's deed or established through a city environmental designation registered with the DOB. A certification of continued protectiveness of the cleanup will be required from time to time to show that the approved cleanup is still effective.

REMEDIAL ACTION WORK PLAN

1.0 PROJECT BACKGROUND

470 Manhattan Ave LLC is working with the NYC Office of Environmental Remediation (OER) in the New York City Voluntary Cleanup Program (VCP) and in the (E) Designation Program to investigate and remediate a property located at 470 Manhattan Avenue in the Greenpoint section of Brooklyn, New York, herein referred to as the “Site”. A Remedial Investigation (RI) was performed to compile and evaluate data and information necessary to develop this Remedial Action Work Plan (RAWP) in a manner that will render the Site protective of public health and the environment consistent with the contemplated end use. This RAWP establishes remedial action objectives (RAOs), provides a remedial alternatives analysis that includes consideration of a permanent cleanup, and provides a description of the selected remedial action. The remedial action described in this document provides for the protection of public health and the environment and complies with applicable environmental standards, criteria, and guidance, and applicable laws and regulations.

1.1 Site Location and Background

The Site is located at 470 Manhattan Avenue in the Greenpoint section in Brooklyn, New York and is identified as Block 2714 Lots 1, 30, 32, and 33 on the New York City Tax Map. Figure 1 shows the Site location. The Site is 31,450 square feet and is bounded by residential buildings to the northeast, Eckford Street to the northwest, residential buildings to the east, Newton Street to the south, and Manhattan Avenue to the west. The Site is currently a series of vacant undeveloped dirt lots and vacant buildings. A map of the Site boundary is shown on Figure 2.

1.2 Redevelopment Plan

The proposed development project consists of the demolition of the Site buildings and the construction of an at-grade seven-story building with mechanical space, amenities, and a lobby on the first floor, and 135 residential units above. Twenty percent of the residences will consist of affordable housing units. The 142,115-square foot proposed building will occupy the southern and western portion of the Site with 57 at-grade tenant parking spaces on the northern and eastern portions of the Site. Excavation is expected to extend to approximately 4 feet below grade at the location of the proposed building, to approximately 6 feet below grade at the location of the proposed covered parking garage, and to approximately 8 feet in the central portion of the Site for the installation of an elevator pit. A small landscaped area is proposed along the Eckford Street frontage of the building. The current zoning designation is M1-2/R6A (light manufacturing and residential), which is consistent with the proposed use. The proposed development plans are included as Appendix B.

The remedial action contemplated under this RAWP may be implemented independently of the proposed redevelopment plan.

1.3 Description of Surrounding Property

The Site is 31,450 square feet and is and is bounded is bounded by residential buildings to the northeast, Eckford Street to the northwest, residential buildings to the east, Newton Street to the south, and Manhattan Avenue to the west. The current zoning designation of the Site is M1-2/R6A (light manufacturing and residential). The surrounding area is primarily developed with residential, commercial, and manufacturing properties. Ericsson Playground and McCarren Park are located west of the Site across Manhattan Avenue. John Ericsson Middle School 126, Magnet School for Environmental Engineering, at 424 Leonard Street, is located approximately 270 feet southwest of the Site. A map showing surrounding land use is provided as Figure 3.

1.4 Summary of Past Site Uses and Areas of Concern

Historic uses at the Site include unspecified manufacturing, sash and door storage and a woodworking shop associated with I. Feldman & Son Inc. Sash & Door Manufacturing, a metal container manufacturer, and an enameling works with a baking oven and spray booths on Lot 1; a garage and an unspecified factory on Lot 30; freight and motor freight storage with a gasoline tank on Lot 32; and a barrel shed, a carriage garage, and a cooperage on Lot 33. Lots 30, 32, and 33 contain (E) Designations for hazardous materials listed in the Department of City Planning (E) Designation database established as part of the rezoning of Williamsburg and Greenpoint. The surrounding area was developed historically with residential, commercial, educational, manufacturing, automotive, and woodworking uses.

The Areas of Concern (AOCs) identified for the Site include:

1. Lots 30, 32, and 33 contain (E) Designations for hazardous materials listed in the Department of City Planning (E) Designation database established as part of the rezoning of Williamsburg and Greenpoint.
2. A vent and fill pipe were observed on the northeastern exterior wall of the three-story residential building on Lot 1 fronting Eckford Street. A vaulted 3,000-gallon No. 2 fuel oil AST was observed in the basement of the residential building on Lot 1.
3. Historic fill may be present at the Site.
4. The surrounding area was developed historically with residential, commercial, educational, manufacturing, automotive, and woodworking uses, including the Joseph Goetz Manhattan Cabinet Works, I. Feldman Sash and Door Manufacturing, unspecified manufacturing and warehouses, textile printing, cloth combining, a wire spring manufacturer, a cabinet finisher, a tin smith, a fuel oil company, a blacksmith, George N. Gardiner & Son Marine Paint Manufacturing, a beverage bottling, junk storage, Mesisel Danowitz & Company with associated planing and molding facilities, lumber storage and yards, kilns, cooperages, Atlantic Hardwood Company, an iron pipe warehouse, a metal works, lacquer spraying, a machine shed and shop, a motor grinder, a motor freight station, garages with gasoline tanks, trucking and parking facilities, tractor storage, a truck bay, and automotive repair, washing, and filling stations. Additionally, several properties in the surrounding area were listed in the Resource Conservation Recovery Act (RCRA), Petroleum Bulk Storage (PBS), Spills, (E) Designation, and Leaking Underground Storage Tank (LUST) databases. A groundwater monitoring well was observed east of the Site on the Graham Avenue sidewalk. The purpose of the monitoring well is not known, but may be related to current or historical off-site uses.
5. Historic on-site and off-site uses may have affected subsurface conditions at the Site.

1.5 Summary of Work Performed under the Remedial Investigation

AKRF performed the following scope of work on behalf of 470 Manhattan Ave LLC:

1. Conducted a Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Installed 10 soil borings across the Site, and collected 20 soil samples for chemical analysis from the soil borings to evaluate soil quality;
3. Installed five groundwater monitoring wells at the Site and collected five groundwater samples for chemical analysis to evaluate groundwater quality; and
4. Installed seven soil vapor probes at the Site and collected seven soil vapor samples and one ambient air sample for chemical analysis.

1.6 Summary of Findings of Remedial Investigation

A Remedial Investigation (RI) was performed and the results are documented in a companion document called "Remedial Investigation Report (RIR), 470 Manhattan Avenue, Block 2714, Lots 1, 30, 32, and 33, Brooklyn, New York" by AKRF, Inc. dated November 2015.

1. The Site is relatively level and lies at an elevation of approximately 16 feet above sea level.
2. Depth to groundwater ranges from 10.0 to 12.3 feet below grade at the Site.
3. Groundwater is expected to flow generally from east to west towards the East River.
4. Bedrock was not encountered during the RI.
5. The stratigraphy of the Site, from the surface down, consists of approximately 12 feet of historic fill, characterized by sand, gravel, silt, concrete, asphalt, brick, and ash. Below the historic fill is a sand, gravel, and silt stratum to the termination of each boring.
6. Twenty soil samples were collected for laboratory analysis from soil borings SB-1 through SB-10. Soil sample analytical results were compared to NYSDEC 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (UUSCOs) and Part 375 Soil Cleanup Objectives for Restricted Residential Soil Cleanup Objectives (RRSCOs). VOCs were detected in 16 of the 20 samples analyzed during the investigation. Acetone and benzene were detected above the respective UUSCOs but below the RRSCOs in two soil samples. No other VOCs were detected above UUSCOs or RRSCOs in any of the soil samples analyzed as part of the investigation.

SVOCs were detected in 19 of the 20 soil samples analyzed during the investigation. Total SVOC concentrations ranged between an estimated concentration of 1.98 mg/kg in soil sample SB-4 (4-6) and an estimated concentration of 291 mg/kg in soil sample SB-10 (4-6). Four SVOCs [3-methylphenol/4-methylphenol, benzo(k)fluoranthene, chrysene, and phenol] were detected in at least one soil sample at concentrations exceeding the respective UUSCOs, but below the respective RRSCOs. Seven SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were detected at concentrations ranging between 0.62 mg/kg and 21 mg/kg, exceeding the respective UUSCOs and RRSCOs. The SVOC exceedances were generally polycyclic aromatic hydrocarbons (PAHs), which are a class of compounds found in some petroleum products, coal ash, and in other combustion products that are commonly found in urban fill, which was observed in each of the soil borings advanced during the investigation.

Metals were detected in each of the 20 soil samples analyzed during the investigation. Metals exceedances of UUSCOs and RRSCOs were not detected in soil samples SB-4 (4-6) or SB-5 (4-6). Up to six metals were detected in 18 of the soil samples at concentrations exceeding respective UUSCOs, but below respective RRSCOs. The metals arsenic (maximum concentration of 39 mg/kg), cadmium (maximum concentration of 5.1 mg/kg), copper (maximum concentration of 8,500 mg/kg), lead (maximum concentration of 14,000 mg/kg), and mercury (maximum concentration of 7.6 mg/kg), were detected at concentrations exceeding respective UUSCOs and RRSCOs. The metals exceedances are most likely attributable to historic fill material observed in each of the soil borings during the investigation, which often contain highly variable concentrations of metals.

One PCB, Aroclor 1254, was detected at a low-level estimated concentration of 0.012 mg/kg, below the total PCB UUSCO and RRSCO. No other PCBs were detected in any of the soil samples analyzed during the investigation. The presence of Aroclor 1254 is most likely

attributable to the presence of historic fill material observed in the soil boring, and is not indicative of a spill or a release.

Pesticides were detected in 10 of the 20 soil samples analyzed during the investigation. One pesticide, 4,4',-DDD, was detected at a concentration of 0.00434 mg/kg, exceeding the respective UUSCO, but below the respective RRSCO. No other pesticides were detected above the respective UUSCOs or RRSCO in any of the soil samples. The presence of 4,4',-DDD is most likely attributable to the presence of historic fill material observed in the soil boring, and is not indicative of a spill or a release.

7. Five groundwater samples were collected for laboratory analysis from temporary groundwater monitoring wells GW-1 through GW-5. Groundwater sample analytical results were compared to the New York State 6 NYCRR Part 703.5 Class GA Ambient Water Quality Standards (AWQS). VOCs were detected in each of the five groundwater samples analyzed during the investigation. 1,1-Dichloroethane was detected in groundwater sample GW-4 at a concentration of 14 µg/L, above the respective AWQS of 5 µg/L. Methyl tert-butyl ether (MTBE) was detected in groundwater samples GW-1 and GW-5 at concentrations of 20 µg/L and 48 µg/L, respectively, which exceeded the AWQS of 10 µg/L. No other VOCs were detected above AWQS in any of the groundwater samples analyzed during the investigation.

SVOCs were detected in four of the five groundwater samples analyzed during the investigation. SVOCs were not detected in groundwater sample GW-4. Three SVOCs [benzo(a)anthracene, benzo(b)fluoranthene, and chrysene] were detected in groundwater sample GW-2 at estimated concentrations between 0.05 µg/L and 0.18 µg/L, exceeding the AWQS of 0.002 µg/L for these compounds. No other SVOCs were detected above AWQS in any of the groundwater samples analyzed during the investigation.

Metals were detected in each of the five groundwater samples analyzed during the investigation. Five metals (lead, magnesium, mercury, nickel, and sodium) were detected in the unfiltered samples at concentrations exceeding the respective AWQS. Of these, magnesium and sodium were detected in the filtered groundwater samples exceeding the respective AWQS. The presence of the metals in the unfiltered groundwater samples is likely a result of sediment entrained in the samples, which was observed during groundwater sampling at each of the five groundwater monitoring well sampling locations. The presence of these metals in the filtered groundwater samples are typical of groundwater quality in Brooklyn and do not appear to be related to a spill or release at the Site.

PCBs were not detected in any of the groundwater samples analyzed during the investigation.

Pesticides were detected in two of the five groundwater samples analyzed during the investigation. 4,4'-DDT was detected at a low-level estimated concentration in groundwater sample GW-2. Chlordane was detected at an estimated concentration of 0.116 µg/L in groundwater sample GW-4, above the respective AWQS of 0.05 µg/L. No other pesticides were detected in the groundwater samples analyzed during the investigation.

8. Seven soil vapor samples were collected for laboratory analysis from soil vapor points SV-1 through SV-7. Soil vapor sample analytical results were compared to the NYSDOH 2006 Guidance for Evaluating Soil Vapor Intrusion soil vapor intrusion air guidance values (AGVs) and matrices, the September 2013 NYSDOH Fact Sheet update for tetrachloroethene (PCE), and the August 2015 NYSDOH Fact Sheet update for trichloroethene (TCE).

A review of the soil vapor sample analytical results identified 31 VOCs detected in the seven soil vapor samples. VOCs associated with petroleum [including benzene, toluene, ethylbenzene, xylenes (collectively referred to as BTEX), 1,3-butadiene, 2-butanone, 1,3-

dichlorobenzene, 1,2,4- and 1,3,5-trimethylbenzene, 2-hexanone, chloroethane, chloromethane, cyclohexane, ethyl alcohol, heptane, tert-butyl alcohol, hexane, styrene, 4-ethyltoluene, and 2,2,4-trimethylpentane] were detected at individual concentrations up to 279 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Solvent-related VOCs [including acetone, carbon disulfide, carbon tetrachloride, chloroform, dichlorodifluoromethane, isopropyl alcohol, PCE, TCE, trans-1,2-dichloroethene, trichlorofluoromethane, 1,1,1-trichloroethane, and 1,1-dichloroethane] were detected at individual concentrations up to 2,580 $\mu\text{g}/\text{m}^3$.

PCE was detected in six of the seven soil vapor samples at concentrations up to 22.4 $\mu\text{g}/\text{m}^3$, below the respective AGV of 30 $\mu\text{g}/\text{m}^3$. TCE was detected in soil vapor samples SV-1 and SV-6 at concentrations of 14.6 $\mu\text{g}/\text{m}^3$ and 46 $\mu\text{g}/\text{m}^3$, respectively, above the AGV of 2 $\mu\text{g}/\text{m}^3$.

For more detailed results, consult the RIR. Based on an evaluation of the data and information from the RIR and this RAWP, waste classification sampling will be conducted to determine if disposal of significant amounts of hazardous waste will be expected at this Site.

2.0 REMEDIAL ACTION OBJECTIVES

Based on the results of the RI, the following remedial action objectives (RAOs) have been identified for the Site:

2.1 Soil

- Prevent direct contact with contaminated soil.
- Prevent exposure to contaminants volatilizing from contaminated soil.
- Prevent migration of contaminants that would result in groundwater or surface water contamination.

2.2 Groundwater

- Prevent exposure to contaminants volatilizing from contaminated groundwater.

2.3 Soil Vapor

- Prevent exposure to contaminants in soil vapor.
- Prevent migration of soil vapor into dwelling and other occupied structures.

3.0 REMEDIAL ALTERNATIVES ANALYSIS

The goal of the remedy selection process is to select a remedy that is protective of human health and the environment taking into consideration the current, intended, and reasonably anticipated future use of the Site. The remedy selection process begins by establishing RAOs for media in which chemical constituents were found in exceedance of applicable standards, criteria, and guidance values (SCGs). Remedial alternatives are then developed and evaluated based on the following ten criteria:

- Protection of human health and the environment;
- Compliance with SCGs;
- Short-term effectiveness and impacts;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contaminated material;
- Implementability;
- Cost effectiveness;
- Community acceptance;
- Land use; and
- Sustainability.

As required, a Track 1 Unrestricted Use scenario is evaluated for the remedial action. The following is a detailed description of the alternatives analyzed to address impacted media at the Site:

Alternative 1:

- Selection of New York State Department of Environmental Conservation (NYSDEC) 6NYCRR Part 375 Unrestricted Use (Track 1) Soil Cleanup Objectives (SCOs) (UUSCOs).
- Removal of all soil/fill exceeding Track 1 UUSCOs throughout the Site and confirmation that Track 1 UUSCOs have been achieved with post-excitation endpoint sampling. Based on the results of the RI, it is expected that this alternative would be achieved by excavation to at least 12 feet below grade to remove all historic fill. If soil/fill containing analytes at concentrations above UUSCOs is still present at the base of the excavation after removal of all soil required for construction of the new building foundation is complete, additional excavation would be performed to ensure complete removal of soil/fill that does not meet Track 1 UUSCOs.

Alternative 2:

- Establishment of Site-specific Track 4 SCOs (SSSCOs).
- Removal of all soil/fill exceeding Track 4 SSSCOs and confirmation that Track 4 SSSCOs have been achieved with post-excitation end point sampling. Based on the results of the RI, it is expected that this alternative would be achieved by excavating the four hotspots identified at the Site and collecting confirmatory endpoint samples. As part of development, soil beneath the proposed building foundation will be excavated to a depth of approximately 4 feet below grade, with excavation to a depth of approximately 8 feet below grade at the location of the proposed elevator pit. The northern and eastern portions of the Site will be graded for a covered parking lot. If soil/fill containing analytes at concentrations above Track 4 SSSCOs is still present at the base of the excavation, additional excavation would be performed to meet Track 4 SSSCOs.
- Placement of a composite cover system over the entire Site to prevent exposure to remaining soil/fill;
- Installation of a vapor barrier system beneath the building slab and along foundation side walls to prevent potential exposures from soil vapor;

- Installation of an active sub-slab depressurization system (SSDS);
- Establishment of use restrictions including prohibitions on the use of groundwater from the Site; prohibitions of restricted Site uses, such as farming or vegetable gardening, to prevent future exposure pathways; and prohibition of a higher level of land use without OER approval;
- Establishment of an approved SMP to ensure long-term management of these ECs and ICs, including the performance of periodic inspections and certification that the controls are performing as they were intended. The SMP will note that the property owner and property owner's successors and assigns must comply with the approved SMP; and
- The property will continue to be registered with an (E) Designation with the DOB.

3.1 Threshold Criteria—Protection of Public Health and the Environment

This criterion is an evaluation of the remedy's ability to protect public health and the environment, and an assessment of how risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, and implementation of ECs and/or ICs. Protection of public health and the environment must be achieved for all approved remedial actions.

Alternative 1 would be protective of human health and the environment by removing all soil/fill exceeding Track 1 UUSCOs and groundwater protection standards, thus eliminating potential for direct contact with contaminated soil/fill once construction is complete and eliminating the risk of contaminants leaching into groundwater.

Alternative 2 would achieve comparable protections of human health and the environment by excavation and removal of most of the historic fill at the Site to approximately 4 feet below grade at the location of the proposed building, to approximately 6 feet below grade at the location of the proposed covered parking garage, and to approximately 8 feet in the central portion of the Site for the installation of an elevator pit. Alternative 2 will ensure that remaining soil/fill on-site meets Track 4 SSSCOs, as well as by placement of ICs and/or ECs, including a composite cover system. The composite cover system would prevent direct contact with any remaining on-site soil/fill. Implementing ICs including a SMP and continuing the (E) Designation on the property would ensure that the composite cover system remains intact and protective of public health.

For both alternatives, potential exposure to contaminated soil during construction would be minimized by implementing a Construction Health and Safety Plan (CHASP), an approved Soil/Materials Management Plan (SMMP), and a Community Air Monitoring Plan (CAMP). Although groundwater is not expected to be encountered, potential contact with contaminated groundwater would be prevented as its use is prohibited by city laws and regulations. Potential future migration of soil vapors into the new building would be prevented by installing an active SSDS and a vapor barrier below the building slab and outside foundations walls below grade.

3.2 Balancing Criteria

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

This evaluation criterion assesses the ability of the alternative to achieve applicable standards, criteria, and guidance.

Alternative 1 would achieve compliance with the remedial goals, chemical-specific SCGs and RAOs for soil through removal of soil to achieve Track 1 UUSCOs and Protection of Groundwater SCOs. Compliance with SCGs for soil vapor would also be achieved by installing a vapor barrier and sub-slab depressurization system (SSDS) below the new building slab.

Alternative 2 would achieve compliance with the remedial goals, chemical-specific SCGs and RAOs for soil through removal of soil to meet Track 4 SSSCOs. Compliance with SCGs for soil vapor would also be achieved by installing a vapor barrier and active SSDS below the new building slab. A SMP would ensure that these controls remained protective for the long term. Health and safety measures contained in the CHASP and CAMP will be implemented during Site redevelopment under this RAWP. For both alternatives, focused attention on means and methods employed during the remedial action would ensure that handling and management of contaminated material would be in compliance with applicable SCGs. These measures will protect on-site workers and the surrounding community from exposure to Site-related contaminants.

3.2.2 Short-Term Effectiveness and Impacts

This evaluation criterion assesses the effects of the alternative during the construction and implementation phase until remedial action objectives are met. Under this criterion, alternatives are evaluated with respect to their short term effects during the remedial action on public health and the environment during implementation of the remedial action, including protection of the community, on-site workers, and the environment.

Both Alternative 1 and 2 have similar short-term effectiveness during their implementation, as each requires excavation of historic fill material. Both alternatives would result in short-term dust generation impacts associated with excavation, handling, load out of materials, and truck traffic. Short-term impacts would be higher for Alternative 1 since excavation of greater amounts of historical fill material would take place. However, focused attention to means and methods during a Track 1 removal action, including community air monitoring and appropriate truck routing, would minimize the overall impact of these activities.

An additional short-term adverse impact and risk to the community associated with both remedial alternatives is increased truck traffic. Truck traffic will be routed on the most direct course using major thoroughfares where possible and flag persons will be used to protect pedestrians at Site entrances and exits. Truck traffic would be greater for Alternative 1 than for Alternative 2 due to the greater amount of soil that would be excavated and disposed of off-site.

The potential adverse impact to the community, workers, and the environment for both alternatives would be minimized through implementation of control plans including a CHASP, a CAMP, and a SMMP during all on-site soil disturbance activities, which would minimize the release of contaminants into the environment. Both alternatives provide short-term effectiveness in protecting the surrounding community by decreasing the risk of contact with on-site contaminants. Construction workers operating under appropriate management procedures and a CHASP would provide protection from on-site contaminants by wearing Personal Protective Equipment (PPE) consistent with the documented risks within the respective work zones.

3.2.3 Long-Term Effectiveness and Permanence

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual contamination remaining at the Site after response objectives have been met, such as: permanence of the remedial alternative; magnitude of remaining contamination; adequacy of controls including the adequacy and suitability of ECs and/or ICs that may be used to manage contaminant residuals that remain at the Site; and assessment of containment systems and ICs that are designed to eliminate exposures to contaminants and long-term reliability of ECs.

Alternative 1 would achieve long-term effectiveness and permanence related to on-site contamination by permanently removing all impacted soil/fill above Track 1 UUSCOs. Removal of on-site contaminant sources would also prevent future groundwater contamination. Alternative 1 would not necessarily address potential vapor intrusion for an off-site source of contamination.

Alternative 2 would provide long-term effectiveness by removing most on-site contamination and attaining Track 4 SSSCOs; installing a composite cover system across the Site; maintaining use restrictions; establishing an SMP to ensure long-term management of ICs and ECs; and maintaining registration as an (E)-designated property to memorialize these controls for the long term. The SMP would ensure long-term effectiveness of all ECs and ICs by requiring periodic inspection and certification that these controls and restrictions continue to be in place and are functioning as they were intended, assuring that protections designed into the remedy continue to provide the required level of protection.

3.2.4 Reduction of Toxicity, Mobility, or Volume of Contaminated Material

This evaluation criterion assesses the remedial alternatives use of remedial technologies that permanently and significantly reduce toxicity, mobility, or volume of contaminants as their principal element. The following is the hierarchy of source removal and control measures that are to be used to remediate a Site, ranked from most preferable to least preferable: removal and/or treatment, containment, and elimination of exposure and treatment of source at the point of exposure. It is preferred to use treatment or removal to eliminate contaminants at a Site, reduce the total mass of toxic contaminants, cause irreversible reduction in contaminants mobility, or reduce of total volume of contaminated media.

Alternative 1 will permanently eliminate the toxicity, mobility, and volume of contaminants from on-site soil by removing all soil in excess of Track 1 UUSCOs.

Alternative 2 would remove historic fill at the Site to approximately 4 feet below grade at the location of the proposed building, to approximately 6 feet below grade at the location of the proposed covered parking garage, to approximately 8 feet in the central portion of the Site for the installation of an elevator pit, and variable depths for the four targeted hotspots. All remaining on-site soil/fill beneath the new building will meet Track 4 SSSCOs.

Based on the anticipated excavation depth for Alternative 2, Alternative 1 would remove a greater total mass of contaminants from the Site.

3.2.5 Implementability

This evaluation criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation, including technical feasibility of construction and operation, reliability of the selected technology, ease of undertaking remedial action, monitoring considerations, administrative feasibility (e.g. obtaining permits for remedial activities), and availability of services and materials.

The techniques, materials, and equipment to implement both Alternatives 1 and 2 are readily available and have been proven to be effective in remediating the contaminants present on the Site. They use standard equipment and technologies that are well established in the industry. The reliability of each remedy is also high.

Alternative 1 would likely require excavation below the water table, which would require a dewatering permit and handling of saturated soil.

There are no special difficulties associated with Alternative 2.

3.2.6 Cost Effectiveness

This evaluation criterion addresses the cost of alternatives, including capital costs (such as construction, equipment, disposal, and engineering costs) and Site management costs (costs incurred after remedial construction is complete) necessary to ensure the continued effectiveness of a remedial action.

Since historic fill at the Site was found to extend to a depth of at least 12 feet below grade during the RI, and the new building requires excavation to approximately 4 feet below grade at the location of the proposed building, to approximately 6 feet below grade at the location of the proposed covered parking garage, and to approximately 8 feet in the central portion of the Site for the installation of an elevator pit, and variable depths for the four targeted hotspots, the costs associated with Alternative 1 would be higher than Alternative 2. Additional costs would include installation of additional shoring/underpinning, disposal of additional soil, import of clean soil for backfill, and dewatering. However, long-term operation and maintenance costs for Alternative 2 are likely higher than Alternative 1 based on implementation of a SMP as part of Alternative 2.

The remedial plan would couple the remedial action with the redevelopment of the Site, lowering total costs. The remedial plan will also consider the selection of the most appropriate disposal facilities to reduce transportation and disposal costs during cleanup and redevelopment of the Site.

3.2.7 Community Acceptance

This evaluation criterion addresses community opinion and support for the remedial action. Observations here will be supplemented by public comment received on the RAWP.

This RAWP will be subject to a public review under the VCP and will provide the opportunity for detailed public input on the remedial alternatives and the selected remedy. This public comment will be considered by OER prior to approval of this plan. The CPP for the project is provided as Appendix B. Observations here will be supplemented by public comment received on the RAWP. Under both alternatives, the overall goals of the remedial program, to protect public health and the environment and eliminate potential contaminant exposures, have been broadly supported by citizens in NYC communities.

3.2.8 Land Use

This evaluation criterion addresses the proposed use of the property. This evaluation has considered reasonably anticipated future uses of the Site and takes into account: current use and historical and/or recent development patterns; applicable zoning laws and maps; New York State's Brownfield Opportunity Areas (BOA) pursuant to Section 970-r of the General Municipal Law; applicable land use plans; proximity to real property currently used for residential use, and to commercial, industrial, agricultural, and/or recreational areas; environmental justice impacts, federal or state land use designations; population growth patterns and projections; accessibility to existing infrastructure; proximity of the Site to important cultural resources and natural resources, potential vulnerability of

groundwater to contamination that might emanate from the Site, proximity to flood plains, geography, and geology; and current ICs applicable to the Site.

The current, intended, and reasonably anticipated future land use of the Site and its surroundings are compatible with the selected remedy of soil remediation. The proposed future use of the Site includes the construction of a seven-story building with mechanical space, amenities, and a lobby on the first floor and 135 residential units above. Twenty percent of the residences will consist of affordable housing units. The 142,115-square foot proposed building will occupy the southern and western portion of the Site with 57 tenant parking spaces on the northern and eastern portions of the Site. Excavation is expected to extend to approximately 4 feet below grade at the location of the proposed building, to approximately 6 feet below grade at the location of the proposed covered parking garage, and to approximately 8 feet in the central portion of the Site for the installation of an elevator pit. Following remediation, the Site will meet either Track 1 UUSCOs or Track 4 SSSCOs, both of which are protective of public health and the environment for its planned residential use. The proposed use is compliant with the property's zoning and is consistent with recent development patterns. The surrounding area is primarily developed with residential, commercial, and manufacturing properties. Ericsson Playground and McCarren Park are located west of the Site across Manhattan Avenue. John Ericsson Middle School 126, Magnet School for Environmental Engineering, is located southwest of the Site across Manhattan Avenue. The proposed development would clean up the property and make it safer; create new employment opportunities, living space for affordable and supportive housing, and associated societal benefits to the community; and other economic benefits from land revitalization.

Temporary short-term project impacts are being mitigated through Site management controls and truck traffic controls during remediation activities. Following remediation, the Site will meet either Track 1 UUSCOs or Track 4 SSSCOs, both of which are protective of public health and the environmental for its planned use.

The Site is not in close proximity to important cultural resources, including federal or state historic or heritage sites or Native American religious sites, natural resources, waterways, wildlife refuges, wetlands, or critical habitats of endangered or threatened species. The Site is located in an urban area and not in proximity to fish or wildlife and neither alternative would result in any potential exposure pathways of contaminant migration affecting fish or wildlife. The remedial action is also protective of groundwater natural resources. The Site does not lie in a Federal Emergency Management Agency (FEMA)-designated flood plain. Both alternatives are equally protective of natural resources and cultural resources. Improvements in the current environmental condition of the property achieved by both alternatives considered in this plan are consistent with the city's goals for cleanup of contaminated land.

3.2.9 Sustainability of the Remedial Action

This criterion evaluates the overall sustainability of the remedial action alternatives and the degree to which sustainable means are employed to implement the remedial action including those that take into consideration NYC's sustainability goals defined in PlaNYC: A Greener, Greater New York. Sustainability goals may include: maximizing the recycling and reuse of non-virgin materials; reducing the consumption of virgin and non-renewable resources; minimizing energy consumption and greenhouse gas emissions; improving energy efficiency; and promotion of the use of native vegetation and enhancing biodiversity during landscaping associated with Site development.

While Alternative 2 would potentially result in lower energy usage based on reducing the volume of material transported off-site, both remedial alternatives are comparable with respect to the opportunity to achieve sustainable remedial action. The remedial plan for either alternative would take into consideration the shortest trucking routes during off-site disposal of historic fill and other soils, which would reduce greenhouse gas emissions and conserve energy used to fuel trucks. The New York City Clean Soil Bank program is available for reuse of any clean native soils under either alternative. A complete list of green remedial activities considered as part of the VCP is included in a Sustainability Statement, provided as Appendix C.

4.0 REMEDIAL ACTION

4.1 Summary of Preferred Remedial Action

The preferred remedial action alternative is Alternative 2, the Track 4 remedial action. The preferred remedial action achieves protection of public health and the environment for the intended use of the property. The preferred remedial action will achieve all of the remedial action objectives established for the project and addresses applicable SCGs. The preferred remedial action is effective in both the short-term and long-term and reduces mobility, toxicity, and volume of contaminants. The preferred remedial action alternative is cost effective and implementable and uses standard methods that are well established in the industry.

The proposed remedial action will consist of:

1. Preparation of a Community Protection Statement and performance of all required NYC VCP Citizen Participation activities according to an approved CPP.
2. Performance of a CAMP for particulates and VOCs.
3. Establishment of Track 4 SSSCOs.
4. Site mobilization involving Site security setup, equipment mobilization, utility mark outs, and marking & staking excavation areas.
5. Performance a geophysical survey to identify underground utilities and/or USTs.
6. Performance of additional Site characterization sampling of soil at the locations of the four hotspot removal areas to confirm removal of contaminants.
7. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency dictated by disposal facility(s).
8. Excavation and removal of soil/fill exceeding Track 4 SSSCOs. Excavation is expected to extend to approximately 4 feet below grade at the location of the proposed building, to approximately 6 feet below grade at the location of the proposed covered parking garage, and to approximately 8 feet in the central portion of the Site for the installation of an elevator pit. Confirmatory endpoint sampling will be conducted at the location of the four hotspots identified during the RI. Soil will be excavated at those locations until analytical data meets Track 4 SSSCOs.
9. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a PID. Appropriate segregation of excavated media on-site.
10. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and non-contaminated materials.
11. Removal of all USTs that are encountered during soil/fill removal actions.
12. Registration of tanks and reporting of any petroleum spills and appropriate closure of these petroleum spills in compliance with applicable local, state, and federal laws and regulations.
13. Transportation and off-site disposal of all soil/fill material at licensed or permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Sampling and analysis of excavated media as required by disposal facilities. Appropriate segregation of excavated media on-site.

14. Collection and analysis of end-point samples to determine the performance of the remedy with respect to attainment of SCOs.
15. Demarcation of residual soil/fill in landscaped areas.
16. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.
17. Construction of an engineered composite cover consisting of a concrete building slab beneath the proposed building foundation and asphalt/concrete pavement at the location of the proposed covered parking lot.
18. Installation of a vapor barrier system consisting of vapor barrier beneath the building slab and outside of sub-grade foundation sidewalls to mitigate soil vapor migration into the building. The vapor barrier system will consist of a Grace Florprufe® 120R (21 mil) or equivalent membrane that meets or exceeds ASTM's E-1745 standard below the slab throughout the full building area and outside all sub-grade foundation sidewalls. All welds, seams, and penetrations will be properly sealed to prevent preferential pathways for vapor migration. The vapor barrier system is an EC for the remedial action. The remedial engineer will certify in the RAR that the vapor barrier system was designed and properly installed to mitigate soil vapor migration into the building.
19. Installation of an active sub-slab depressurization system (SSDS) consisting of a network of horizontal pipe set in the middle of a gas permeable layer immediately beneath the building slab and vapor barrier system. Four legs of horizontal piping will consist of slotted schedule 40 4-inch PVC pipe each connecting to solid schedule 40 PVC pipe underground and penetrating the slab, 4-inch galvanized steel above the slab and manifolded to a 6-inch galvanized steel riser pipe that travels through the building to the roof. The gas permeable layer will consist of a 6-inch thick layer of 2-inch trap rock stone. The riser will terminate on elevator bulkhead roof and connect to a blower and exhaust stack. The exhaust stack will terminate 10 feet above the roof and at least 12 inches above the parapet, and at least 15 feet from all windows, openings, air intakes, outdoor occupied spaces, etc. The SSDS blower and alarm system will be hard-wired into the building. Vacuum indicators and pressure gauges will be installed at the slab penetration and blower inlet. Flow meters will be installed at the manifold.
20. Construction and operation of a grade-level covered parking with high volume air exchange in conformance with NYC Building Code.
21. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.
22. Performance of all activities required for the remedial action, including acquisition of required permits and attainment of pretreatment requirements, in compliance with applicable laws and regulations.
23. Dewatering is not expected to be necessary during redevelopment at the Site. If dewatering becomes necessary, it will be conducted in compliance with city, state, and federal laws and regulations. Extracted groundwater will either be containerized for off-site licensed or permitted disposal or will be treated under a permit from New York City Department of Environmental Protection (NYCDEP) to meet pretreatment requirements prior to discharge to the sewer system.
24. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.

25. Submission of a RAR that describes the remedial activities, certifies that the remedial requirements have been achieved, defines the Site boundaries, lists any changes from this RAWP, and describes all ECs and ICs to be implemented at the Site.
26. Submission of an approved Site Management Plan (SMP) in the RAR for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.
27. The property will continue to be registered with an E-Designation with the NYC DOB. Establishment of ECs and ICs in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. ICs will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER-approval.

4.2 Soil Cleanup Objectives and Soil/ Fill Management

Track 2 Restricted Residential SCOs are proposed for this project and SCOs are defined in 6 NYCRR Part 375, Table 6.8 Track 2 Restricted Residential Use. Additionally, the following Track 4 SSSCOs will be utilized for this project:

Contaminant	Site-Specific SCOs
Total SVOCs	250 ppm
Lead	1,000 ppm
Mercury	3.5 ppm
Arsenic	32 ppm
Copper	1,720 ppm

ppm= parts per million

Soil and materials management on-site and off-site, including excavation, handling and disposal, will be conducted in accordance with the SMMP, provided as Appendix D. Discrete contaminant sources (such as hotspots) will be identified by GPS or surveyed. This information will be provided in the RAR.

4.2.1 Soil/Fill Excavation and Removal

Excavation is expected to extend to approximately 4 feet below grade at the location of the proposed building, to approximately 6 feet below grade at the location of the proposed covered parking garage, and to approximately 8 feet in the central portion of the Site for the installation of an elevator pit. The location of planned excavations is shown on Figure 4. The total quantity of soil/fill expected to be excavated and disposed off-site is 5,000 cubic yards. For each disposal facility to be used in the remedial action, a letter from the developer/QEP to the receiving facility requesting approval for disposal and a letter back to the developer/QEP providing approval for disposal will be submitted to OER prior to any transport and disposal of soil at a facility.

Disposal facilities will be reported to OER when they are identified and prior to the start of remedial action.

4.2.2 Endpoint Sampling

Endpoint samples will be analyzed for compounds and elements as described below utilizing the following methodology:

- Volatile organic compounds (VOCs) by EPA Method 8260;
- Semivolatile organic compounds (SVOCs) by EPA Method 8270;
- Target Analyte List (TAL) metals; and
- Pesticides/Polychlorinated Biphenyls (PCBs) by EPA Method 8081/8082.

New York State ELAP-certified labs will be used for all endpoint sample analyses. Labs performing endpoint sample analyses will be reported in the RAR. The RAR will provide a tabular and map summary of all endpoint sample results and will include all data including non-detects and applicable standards and/or guidance values.

4.2.3 Confirmation End-point Sampling

Removal actions for development purposes under this plan will be performed in conjunction with confirmation end-point soil sampling. Post-excavation confirmatory endpoint samples will be collected from the base of the excavation at the four hotspot locations. To evaluate attainment of Track 4 SSSCOs, analytes will include those for which SCOs have been developed, including total SVOCs, lead, mercury, arsenic, and copper according to analytical methods described above. If Track 1 UUSCOs are pursued, samples will be analyzed for VOCs, SVOCs, pesticides, PCBs, and metals according to analytical methods described above.

4.2.4 Hotspot End-point Sampling

End-point samples will be collected from the sidewalls and base of excavation at each of the four hotspot locations identified in the RI, according to the procedure listed below. Hotspots include soil samples SB-9 (4-6) for lead, SB-7 (0-2) for arsenic, SB-3 (0-2) for mercury, SB-10 (4-6) for total SVOCs, and SB-3 (0-2) for copper. End-point samples will be analyzed for SCO trigger parameters. Hotspots will be established as 10 foot by 10 foot excavation areas. The depth will be dependent upon sampling at the respective location. If necessary, hotspots will be extended laterally 5 feet and 2 feet in depth, based upon endpoint sampling results.

For any hotspots identified during this remedial program, including any hotspots identified during the remedial action, hotspot removal actions will be performed to ensure that hotspots are fully removed and end-point samples will be collected at the following frequency:

1. For excavations less than 20 feet in total perimeter, at least one bottom sample and one sidewall sample biased in the direction of surface runoff.
2. For excavations 20 to 300 feet in perimeter:
 - For surface removals, one sample from the top of each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area.
 - For subsurface removals, one sample from each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area.
3. For sampling of volatile organics, bottom samples should be taken within 24 hours of excavation, and should be taken from the zero to six-inch interval at the excavation floor. Samples taken after 24 hours should be taken at six to twelve inches.
4. For contaminated soil removal, post-remediation soil samples for laboratory analysis should be taken immediately after contaminated soil removal. If the excavation is

enlarged horizontally, additional soil samples will be taken pursuant to bullets 1 to 3 above.

Post-remediation end-point sample locations and depth will be biased towards the areas and depths of highest contamination identified during previous sampling episodes unless field indicators such as field instrument measurements or visual contamination identified during the remedial action indicate that other locations and depths may be more heavily contaminated. In all cases, post-remediation samples should be biased toward locations and depths of the highest expected contamination.

If either Light Non Aqueous Phase Liquid (LNAPL) and/or Dense Non Aqueous Phase Liquid (DNAPL) are detected, appropriate samples will be collected for characterization and “finger print analysis” and required regulatory reporting (i.e. spills hotline) will be performed.

4.2.5 Quality Assurance/Quality Control (QA/QC)

The following QA/QC will be conducted during sampling events:

- Sample collection apparatus
- Sampling methods
- Decontamination methods
- Sample containers
- Holding time
- Preservatives including temperature
- Lab blanks
- Detection levels
- Standards for comparative analysis

4.2.6 Import of Soils

Import of soils onto the Site will be performed in conformance with the SMMP, provided as Appendix D. Imported soil will meet the lower of:

- Track 2 Restricted Residential SCOs (RRSCOs) or Commercial SCOs; and
- Groundwater Protection Standards in Part 375-6.8.

The estimated quantity of soil to be imported into the Site in the area of the proposed landscaped area is 5,000 cubic yards at the location of the current three-story residential building basement and in the proposed landscaped area along Eckford Street. Figure 5 shows the composite site cover system plan for the Site.

4.2.7 Reuse of On-site Soils

Reuse of soil onsite is not anticipated. As a contingency, any reuse of onsite soils already onsite will be performed in conformance with the Soil/Materials Management Plan in Appendix D. Reuse soils will meet the SCO’s established for this project.

4.3 Engineering Controls (ECs)

ECs will be employed in the remedial action to address residual contamination remaining at the Site. The Site has three primary ECs. These are:

1. Composite Cover System
2. Soil Vapor Barrier System
3. Active Sub-Slab Depressurization System

4.3.1 Composite Cover System

Exposure to residual soil/fill will be prevented by an engineered, composite cover system to be built on the Site. This composite cover system will be comprised of a reinforced concrete slab underlain by 12 inches of clean sub-base material in building areas, 4 inches of asphalt or concrete pavement in parking areas, and 2 feet of clean soil in the proposed landscaped area along Eckford Street.

Figure 5 shows the typical design and location for each remedial cover type used on this Site. The composite cover system will be a permanent engineering control. The system will be inspected and its performance certified at specified intervals as required by this RAWP and the SMP. A SMMP will be included in the SMP and will outline the procedures to be followed in the event that the composite cover system and underlying residual soil/fill is disturbed after the remedial action is complete. Maintenance of this composite cover system will be described in the SMP in the RAR.

4.3.2 Vapor Barrier System

A vapor barrier system will be installed beneath the building slab and outside of sub-grade foundation sidewalls to mitigate soil vapor migration into the building. The vapor barrier system will consist of a Grace Florprufe® 120R (21 mil) or equivalent membrane that meets or exceeds ASTM's E-1745 standard below the slab throughout the full building area and outside all sub-grade foundation sidewalls. All welds, seams, and penetrations will be properly sealed to prevent preferential pathways for vapor migration. The vapor barrier system is an EC for the remedial action. The remedial engineer will certify in the RAR that the vapor barrier system was designed and properly installed to mitigate soil vapor migration into the building.

A plan view showing the location of the proposed vapor barrier system is provided on Figure 5. Typical design sections and product specification sheets for the vapor barrier are provided as Appendix E. The RAR will include as-built drawings and diagrams, manufacturer documentation, and installation photographs.

The RAR will include a PE-certified letter (on company letterhead) from the primary contractor responsible for installation oversight and field inspections and a copy of the manufacturer's certificate of warranty.

The vapor barrier is a permanent EC and will be inspected and its performance certified at specified intervals as required by this RAWP and the SMP. A SMMP will be included in the SMP and will outline the procedures to be followed in the event that the composite cover system and underlying vapor barrier system is disturbed after the remedial action is complete. Maintenance of these systems will be described in the SMP in the RAR.

4.3.3 Sub-Slab Depressurization System (SSDS)

An active SSDS consisting of a network of horizontal pipe set in the middle of a gas permeable layer will be installed immediately beneath the building slab and vapor barrier

system. Four legs of horizontal piping will consist of slotted schedule 40 4-inch PVC pipe. The piping will then transition to solid PVC piping penetrating the slab to 4-inch galvanized steel piping and manifolded to a 6-inch galvanized steel riser pipe that travels through the building to the roof. The gas permeable layer will consist of a 6-inch thick layer of 2-inch trap rock stone. The riser will terminate on the elevator bulkhead roof and connect to a blower and exhaust stack. The exhaust stack will terminate 10 feet above the roof and at least 12 inches above the parapet, and at least 15 feet from all windows, openings, air intakes, outdoor occupied spaces, etc. The SSDS blower and alarm system will be hard-wired into the building. Vacuum indicators and pressure gauges will be installed at the slab penetration and blower inlet. Flow meters will be provided at the manifold.

The SSDS is a permanent EC. The system will be inspected and its performance certified at specified intervals as required by this RAWP and the SMP. Maintenance of this SSDS will be described in the SMP in the RAR. The location and layout of the SSDS is shown in Appendix F.

4.4 Institutional Controls (ICs)

A series of ICs are required under this Remedial Action to assure permanent protection of public health by elimination of exposure to residual materials. These ICs define the program to operate, maintain, inspect, and certify the performance of ECs and ICs on the Site. ICs would be implemented in accordance with a SMP included in the RAR. ICs will include the following:

- Continued registration of the (E) Designation for the property. This RAWP includes a description of all ECs and ICs and summarizes the requirements of the SMP which will note that the property owner and property owner's successors and assigns must comply with the approved SMP;
- Submittal of a SMP in the RAR for approval by OER that provides procedures for appropriate operation, maintenance, inspection, and certification of ECs and ICs. The SMP will require that the property owner and property owner's successors and assigns will submit to OER a periodic written statement that certifies that: (1) controls employed at the Site are unchanged from the previous certification or that any changes to the controls were approved by OER; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. OER retains the right to enter the Site in order to evaluate the continued maintenance of any controls. This certification shall be submitted at a frequency to be determined by OER in the SMP and will comply with RCNY §43-1407(1)(3).
- Vegetable gardens and farming on the Site are prohibited in contact with residual soil materials;
- Use of groundwater underlying the Site is prohibited without treatment rendering it safe for its intended use;
- All future activities on the Site that will disturb residual material must be conducted pursuant to the soil management provisions in an approved SMP;
- The Site will be used for residential use and will not be used for a higher level of use without prior approval by OER.

4.5 Site Management Plan (SMP)

Site Management is the last phase of remediation and begins with the approval of the RAR and issuance of the Notice of Completion (NOC) for the Remedial Action. The SMP describes appropriate methods and procedures to ensure implementation of all ECs and ICs that are

required by this RAWP. The SMP is submitted as part of the RAR but will be written in a manner that allows its use as an independent document. Site Management continues until terminated in writing by OER. The property owner is responsible to ensure that all Site Management responsibilities defined in the SMP are implemented.

The SMP will provide a detailed description of the procedures required to manage residual soil/fill left in place following completion of the remedial action in accordance with the Voluntary Cleanup Agreement with OER. This includes a plan for: (1) implementation of ECs and ICs; (2) operation and maintenance of ECs; (3) inspection and certification of ICs and ECs.

Site management activities and EC/IC certification will be scheduled by OER on a periodic basis to be established in the RAR and the SMP and will be subject to review and modification by OER. The SMP will be based on a calendar year and certification reports will be due for submission to OER by July 30 of the year following the reporting period.

4.6 Qualitative Human Health Exposure Assessment

The objective of the qualitative exposure assessment is to identify potential receptors and pathways for human exposure to the contaminants of concern (COC) that are present at, or migrating from, the Site. The identification of exposure pathways describes the route that the COC takes to travel from the source to the receptor. An identified pathway indicates that the potential for exposure exists; it does not imply that exposures actually occur.

Data and information reported in the Remedial Investigation Report (RIR) are sufficient to complete a Qualitative Human Health Exposure Assessment (QHHEA) for this project. As part of the VCP process, a QHHEA was performed to determine whether the Site poses an existing or future health hazard to the Site's exposed or potentially exposed population. The sampling data from the RI were evaluated to determine whether there is any health risk under current and future conditions by characterizing the exposure setting, identifying exposure pathways, and evaluating contaminant fate and transport. This QHHEA was prepared in accordance with Appendix 3B and Section 3.3 (b) 8 of the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation.

4.6.1 Known and Potential Contaminant Sources

Based on the results of the RIR, the contaminants of concern are:

- Soil: SVOCs and metals above NYSDEC UUSCOs and RRSCO
- Groundwater: VOCs and total and dissolved metals above NYSDEC AWQS
- Soil Vapor: TCE above NYSDEC AGVs and petroleum-related contaminants including benzene, toluene, ethylbenzene, xylenes (collectively referred to as BTEX), 1,3-butadiene, 2-butanone, 1,3-dichlorobenzene, 1,2,4- and 1,3,5-trimethylbenzene, 2-hexanone, chloroethane, chloromethane, cyclohexane, ethyl alcohol, heptane, tert-butyl alcohol, hexane, styrene, 4-ethyltoluene, and 2,2,4-trimethylpentane.

4.6.2 Nature, Extent, Fate, and Transport of Contaminants

- Soil: SVOCs and metals were identified across the Site in shallow and deep soil samples above UUSCOs and RRSCO. The metal exceedances are likely attributable to historic fill material, which was observed in each of the soil borings advanced during the Remedial Investigation.
- Groundwater: VOCs and metals in total and dissolved groundwater samples were identified across the Site above AWQS. These exceedances are likely attributable to sediment entrained within samples, which was noted during sampling. Additionally,

an on-site gasoline tank may have contributed to VOC concentrations in groundwater.

- Soil Vapor: TCE was detected at two soil vapor locations on the northern and western portions of Lot 33 above the AGV. A Site source was not identified and these exceedances may be attributable to an off-site source. Additionally, an on-site gasoline tank may have contributed to non-chlorinated related VOC detections in soil vapor.

4.6.3 Receptor Populations

On-Site Receptors: The Site is currently a series of vacant undeveloped dirt lots and vacant buildings. Access to the Site is restricted by a locked, perimeter fence. On-site receptors are limited to trespassers and Site representatives and visitors granted access to the Site. During construction, potential on-site receptors include construction workers, Site representatives, and visitors. Under proposed future conditions, potential on-site receptors include adult and child building residents, workers, and visitors.

Off-Site Receptors: Potential off-site receptors within a 500 foot radius of the Site include: adult and child residents; commercial and construction workers; pedestrians; and trespassers based on the following land uses within 500 feet of the Site:

1. Commercial Businesses – existing and future
2. Residential Buildings – existing and future
3. Building Construction/ Renovation – existing and future
4. Pedestrians, Trespassers, Cyclists – existing and future
5. Schools – existing and future

4.6.4 Potential Routes of Exposure

Three potential primary routes exist by which chemicals can enter the body: ingestion, inhalation, and dermal absorption. Exposure can occur based on the following potential media:

- Ingestion of groundwater or fill/ soil;
- Inhalation of vapors or particulates; and
- Dermal absorption of groundwater or fill/ soil.

4.6.5 Potential Exposure Points

Current Conditions: The Site is currently a series of vacant undeveloped dirt lots and vacant buildings. Although the Site is fenced and locked, there is a potential exposure pathway from surface soil/fill to trespassers. Groundwater is not exposed at the Site. The Site is served by the public water supply and groundwater is not used at the Site for potable supply so there is no potential for exposure. Although Lot 1 at the Site is currently developed, the buildings are vacant.

Construction/ Remediation Conditions: During the remedial action, on-site workers will come into direct contact with surface and subsurface soils as a result of on-site construction and excavation activities. On-site construction workers potentially could ingest, inhale, or have dermal contact with exposed impacted soil and fill. Similarly, off-site receptors could be exposed to dust and vapors from on-site activities. Due to the depth of groundwater, direct contact with groundwater is not expected. During construction, on-site and off-site exposures to contaminated dust from on-site will be

addressed through the SMMP, dust controls, and through the implementation of the CAMP and CHASP.

Proposed Future Conditions: Under future remediated conditions, all soils in excess of Track 4 SCOs will be removed. The Site will be fully capped, preventing potential direct exposure to soil and groundwater remaining in place, and ECs (vapor barrier and SSDS) will prevent any potential exposure due to inhalation by preventing soil vapor intrusion. The Site is served by the public water supply, and groundwater is not used at the Site. There are no plausible off-site pathways for oral, inhalation, or dermal exposure to contaminants derived from the Site.

4.6.6 Overall Human Health Exposure Assessment

There are potential complete exposure pathways for the current Site condition. There are potential complete exposure pathways that require mitigation during implementation of the remedy. There are no complete exposure pathways under future conditions after the Site is developed. This assessment takes into consideration the reasonably anticipated use of the Site, which includes a residential structure, Site-wide surface cover, and a subsurface vapor barrier and an SSDS for the building. Under current conditions, on-site exposure pathways exist for those with access to the Site and trespassers. During remedial construction, on-site and off-site exposures to contaminated dust from historic fill material will be addressed through dust controls, and through the implementation of the CAMP, the SMMP, and the CHASP. Potential post-construction use of groundwater is not considered an option because groundwater in this area of NYC is not used as a potable water source. There are no surface waters in close proximity to the Site that could be impacted or threatened.

5.0 REMEDIAL ACTION MANAGEMENT

5.1 Project Organization and Oversight

Principal personnel who will participate in the remedial action is Marc Godick, LEP. The Professional Engineer (PE) for this project is Michelle Lapin.

5.2 Site Security

The Site will be completely closed from public access by using secured construction fencing. No unauthorized personnel will be able to access the Site. During off hours, the active portions of the Site will be completely enclosed within a locked gate. It is not anticipated that traffic will be disrupted beyond normal contractor vehicle traffic going to and from the Site during construction. Any sidewalk closures that are required during the course of construction/remediation activities will be conducted in accordance with DOT permits.

5.3 Work Hours

The hours for operation of cleanup will comply with the DOB construction code requirements or according to specific variances issued by that agency. The hours of operation will be conveyed to OER during the pre-construction meeting.

5.4 Construction Health and Safety Plan

The Construction Health and Safety Plan (CHASP) is included as Appendix G. The Site Safety Officer (SSO) will be Kevin Hennigan. Remedial work performed under this RAWP will be in full compliance with applicable health and safety laws and regulations, including Site and Occupation Safety and Health Administration (OSHA) worker safety requirements and Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) requirements. Confined space entry, if any, will comply with OSHA requirements and industry standards and will address potential risks. The parties performing the remedial construction work will ensure that performance of work is in compliance with the CHASP and applicable laws and regulations. The HASP pertains to remedial and invasive work performed at the Site until the issuance of the Notice of Completion.

All field personnel involved in remedial activities will participate in training required under 29 CFR 1910.120, such as 40-hour hazardous waste operator training and annual 8-hour refresher training. The SSO will be responsible for maintaining workers training records.

Personnel entering any exclusion zone will be trained in the provisions of the CHASP and will comply with all requirements of 29 CFR 1910.120. Site-specific training will be provided to field personnel. Additional safety training may be added depending on the tasks performed. Emergency telephone numbers will be posted at the Site location before any remedial work begins. A safety meeting will be conducted before each shift begins. Topics to be discussed include task hazards and protective measures (physical, chemical, environmental); emergency procedures; PPE levels; and other relevant safety topics. Meetings will be documented in a log book or specific form.

An emergency contact sheet with names and phone numbers is included in the CHASP. That document will define the specific project contacts for use in case of emergency.

5.5 Community Air Monitoring Plan (CAMP)

Real-time air monitoring for VOCs and particulate levels at the perimeter of the exclusion zone or work area will be performed. Continuous monitoring will be performed for all ground intrusive activities and during the handling of contaminated or potentially contaminated media. Ground

intrusive activities include, but are not limited to, soil/waste excavation and handling, test pit excavation or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be performed during non-intrusive activities such as the collection of soil, sediment, and/or groundwater samples. Periodic monitoring during sample collection, for instance, will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, during well bailing/purging, and taking a reading prior to leaving a sample location. Depending upon the proximity of potentially exposed individuals, continuous monitoring may be performed 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. Exceedances of action levels observed during performance of the CAMP will be reported to the OER project manager and included in the daily report.

5.5.1 VOC Monitoring, Response Levels, and Actions

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

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

All 15-minute readings must be recorded and be available for OER personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

5.5.2 Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM₁₀) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible alarm to

indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM₁₀ particulate level is 100 micrograms per cubic meter (μm^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 will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 μm^3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM₁₀ particulate levels are greater than 150 μm^3 above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM₁₀ particulate concentration to within 150 μm^3 of the upwind level and in preventing visible dust migration.

All readings will be recorded and be available for OER personnel to review.

5.6 Agency Approvals

All permits or government approvals required for remedial construction have been or will be obtained prior to the start of remedial construction. Approval of this RAWP by OER does not constitute satisfaction of these requirements and will not be a substitute for any required permit.

5.7 Site Preparation

5.7.1 Pre-Construction Meeting

OER will be invited to attend the pre-construction meeting at the Site with all parties involved in the remedial process prior to the start of remedial construction activities.

5.7.2 Mobilization

Mobilization will be conducted as necessary for each phase of work at the Site. Mobilization includes field personnel orientation, equipment mobilization (including securing all sampling equipment needed for the field investigation), marking/staking sampling locations, and utility mark-outs. Each field team member will attend an orientation meeting to become familiar with the general operation of the Site, health and safety requirements, and field procedures.

5.7.3 Utility Marker Layouts, Easement Layouts

The presence of utilities and easements on the Site will be fully investigated prior to the performance of invasive work such as excavation or drilling under this plan by using, at a minimum, the One-Call System (811). Underground utilities may pose an electrocution, explosion, or other hazard during excavation or drilling activities. All invasive activities will be performed in compliance with applicable laws and regulations including NYC Building Code to assure safety. Utility companies and other responsible authorities will be contacted to locate and mark the locations, and a copy of the mark-out ticket will be retained by the contractor prior to the start of drilling, excavation or other invasive subsurface operations. Overhead utilities may also be present within the anticipated work zones. Electrical hazards associated with drilling in the vicinity of overhead utilities will be prevented by maintaining a safe distance between overhead power lines and drill rig masts.

Proper safety and protective measures pertaining to utilities and easements, and compliance with all laws and regulations will be employed during invasive and other work contemplated under this RAWP. The integrity and safety of on-site and off-site structures will be maintained during all invasive, excavation or other remedial activity performed under the RAWP.

5.7.4 Dewatering

Dewatering is not anticipated during remediation and construction.

5.7.5 Equipment and Material Staging

Equipment and materials will be stored and staged in a manner that complies with applicable laws and regulations.

5.7.6 Stabilized Construction Entrance

Steps will be taken to ensure that trucks departing the Site will not track soil, fill, or debris off-site. Such actions may include use of cleaned asphalt or concrete pads or use of stone or other aggregate-based egress paths between the truck inspection station and the property exit. Measures will be taken to ensure that adjacent roadways will be kept clean of project related soils, fill, and debris.

5.7.7 Truck Inspection Station

An outbound truck inspection station will be set up close to the Site exit. Before exiting the Site, trucks will be required to stop at the truck inspection station and will be examined for evidence of contaminated soil on the undercarriage, body, and wheels. Soil and debris will be removed. Brooms, shovels, and/or clean water will be utilized for the removal of soil from vehicles and equipment, as necessary.

5.7.8 Extreme Storm Preparedness and Response Contingency Plan

Damage from flooding or storm surge can include dislocation of soil and stockpiled materials, dislocation of Site structures and construction materials and equipment, and dislocation of support of excavation structures. Damage from wind during an extreme storm event can create unsafe or unstable structures, damage safety structures, and cause downed power lines creating dangerous Site conditions and loss of power. In the event of emergency conditions caused by an extreme storm event, the enrollee will undertake the following steps for site preparedness prior to the event and response after the event.

5.7.9 Storm Preparedness

Preparations in advance of an extreme storm event will include the following: containerized hazardous materials and fuels will be removed from the property; loose materials will be secured to prevent dislocation and blowing by wind or water; heavy equipment such as excavators and generators will be removed from excavated areas, trenches and depressions on the property to high ground or removed from the property; an inventory of the property with photographs will be performed to establish conditions for the site and equipment prior to the event; stockpile covers for soil and fill will be secured by adding weights such as sandbags for added security and worn or ripped stockpile covers will be replaced with competent covers; stockpiled hazardous wastes will be removed from the property; stormwater management systems will be inspected and fortified, including, as necessary: clean and reposition silt fences, hay bales, clean storm sewer filters and traps, and secure and protect pumps and hosing.

5.7.10 Storm Response

At the conclusion of an extreme storm event, as soon as it is safe to access the property, a complete inspection of the property will be performed. A Site inspection report will be submitted to OER at the completion of Site inspection and after the Site security is assessed. Site conditions will be compared to the inventory of Site conditions and material performed prior to the storm event and significant differences will be noted. Damage from storm conditions that result in acute public safety threats, such as downed power lines or imminent collapse of buildings, structures or equipment will be reported to public safety authorities via appropriate means such as calling 911. Petroleum spills will be reported to NYSDEC within two hours of identification and consistent with state regulations. Emergency and spill conditions will also be reported to OER. Public safety structures, such as construction security fences, will be repaired promptly to eliminate public safety threats. Debris will be collected and removed. Dewatering will be performed in compliance with existing laws and regulations and consistent with emergency notifications, if any, from proper authorities. Eroded areas of soil including unsafe slopes will be stabilized and fortified. Dislocated materials will be collected and appropriately managed. Support of excavation structure will be inspected and fortified as necessary. Impacted stockpiles will be contained and damaged stockpile covers will be replaced. Stormwater control systems and structures will be inspected and maintained as necessary. If soil or fill materials are discharged off-site to adjacent properties, property owners and OER will be notified and corrective measure plan designed to remove and clean dislocated material will be submitted to OER and implemented following approval by OER and granting of Site access by the property owner. Impacted off-site areas may require characterization based on Site conditions, at the discretion of OER. If onsite petroleum spills are identified, a qualified environmental professional will determine the nature and extent of the spill and report to NYSDEC's spill hotline at DEC 800-457-7362 within statutory defined timelines. If the source of the spill is ongoing and can be identified, it should be stopped if this can be done safely. Potential hazards will be addressed immediately, consistent with guidance issued by NYSDEC.

5.7.11 Storm Response Reporting

A Site inspection report will be submitted to OER at the completion of site inspection. An inspection report established by OER is available on OER's website (www.nyc.gov/oer) and will be used for this purpose. Site conditions will be compared to the inventory of Site conditions and material performed prior to the storm event and significant differences will be noted. The Site inspection report will be sent to the OER project manager and will include the Site name, address, tax block and lot, Site primary and alternate contact name and phone number. Damage and soil release assessment will include: whether the project had stockpiles; whether stockpiles were damaged; photographs of damage and notice of plan for repair; report of whether soil from the Site was dislocated and whether any of the soil left the Site; estimates of the volume of soil that left the Site, nature of impact, and photographs; description of erosion damage; description of equipment damage; description of damage to the remedial program or the construction program, such as damage to the support of excavation; presence of on-site or off-site exposure pathways caused by the storm; presence of petroleum or other spills and status of spill reporting to the NYSDEC; description of corrective actions; schedule for corrective actions. This report should be completed and submitted to OER project manager with photographs within 24 hours of the time of safe entry to the property after the storm event.

5.8 Traffic Control

Drivers of trucks leaving the Site with soil/fill will be instructed to proceed without stopping in the vicinity of the Site to prevent neighborhood impacts. The planned route on local roads for trucks leaving the Site is shown on Figure 6.

5.9 Demobilization

Demobilization will include:

- As necessary, restoration of temporary access areas and areas that may have been disturbed to accommodate support areas (e.g., staging areas, decontamination areas, storage areas, temporary water management areas, and access area);
- Removal of sediment from erosion control measures and truck wash and disposal of materials in accordance with applicable laws and regulations;
- Equipment decontamination; and
- General refuse disposal.

Equipment will be decontaminated and demobilized at the completion of all field activities. Investigation equipment and large equipment (e.g., soil excavators) will be washed at the truck inspection station as necessary. In addition, all investigation and remediation derived waste will be appropriately disposed.

5.10 Reporting and Record Keeping

5.10.1 Daily reports

Daily reports providing a general summary of activities for each day of active remedial work will be emailed to the OER project manager by the end of the following business day. Those reports will include:

- Project number and statement of the activities and an update of progress made and locations of excavation and other remedial work performed;
- Quantities of material imported and exported from the Site;
- Status of on-site soil/fill stockpiles;
- A summary of all citizen complaints, with relevant details (basis of complaint; actions taken; etc.);
- A summary of CAMP results noting all excursions (CAMP data may be reported); and
- Photographs of notable Site conditions and activities.

The frequency of the reporting period may be revised in consultation with OER project manager based on planned project tasks. Daily email reports are not intended to be the primary mode of communication for notification to OER of emergencies (accidents, spills), requests for changes to the RAWP, or other sensitive or time critical information. However, such information will be included in the daily reports. Emergency conditions and changes to the RAWP will be communicated directly to the OER project manager by personal communication. Daily reports will be included as an appendix in the RAR.

5.10.2 Record Keeping and Photo Documentation

Site record keeping for all remedial work will be performed. These records will be maintained on-site during the project and will be available for inspection by OER staff. Representative photographs will be taken of the Site prior to any remedial activities and

during major remedial activities to illustrate remedial program elements and contaminant source areas. Photographs will be submitted at the completion of the project in the RAR in digital format (i.e., jpeg files).

5.11 Complaint Management

All complaints from citizens will be promptly reported to OER. Complaints will be addressed and outcomes will also be reported to OER in daily reports. Notices to OER will include the nature of the complaint, the party providing the complaint, and the actions taken to resolve any problems.

5.12 Deviations From The Remedial Action Work Plan

All changes to the RAWP will be reported to, and approved by, the OER project manager and will be documented in daily reports and reported in the RAR. The process to be followed if there are any deviations from the RAWP will include a request for approval for the change from OER noting the following:

- Reasons for deviating from the approved RAWP;
- Effect of the deviations on overall remedy; and
- Determination with basis that the remedial action with the deviation(s) is protective of public health and the environment.

6.0 REMEDIAL ACTION REPORT (RAR)

A RAR will be submitted to OER following implementation of the remedial action defined in this RAWP. The RAR will document that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The RAR will include:

- Information required by this RAWP;
- Text description with thorough detail of all ECs and ICs;
- As-built drawings for all constructed remedial elements;
- Manifests for all soil or fill disposal;
- Photographic documentation of remedial work performed under this remedy;
- SMP;
- Description of any changes in the remedial action from the elements provided in this RAWP and associated design documents;
- Tabular summary of all end point sampling results (including all soil test results from the remedial investigation for soil that will remain on Site) and all soil/fill waste characterization results, QA/QC results for all sampling and chemical analysis performed as part of the remedial action;
- Test results or other evidence demonstrating that remedial systems are functioning properly;
- Account of the source area locations and characteristics of all soil or fill material removed from the Site including a map showing the location of these excavations and hotspots, tanks, or other contaminant source areas;
- Full accounting of the disposal destination of all contaminated material removed from the Site. Documentation associated with disposal of all material will include transportation and disposal records, and letters approving receipt of the material;
- Account of the origin and required chemical quality testing for material imported onto the Site;
- Continue registration of the property with an (E) Designation by DOB;
- The RAWP and RIR will be included as appendices to the RAR; and
- Reports and supporting material will be submitted in digital form and final PDFs will include bookmarks for each appendix.

REMEDIAL ACTION REPORT CERTIFICATION

I, Michelle Lapin, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for implementation of the remedial program for the 470 Manhattan Avenue Site. I certify to the following:

- I have reviewed this document, to which my signature and seal are affixed.
- Engineering Controls implemented during this remedial action were designed by me or a person under my direct supervision and achieve the goals established in the Remedial Action Work Plan for this Site.
- The Engineering Controls constructed during this remedial action were professionally observed by me or by a person under my direct supervision and (1) are consistent with the Engineering Control design established in the Remedial action Work Plan and (2) are accurately reflected in the text and drawings for as-built design reported in this Remedial Action Report.
- The OER-approved Remedial Action Work Plan dated [date] and Stipulations in a letter dated [date] were implemented and that all requirements in those documents have been substantively complied with. I certify that contaminated soil, fill, liquids or other material from the property were taken to facilities licensed to accept this material in full compliance with applicable laws and regulations.

Michelle Lapin, P.E.

Name

PE License Number

Signature

Date

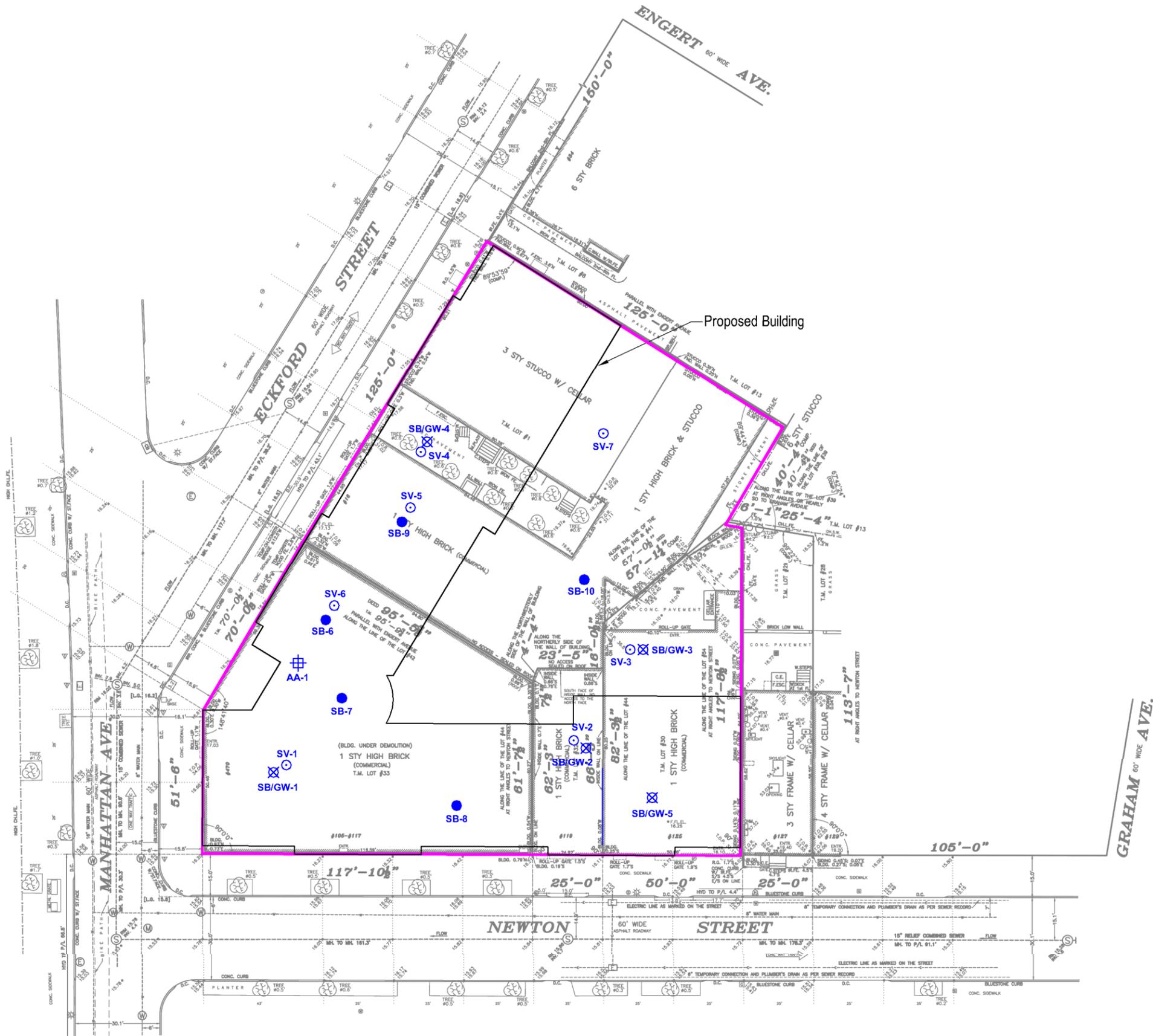
PE Stamp

7.0 SCHEDULE

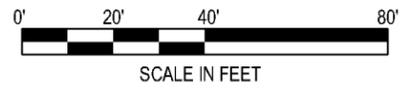
The table below presents a schedule for the proposed remedial action and reporting. If the schedule for remediation and development activities changes, it will be updated and submitted to OER. Currently, a four month remediation period is anticipated.

Schedule Milestone	Weeks from Remedial Action Start	Duration (weeks)
OER Approval of RAWP	0	1
Fact Sheet 2 announcing start of remedy	0	1
Mobilization	1	1
Remedial Excavation	1	6
Demobilization	17	1
Submit Remedial Action Report	40	22

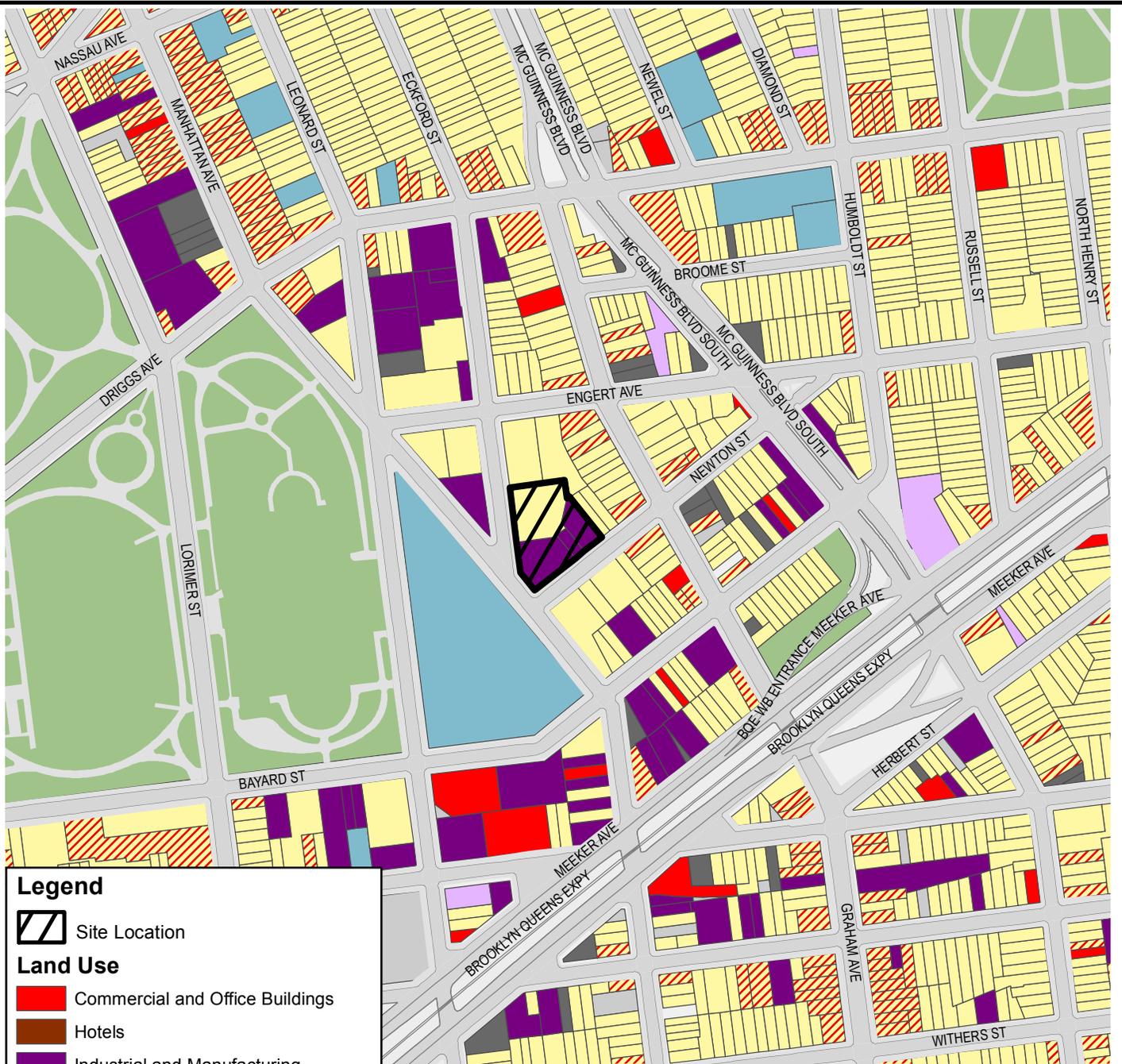
FIGURES



- LEGEND:**
- PROJECT SITE BOUNDARY
 - SOIL BORING LOCATION
 - SOIL VAPOR POINT LOCATION
 - ⊗ SOIL BORING/GROUNDWATER LOCATION
 - ⊕ AMBIENT AIR LOCATION



Map Source:
Geoland Land Surveying P.C., "Block 2714, Lot 1, 30, 32 & 33", Dated 09-016-2015.



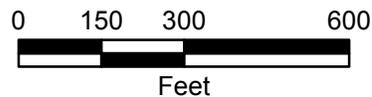
Source: NYCDCP (NYC Dept. of City Planning) GIS database

Legend

 Site Location

Land Use

-  Commercial and Office Buildings
-  Hotels
-  Industrial and Manufacturing
-  Open Space and Outdoor Recreation
-  Parking Facilities
-  Public Facilities and Institutions
-  Residential
-  Residential with Commercial Below
-  Transportation and Utility
-  Vacant Land
-  Vacant Building
-  Under Construction



470 Manhattan Avenue
Block 2714, Lots 1, 30, 32, and 33
 Brooklyn, New York



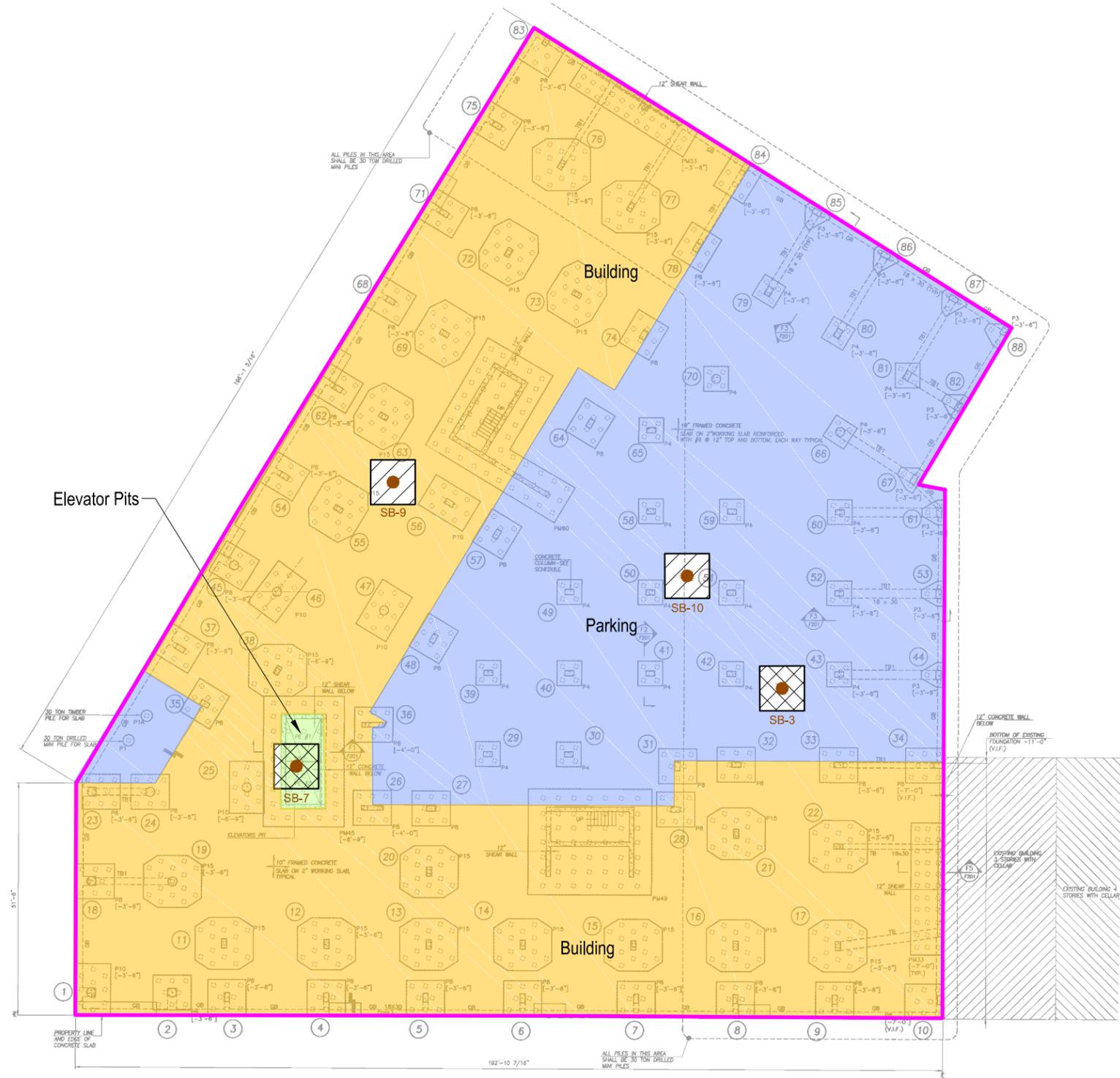
Environmental Consultants
 440 Park Avenue South, New York, N.Y. 10016

DATE
10/14/2015

PROJECT No.
12306

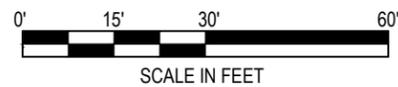
FIGURE
3

SURROUNDING LAND USE



LEGEND:

-  PROJECT SITE BOUNDARY
-  APPROXIMATE EXTENT OF EXCAVATION FOR ELEVATOR PITS (8' BELOW GRADE)
-  APPROXIMATE EXTENT OF GRADING FOR PARKING
-  APPROXIMATE EXTENT OF EXCAVATION FOR PROPOSED BUILDING FOUNDATION (3' - 4' BELOW GRADE)
-  APPROXIMATE EXTENT OF EXCAVATION FOR HOTSPOT TO 7' BELOW GRADE
-  APPROXIMATE EXTENT OF EXCAVATION FOR HOTSPOT TO 3' BELOW GRADE
-  SOIL BORING LOCATION

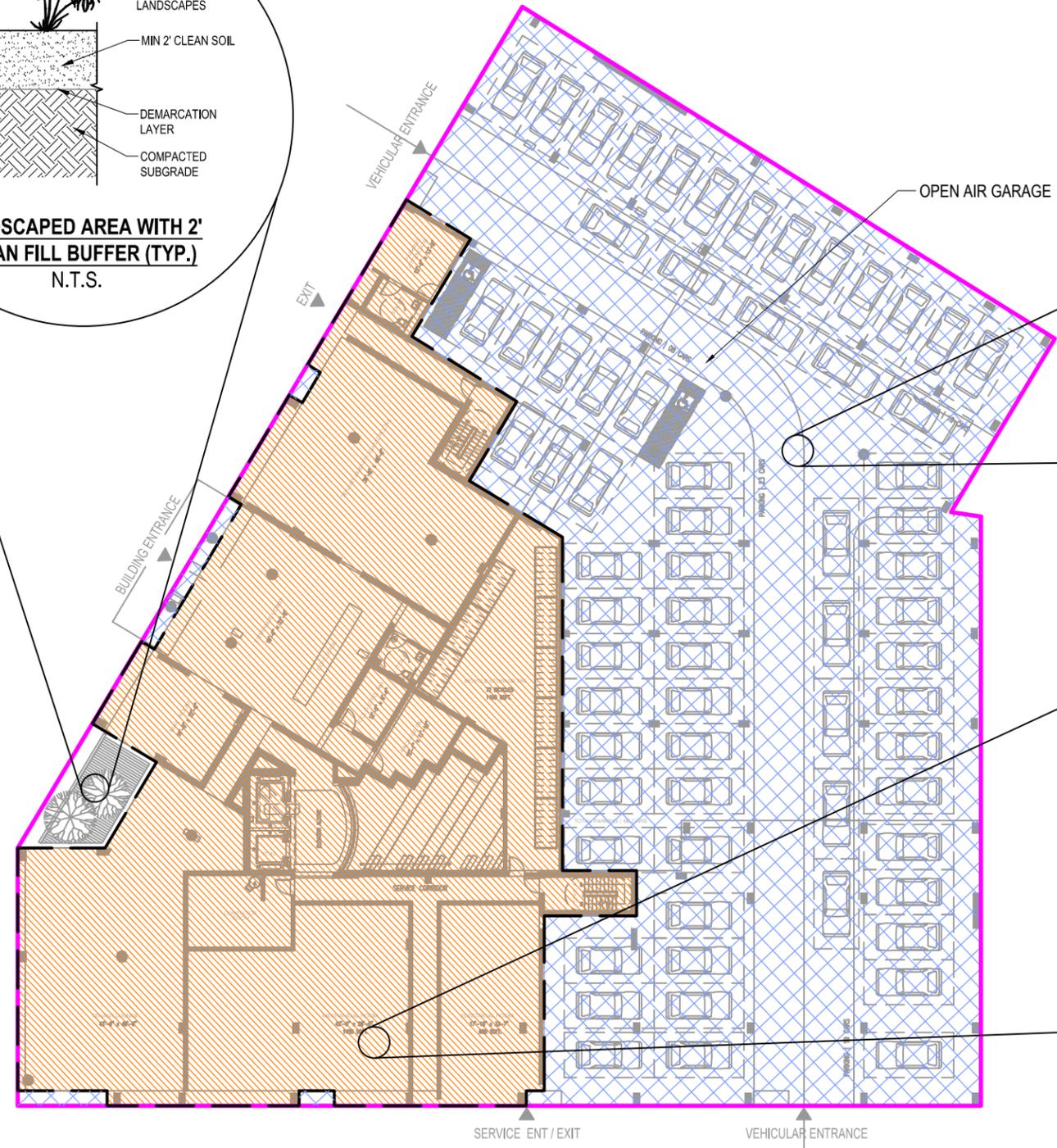
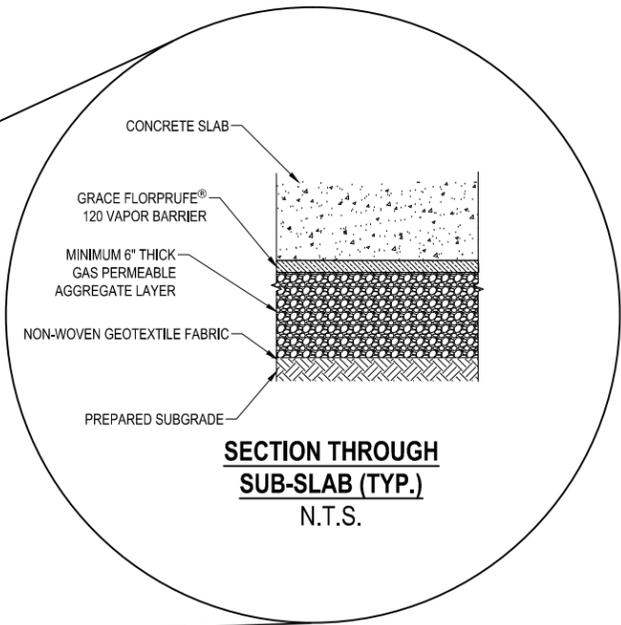
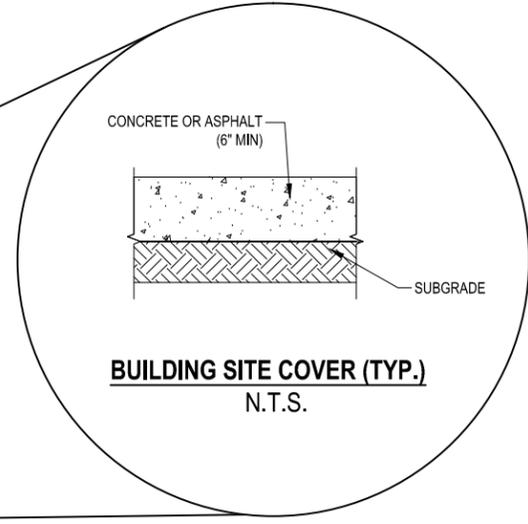
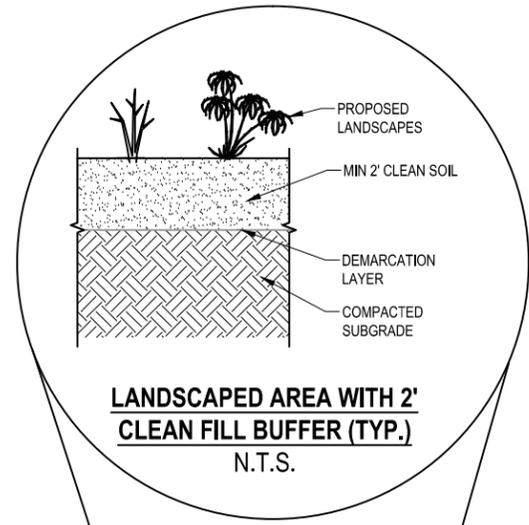


SOURCE:
Based on Figure FO-100, FOUNDATION FRAMING PLAN,
Prepared by GHWA, Inc
11 Broadway, Suite 1700
New York, New York
July 2015

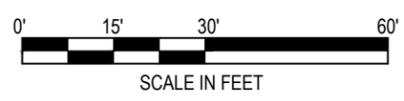


DATE	10/26/2015
PROJECT NO.	12306
SCALE	as shown
FIGURE	4

© 2015 AKRF, Inc. Environmental Consultants W:\Projects\12306 - 470 MANHATTAN AVENUE\Technical\Hazmat\Drawings\Remedial Investigation\12306 Fig 5 RAWP Site Cover REVISED.dwg



SOURCE:
Based on Figure A-100.00, FIRST FLOOR PLAN,
Prepared by GHWA, Inc
11 Broadway, Suite 1700
New York, New York
July 2015



- LEGEND:**
- PROJECT SITE BOUNDARY
 - APPROXIMATE EXTENT OF PROPOSED BUILDING
 - BUILDING SITE COVER
 - CONCRETE OR ASPHALT

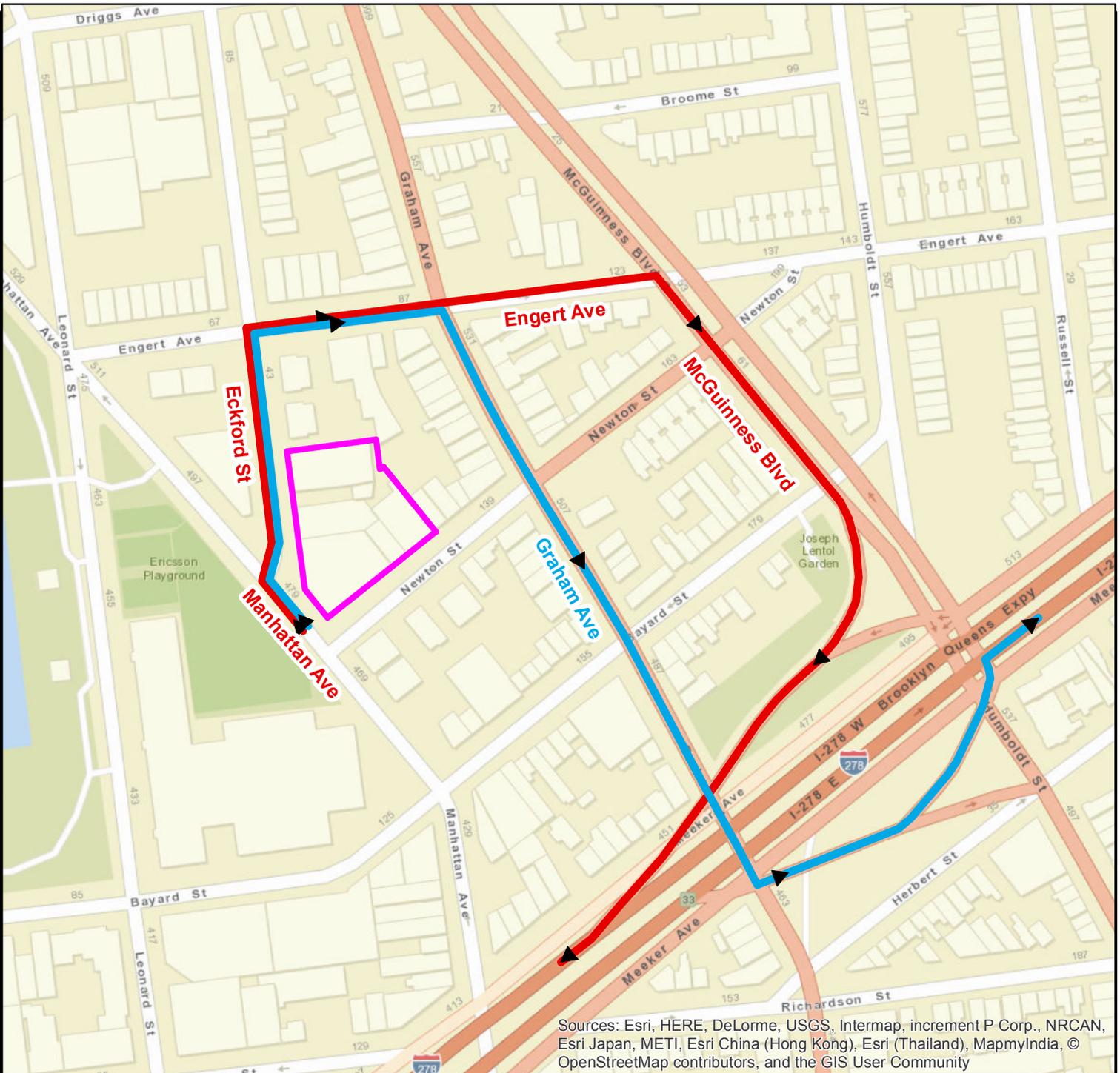


AKRF
Environmental Consultants
440 Park Avenue South, New York, NY 10016

470 Manhattan Avenue
Block 2714, Lots 1, 30, 32, and 33
Brooklyn, New York

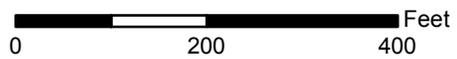
COMPOSITE SITE COVER SYSTEM

DATE	11/4/2015
PROJECT NO.	12306
SCALE	as shown
FIGURE	5



Legend

- Project Site Location
- Exit Truck Route 278 West
- Exit Truck Route 278 East



470 Manhattan Avenue
Block 2714, Lots 1, 30, 32, and 33
 Brooklyn, New York



Environmental Consultants
 440 Park Avenue South, New York, N.Y. 10016

DATE
10/26/2015

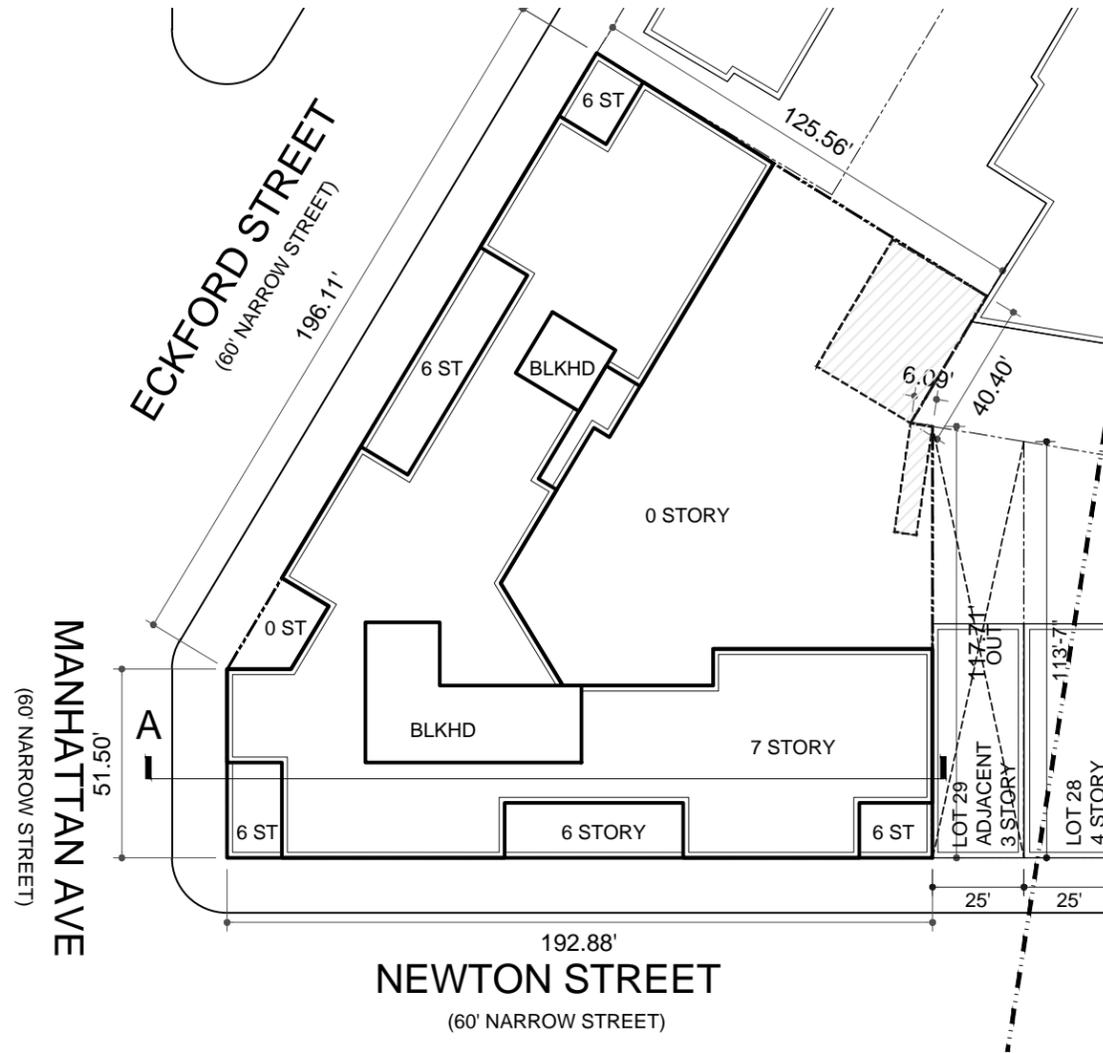
PROJECT No.
12306

FIGURE
6

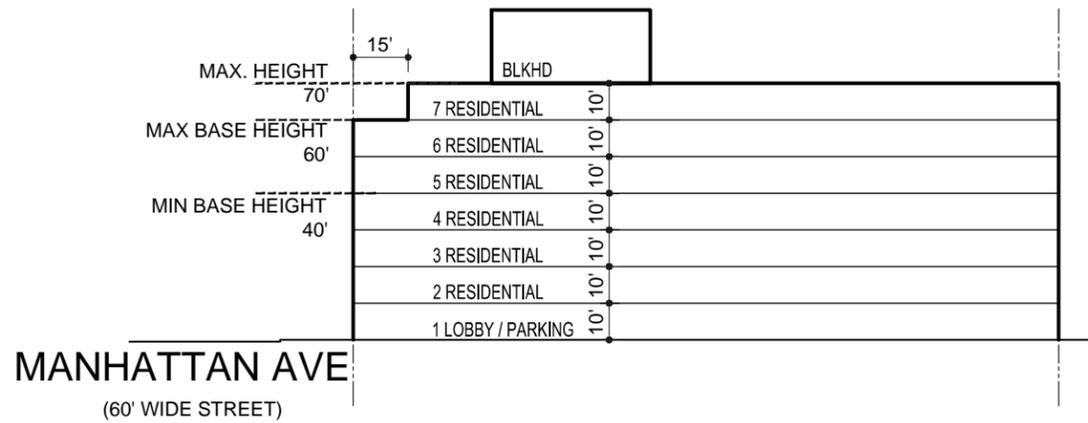
TRUCK ROUTE MAP

APPENDIX A
PROPOSED DEVELOPMENT PLANS

*DESIGN **CONCEPT** | LAYOUTS*



1 SITE PLAN
1"=50'



2 SECTION
1"=50'

470 Manhattan Ave

9-Jul-15

Brooklyn, NY

Scheme 1

Block: 2714
 Lots: 1, 30, 32, 33
 Zoning District: M1-2/R6A
 Special District: MX-8 Special Purpose District
 IHDA
 Little E - Environmental Designation

Site Area:

Estimated Site Area (per tax map):	Lot 1	14,603 SF
	Lot 30	5,129 SF
	Lot 32	1,645 SF
	Lot 33	10,073 SF
Total Lot Area		31,450 SF

Permitted FAR:

Residential Base	All uses in mixed building.	2.70	84,915 SF
Residential Max (IDHA)	(*1.25 FA compensation)	3.60	113,221 SF
Total Permitted Zoning Floor Area:			113,221 SF

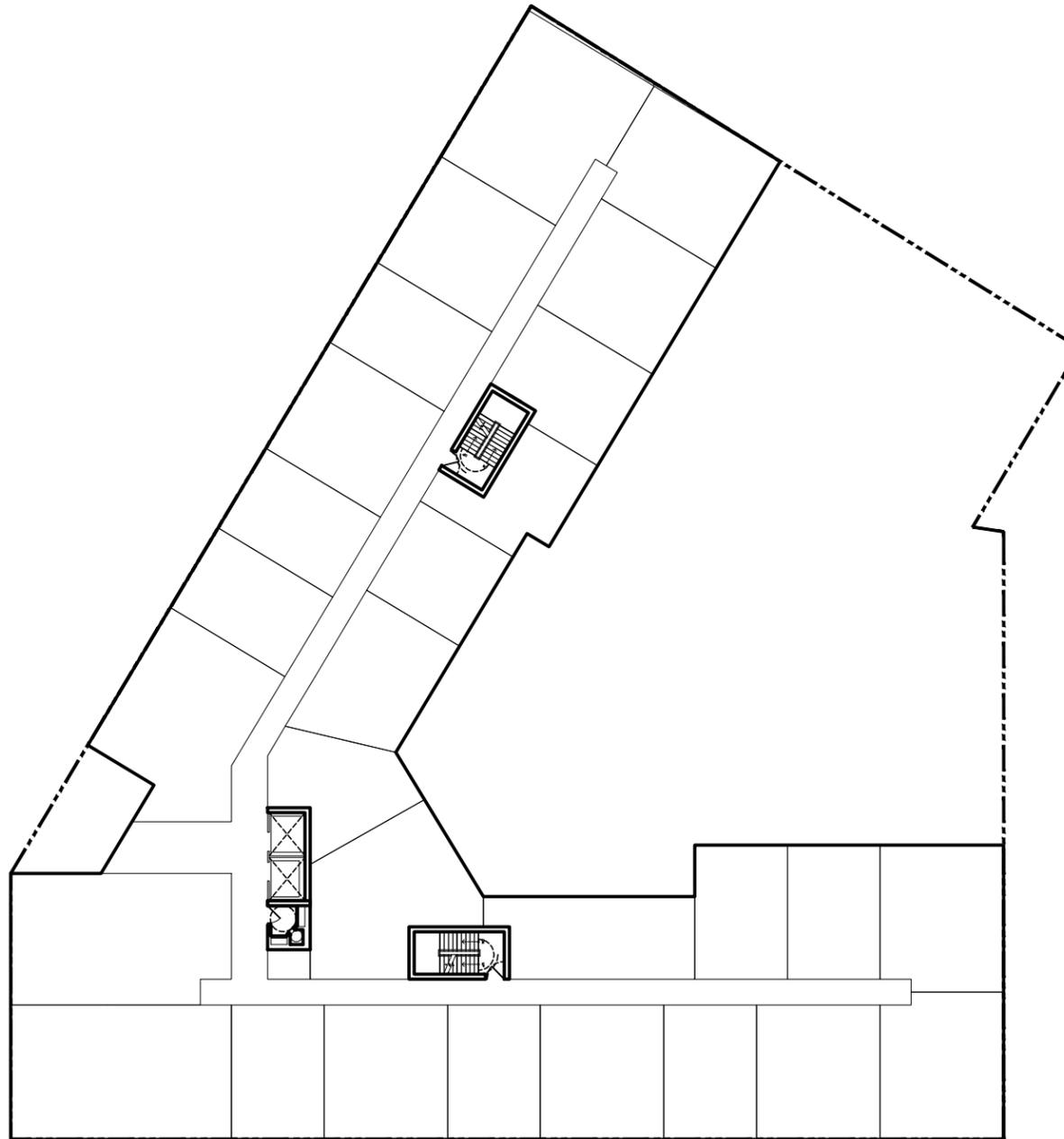
Proposed GFA Calculations:

Max. Permitted ZFA	113,221 SF
+3.5% Mechanical:	3,963 SF
+4.5% QH Deduction:	5,095 SF
Fixed Deductions:	
Wall Resistance Rating Deductions	0 SF
Above Grade Parking	0 SF
Mech Rooms	0 SF
Above Grade GFA Total	122,278 SF

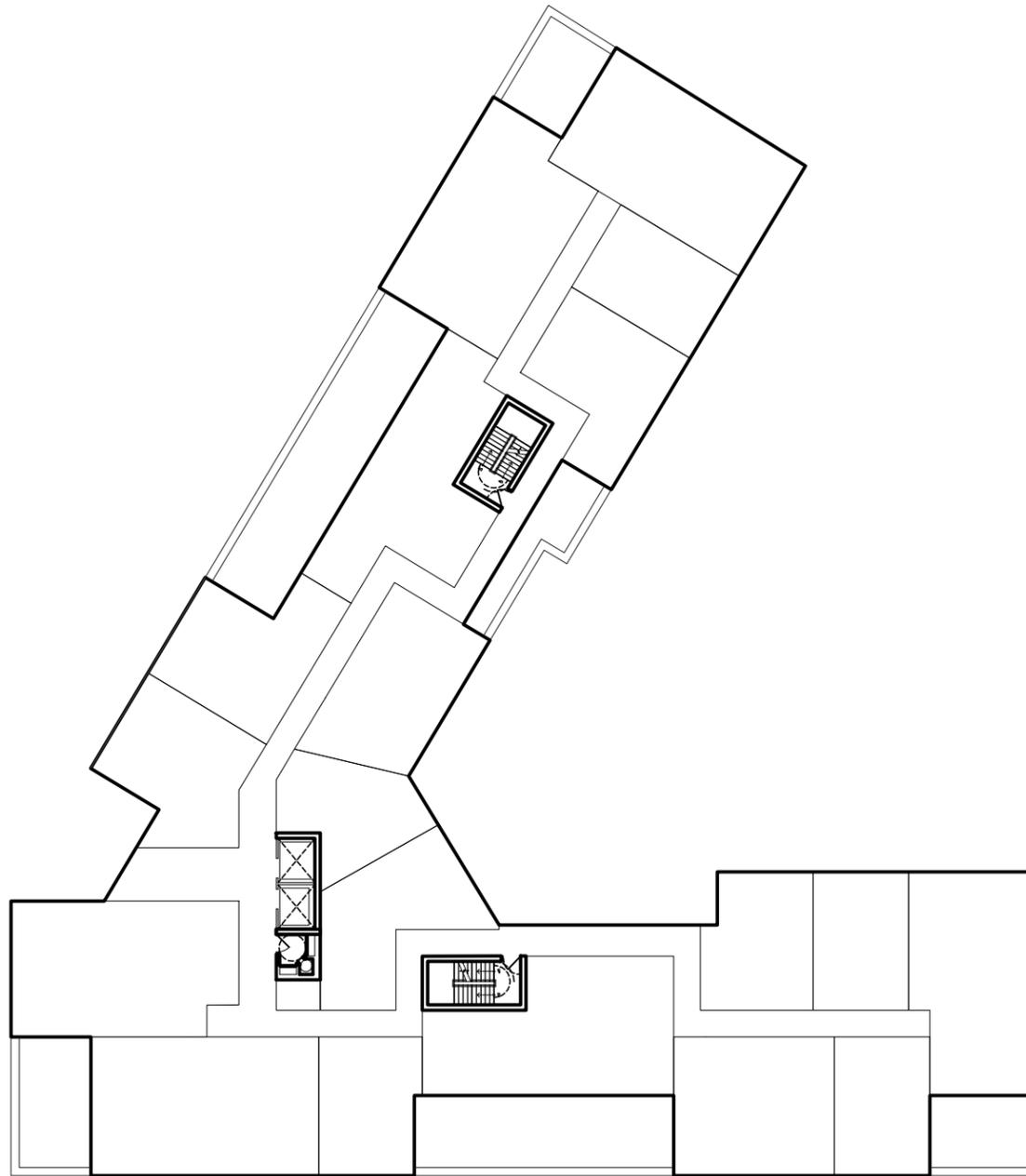
Proposed Gross Floor Areas (SF):

Floor	QTY	Area/FL	Total
C	1	19,837	19,837
1	1	6,236	6,236
2-5	4	19,836	79,344
6	1	19,836	19,836
7	1	16,862	16,862
TOTAL	8		142,115
TOTAL ABOVE GRADE	7		122,278
ALLOWABLE FLOOR AREA REMAINING			0

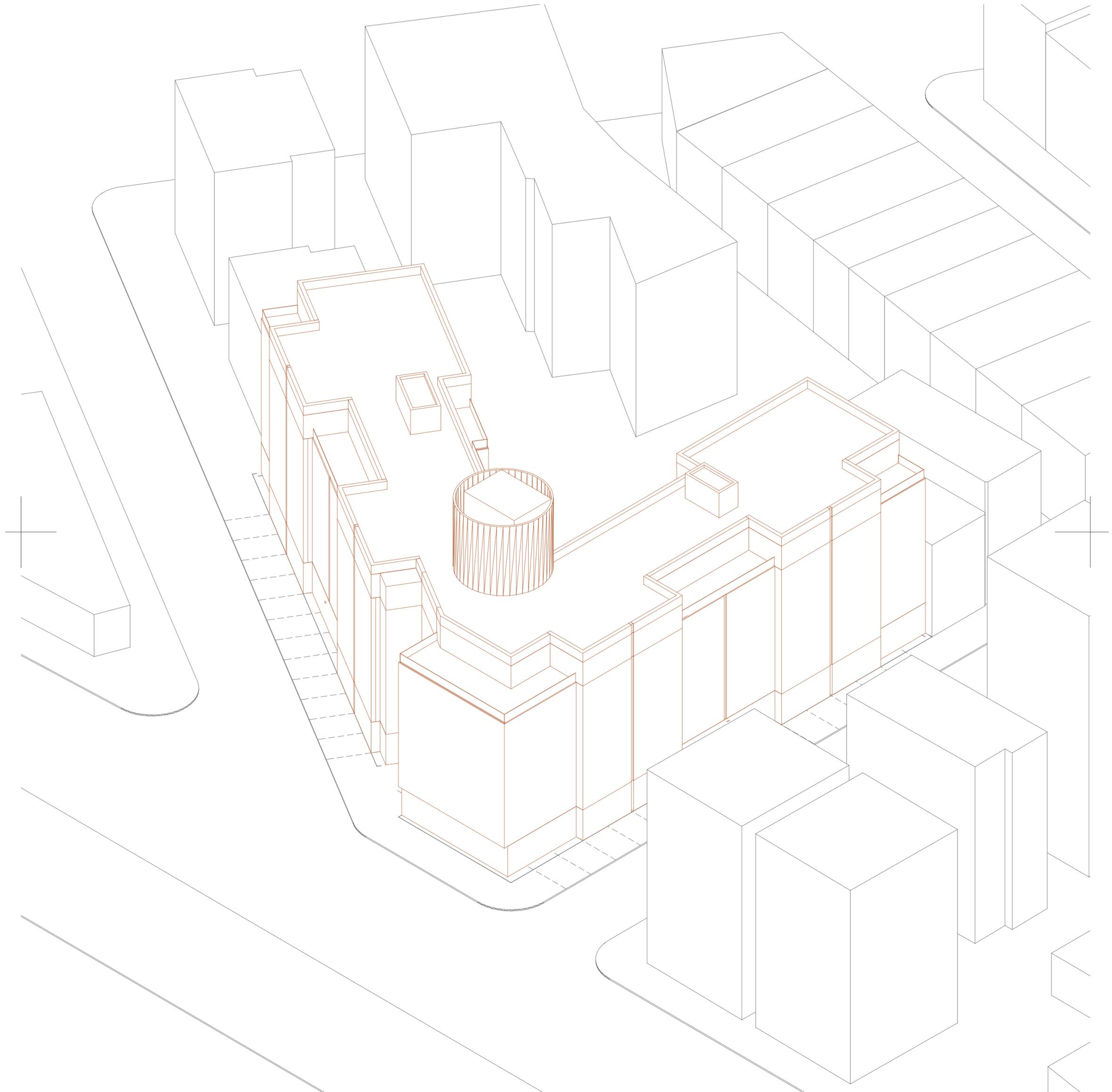
Floor	QTY	Mech	Residential	Residential Amenity	Accessory Parking	Total Per Floor
C	1	0	19,837	0	0	19,837
1	1	0	2,500	3,736	0	6,236
2-5	4	0	79,344	0	0	79,344
6	1	0	19,836	0	0	19,836
7	1	0	16,862	0	0	16,862
TOTAL GROSS	8	0	138,379	3,736	0	142,115
TOTAL ABOVE GRADE	7	0	118,542	3,736	0	122,278

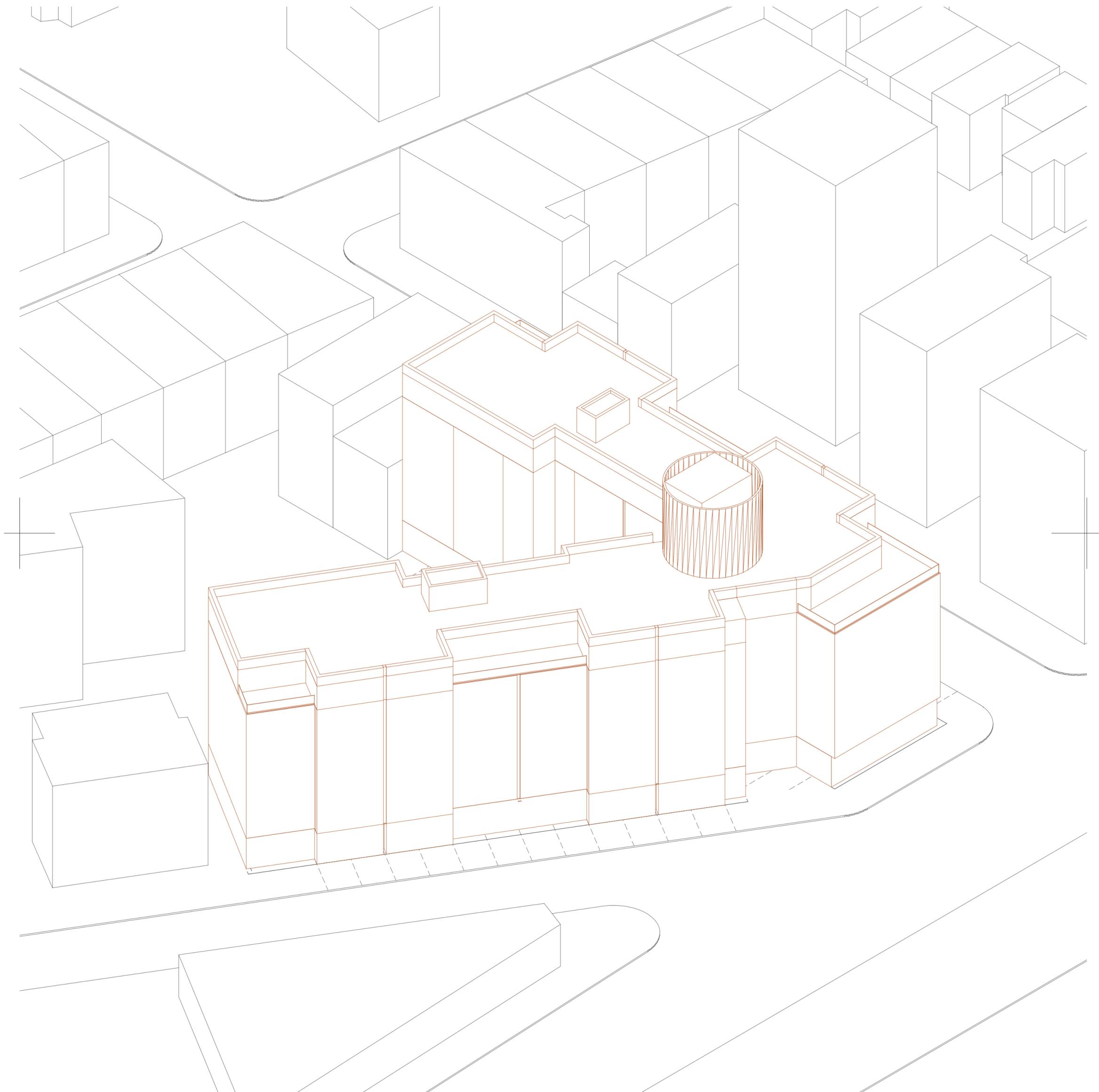


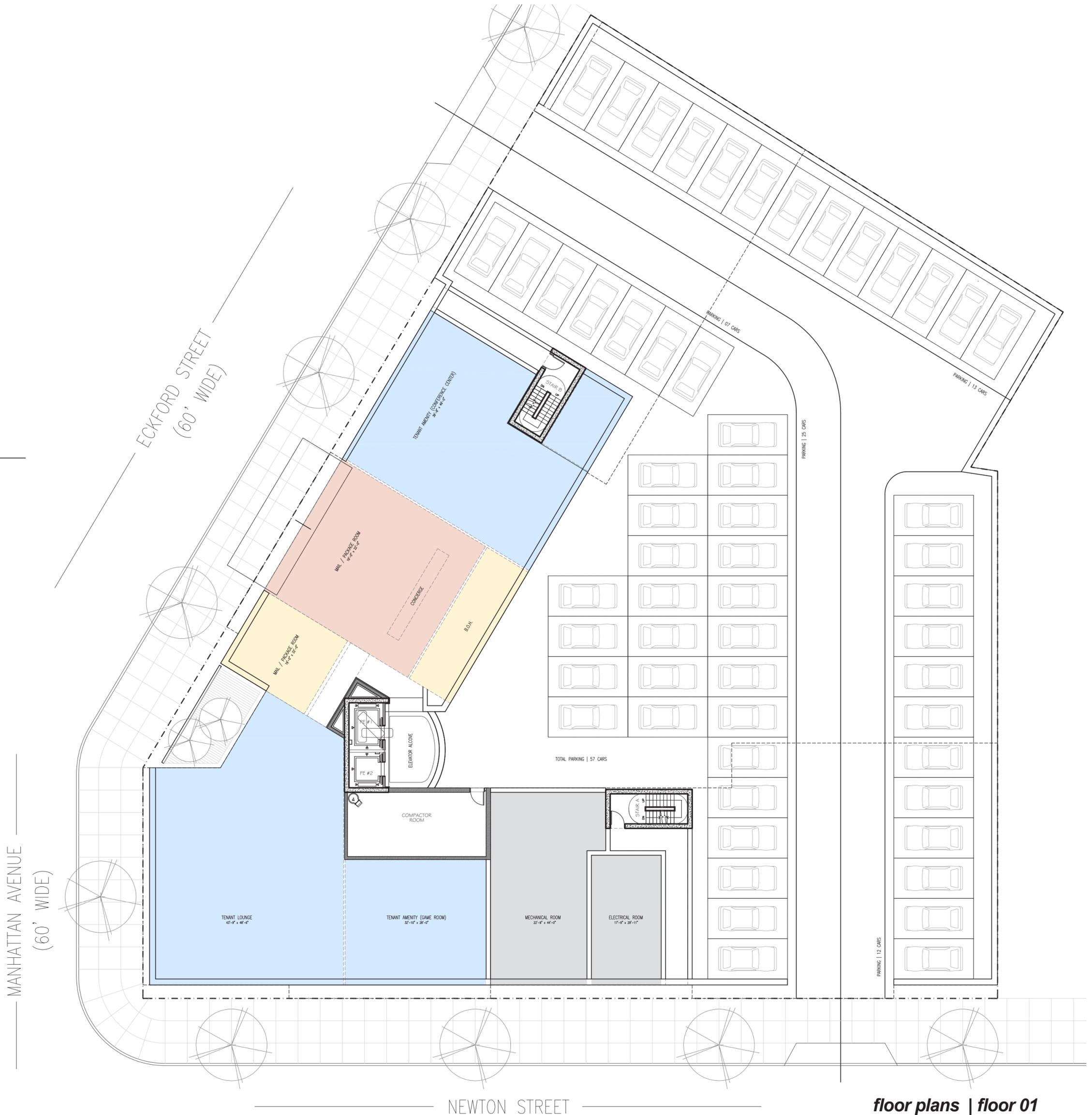
1 2-6 FLOOR PLAN
1/32"=1'



1 2-6 FLOOR PLAN
1/32"=1'





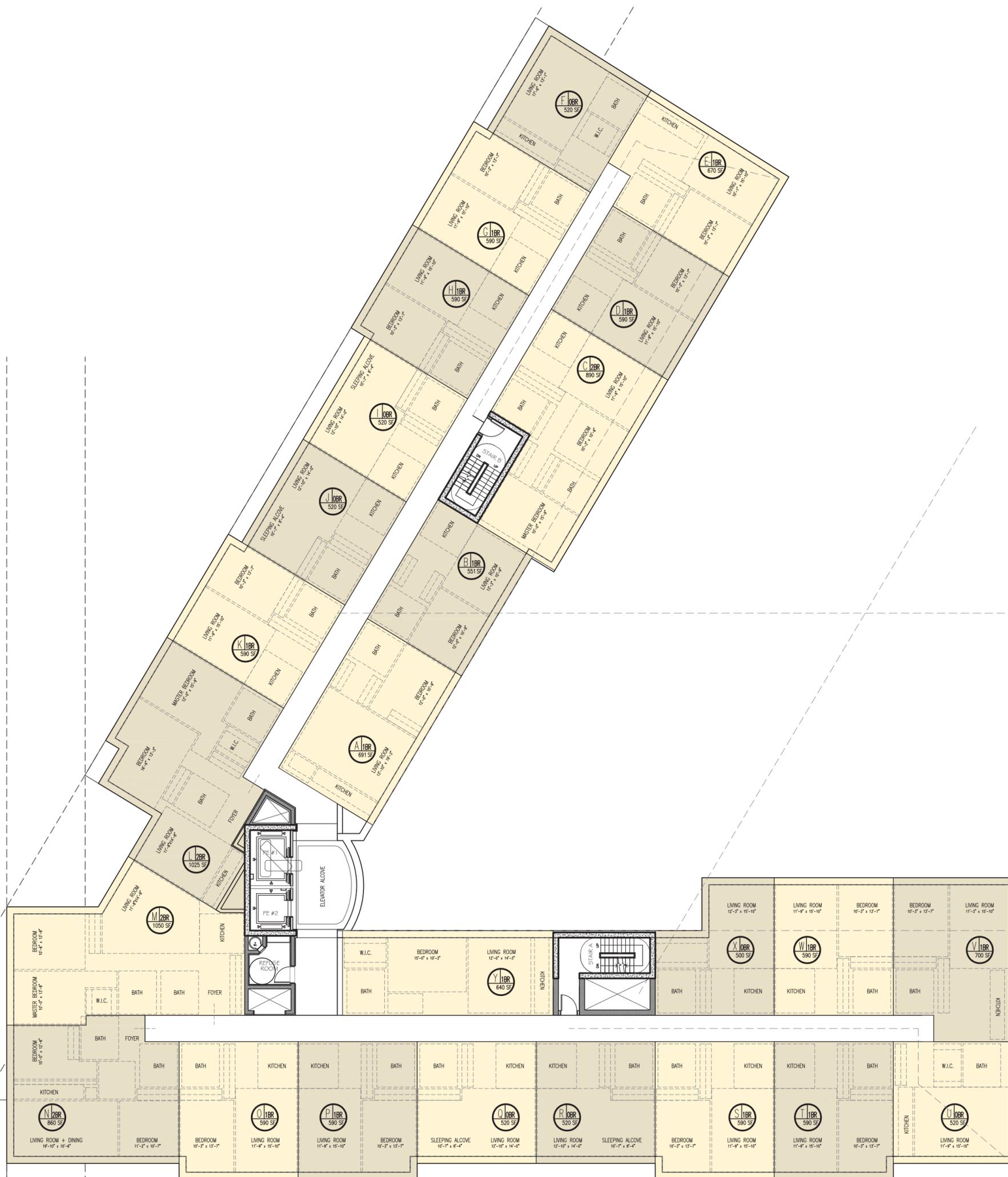


MANHATTAN AVENUE
(60' WIDE)

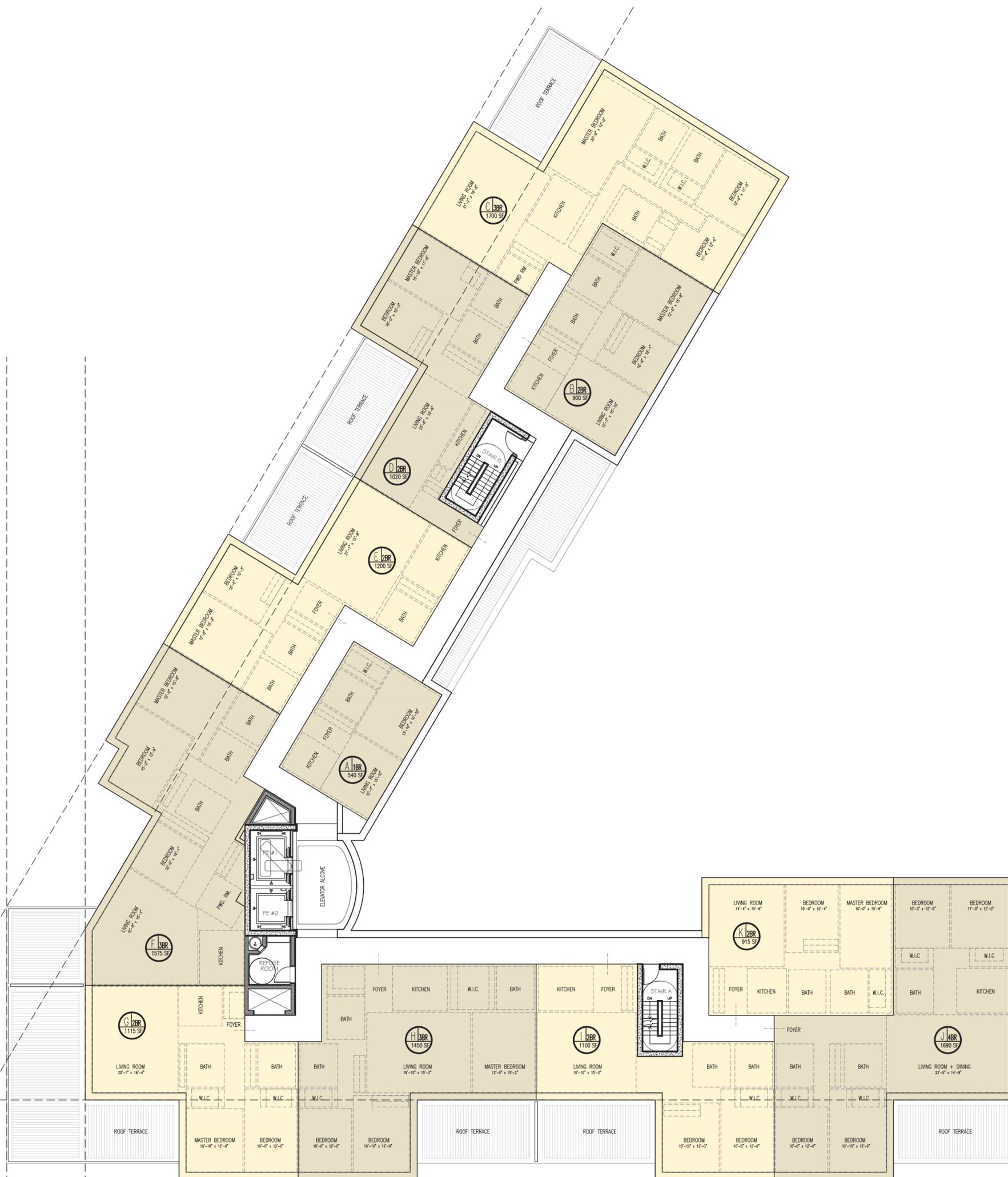
ECKFORD STREET
(60' WIDE)

NEWTON STREET

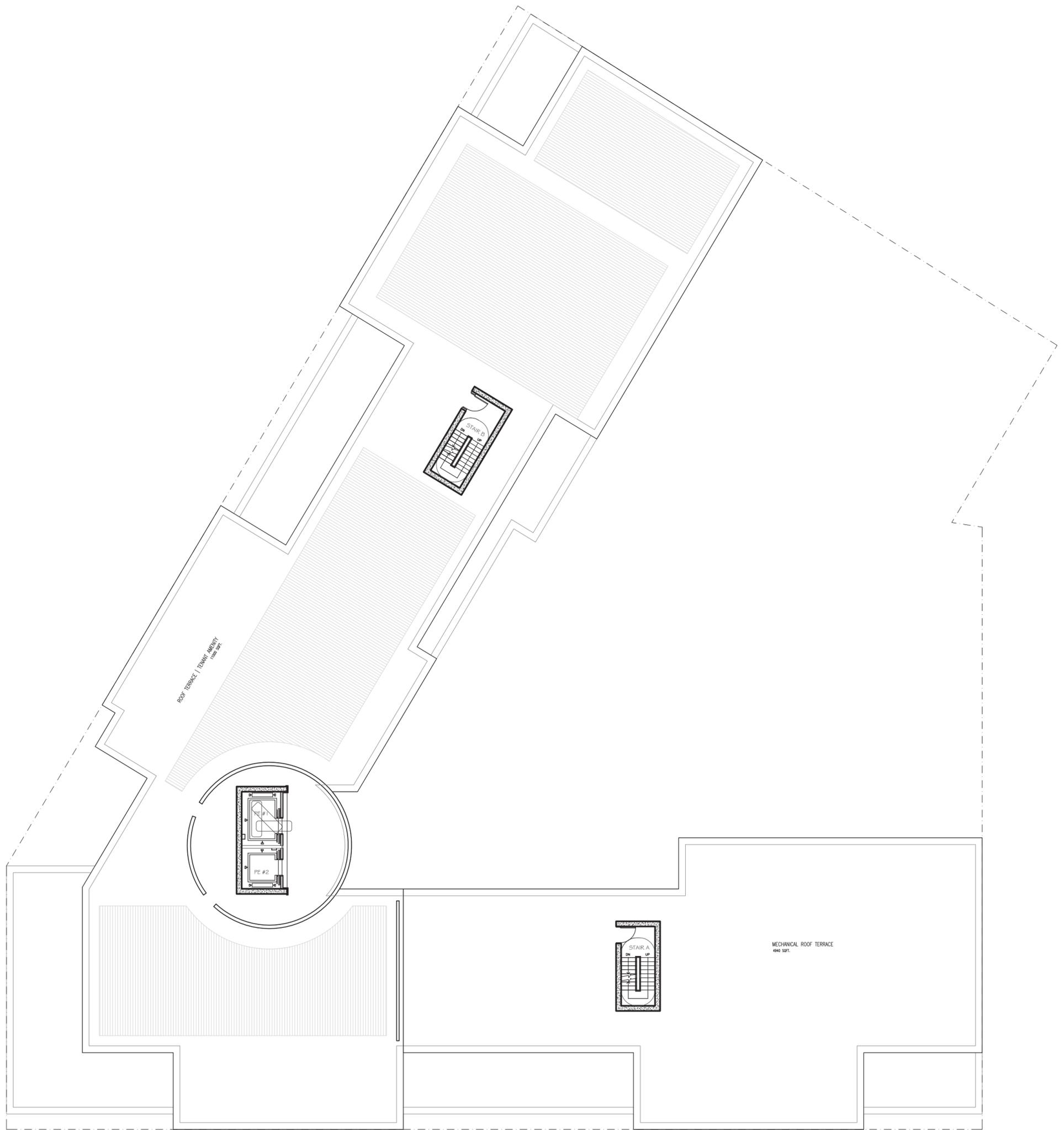
floor plans | floor 01



floor plans | floor 0206



floor plans | floor 07



RENTAL UNIT MATRIX - Suggested						
	0 BEDROOM	1 BEDROOM	2 BEDROOM	3 BEDROOM	4 BEDROOM	TOTAL / FLOOR
FLOOR 01						
FLOOR 02	6	15	4			25
FLOOR 03	6	15	4			25
FLOOR 04	6	15	4			25
FLOOR 05	6	15	4			25
FLOOR 06	6	15	4			25
FLOOR 07		1	6	3	1	11
TOTAL UNITS	30	76	26	3	1	136
	22%	56%	19%	2%	1%	

AREAS																													
FLOOR	MECH/BOH																									NET	GROSS AREA		
CELLAR	0																								0	0			
FLOOR	LOBBY	LOUNGE	PARKING	MECH. RM.	COMP. RELE. RM.																						GROSS AREA		
FIRST	1,290	2,420	#####	990	450	460																					30,135		
FLOOR	APT A	APT B	APT C	APT D	APT E	APT F	APT G	APT H	APT I	APT J	APT K	APT L	APT M	APT N	APT O	APT P	APT Q	APT R	APT S	APT T	APT U	APT V	APT W	APT X	APT Y	FITNES	NET RENTABLE	GROSS AREA	RATIO
2ND	691	551	890	590	670	520	590	590	520	520	590	1025	1050	860	590	590	520	520	590	590	520	700	590	500	640		16,007	18,900	85%
3RD	691	551	890	590	670	520	590	590	520	520	590	1025	1050	860	590	590	520	520	590	590	520	700	590	500	640		16,007	18,900	85%
4TH	691	551	890	590	670	520	590	590	520	520	590	1025	1050	860	590	590	520	520	590	590	520	700	590	500	640		16,007	18,900	85%
5TH	691	551	890	590	670	520	590	590	520	520	590	1025	1050	860	590	590	520	520	590	590	520	700	590	500	640		16,007	18,900	85%
6TH	691	551	890	590	670	520	590	590	520	520	590	1025	1050	860	590	590	520	520	590	590	520	700	590	500	640		16,007	18,900	85%
7TH	540	900	1,700	1,020	1,200	1,575	1,115	1,450	1,100	1,690	915																13,205	15,950	83%
7TH TERRACE			270	280	260	230	720	270	270	280																			
AL NET RENTA	3,995	3,655	6,150	3,970	4,550	4,175	4,065	4,400	3,700	4,290	3,865	5,125	5,250	4,300													51,948	140,585	
ROOF																													
FLOOR																											BULKHEAD	GROSS AREA	
MAIN ROOF																											11000	15,945	

*NET SELLABLE DOES NOT INCLUDE TERRACE AREA

calculations | areas + unit matrix

APPENDIX B CITIZEN PARTICIPATION PLAN

The NYC Office of Environmental Remediation (OER) and 470 Manhattan Ave LLC have established this Citizen Participation Plan (CPP) because the opportunity for citizen participation is an important component of the NYC Voluntary Cleanup Program (VCP). This CPP describes how information about the project will be disseminated to the community during the remedial process. As part of its obligations under the VCP, 470 Manhattan Ave LLC will maintain a repository for project documents and provide public notice at specified times throughout the remedial program. This CPP also takes into account potential environmental justice concerns in the community that surrounds the Site. Under this CPP, project documents and work plans are made available to the public in a timely manner. Public comment on work plans is strongly encouraged during public comment periods. Work plans are not approved by OER until public comment periods have expired and all comments are formally reviewed. An explanation of cleanup plans in the form of a public meeting or informational session is available upon request to OER's project manager assigned to this Site, Isabel McRae, who can be contacted about these issues or any other questions, comments or concerns that arise during the remedial process at (212) 341-2034.

Project Contact List: OER has established a Site contact list for this project to provide public notices in the form of fact sheets to interested members of the community. Communications will include updates on important information relating to the progress of the cleanup program at the Site as well as to request public comments on the cleanup plan. The project contact list includes owners and occupants of adjacent buildings and homes, principal administrators of nearby schools, hospitals and day care centers, the public water supplier that serves the area, established document repositories, the representative Community Board, City Council members, other elected representatives and any local Brownfield Opportunity Area (BOA) grantee organizations. Any member of the public or organization will be added to the Site contact list on request. A copy of the Site contact list is maintained by OER's project manager. If you would like to be added to the Project contact list, contact OER at (212) 788-8841 or by email at brownfields@cityhall.nyc.gov.

Repositories: A document repository is maintained online. Internet access to view OER's document repositories is available at public libraries. This document repository is intended to house, for community review, all principal documents generated during the cleanup program including Remedial Investigation (RI) plans and reports, remedial action work plans and reports, and all public notices and fact sheets produced during the lifetime of the remedial project. The library nearest the Site is:

Branch: Greenpoint Library

Address: 107 Norman Avenue, Brooklyn, New York 11222

Telephone: (718) 349-8504

Hours of Operation:

10:00 AM – 6:00 PM (Monday, Friday)

10:00 AM – 8:00 PM (Tuesday, Wednesday, Thursday)

10:00 AM – 5:00 PM (Saturday)

Closed (Sunday)

Digital Documentation: OER strongly encourages the use of digital documents in repositories as a means of minimizing paper use while also increasing convenience in access and ease of use.

Identify Issues of Public Concern: Members of the community surrounding the Site have expressed concerns about the project, as well as construction and cleanup projects throughout the neighborhood. Concerns have been raised about dust, vibrations, and noise from demolition, cleanup, and construction; historic uses of the property that may result in specific types of contamination; extended work hours at the site; truck traffic; on-going environmental work; etc. These concerns will be addressed by the implementation of CAMP during excavation and the implementation of dust suppression techniques to control dust on an as-needed basis. During excavation the soil will be screened for evidence of contamination from potential historic property use or others sources. Any hot spots identified will be segregated for testing and proper off-site disposal and OER will be promptly notified. The project work hours will comply with the DOB work permit. Trucks traveling to and from the Site will be routed to avoid or limit travel through residential streets until a commercial roadway is reached.

Public Notice and Public Comment: Public notice to all members of the Site contact list is required at three major steps during the performance of the cleanup program (listed below) and at other points that may be required by OER. Notices will include Fact Sheets with descriptive project summaries, updates on recent and upcoming project activities, repository information, and important phone and email contact information. All notices will be prepared by 470 Manhattan Ave LLC, reviewed and approved by OER prior to distribution and mailed by 470 Manhattan Ave LLC. Public comment is solicited in public notices for all work plans developed under the VCP. Final review of all work plans by OER will consider all public comments. Approval will not be granted until the public comment period has been completed.

Citizen Participation Milestones: Public notice and public comment activities occur at several steps during a typical VCP project. See flow chart on the following page, which identifies when during the VCP public notices are issued: These steps include:

Public Notice of the availability of the Remedial Investigation Report and Remedial Action Work Plan and a 30-day public comment period on the Remedial Action Work Plan.

Public notice in the form of a Fact Sheet is sent to all parties listed on the Site contact list announcing the availability of the Remedial Investigation Report (RIR) and Remedial Action Work Plan (RAWP) and the initiation of a 30-day public comment period on the RAWP. The Fact Sheet summarizes the findings of the RIR and provides details of the RAWP. The public comment period will be extended an additional 15 days upon public request. A public meeting or informational session will be conducted by OER upon request.

Public Notice announcing the approval of the RAWP and the start of remediation

Public notice in the form of a Fact Sheet is sent to all parties listed on the Site contact list announcing the approval of the RAWP and the start of remediation.

Public Notice announcing the completion of remediation, designation of Institutional and Engineering Controls and issuance of the Notice of Completion

Public notice in the form of a Fact Sheet is sent to all parties listed on the Site contact list announcing the completion of remediation, providing a list of all Institutional and Engineering Controls implemented for to the Site and announcing the issuance of the Notice of Completion.

APPENDIX C SUSTAINABILITY STATEMENT

This Sustainability Statement documents sustainable activities and green remediation efforts planned under this remedial action.

Reuse of Clean, Recyclable Materials: Reuse of clean, locally-derived recyclable materials reduces consumption of non-renewable virgin resources and can provide energy savings and greenhouse gas reduction.

If possible, 470 Manhattan Ave LLC will reuse clean non-virgin materials; the results of which will be quantified and reported in the RAR.

Reduce Consumption of Virgin and Non-Renewable Resources: Reduced consumption of virgin and non-renewable resources lowers the overall environmental impact of the project on the region by conserving these resources.

Best efforts will be made to quantify energy efficiencies achieved during the remediation and will be reported in the RAR. Where energy savings cannot be easily quantified, a gross indicator of the amount of energy saved or the means by which energy savings was achieved will be reported.

Reduced Energy Consumption and Promotion of Greater Energy Efficiency: Reduced energy consumption lowers greenhouse gas emissions, improves local air quality, lessens in-city power generation requirements, can lower traffic congestion, and provides substantial cost savings.

Best efforts will be made to quantify energy efficiencies achieved during the remediation and will be reported in the RAR. Where energy savings cannot be easily quantified, a gross indicator of the amount of energy saved or the means by which energy savings was achieved will be reported.

Conversion to Clean Fuels: Use of clean fuel improves NYC's air quality by reducing harmful emissions.

Recontamination Control: Recontamination after cleanup and redevelopment is completed undermines the value of work performed, may result in a property that is less protective of public health or the environment, and may necessitate additional cleanup work later or impede future redevelopment. Recontamination can arise from future releases that occur within the property or by influx of contamination from off-site.

An estimate of the area of the Site that utilizes recontamination controls under this plan will be reported in the RAR in square feet.

Stormwater Retention: Stormwater retention improves water quality by lowering the rate of combined stormwater and sewer discharges to NYC's sewage treatment plants during periods of precipitation, and reduces the volume of untreated influent to local surface waters.

Linkage with Green Building: Green buildings provide a multitude of benefits to the city across a broad range of areas, such as reduction of energy consumption, conservation of resources, and reduction in toxic materials use.

The number of Green Buildings that are associated with this brownfield redevelopment property will be reported in the RAR. The total square footage of green building space created as a function of this brownfield redevelopment will be quantified for residential, commercial and industrial/manufacturing uses.

Paperless Brownfield Cleanup Program: 470 Manhattan Ave LLC is participating in OER's Paperless Brownfield Cleanup Program. Under this program, submission of electronic documents will replace submission of hard copies for the review of project documents, communications and milestone reports.

Low-Energy Project Management Program: 470 Manhattan Ave LLC is participating in OER's low-energy project management program. Under this program, whenever possible, meetings are held using remote communication technologies, such as videoconferencing and teleconferencing to reduce energy consumption and traffic congestion associated with personal transportation.

Trees and Plantings: Trees and other plantings provide habitat and add to NYC's environmental quality in a wide variety of ways. Native plant species and native habitat provide optimal support to local fauna, promote local biodiversity, and require less maintenance.

APPENDIX D

SOIL/MATERIALS MANAGEMENT PLAN

1.1 SOIL SCREENING METHODS

Visual, olfactory, and PID soil screening and assessment will be performed under the supervision of a Qualified Environmental Professional and will be reported in the RAR. Soil screening will be performed during invasive work performed during the remedy and development phases prior to issuance of the Notice of Completion.

1.2 STOCKPILE METHODS

Excavated soil from suspected areas of contamination (e.g., hot spots, USTs, drains, etc.) will be stockpiled separately and will be segregated from clean soil and construction materials. Stockpiles will be used only when necessary and will be removed as soon as practicable. While stockpiles are in place, they will be inspected daily, and before and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by OER. Excavated soils will be stockpiled on, at minimum, double layers of 8-mil minimum sheeting, will be kept covered at all times with appropriately anchored plastic tarps, and will be routinely inspected. Broken or ripped tarps will be promptly replaced.

All stockpile activities will be compliant with applicable laws and regulations. Soil stockpile areas will be appropriately graded to control run-off in accordance with applicable laws and regulations. Stockpiles of excavated soils and other materials shall be located at least of 50 feet from the property boundaries, where possible. Hay bales or equivalent will surround soil stockpiles except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

1.3 CHARACTERIZATION OF EXCAVATED MATERIALS

Soil/fill or other excavated media that is transported off-site for disposal will be sampled in a manner required by the receiving facility, and in compliance with applicable laws and regulations. Soils proposed for reuse on-Site will be managed as defined in this plan.

1.4 MATERIALS EXCAVATION, LOAD-OUT, AND DEPARTURE

The PE/QEP overseeing the remedial action will:

- Oversee remedial work and the excavation and load-out of excavated material;
- Ensure that there is a party responsible for the safe execution of invasive and other work performed under this work plan;
- Ensure that Site development activities and development-related grading cuts will not interfere with, or otherwise impair or compromise the remedial activities proposed in this RAWP;
- Ensure that the presence of utilities and easements on the Site has been investigated and that any identified risks from work proposed under this plan are properly addressed by appropriate parties;
- Ensure that all loaded outbound trucks are inspected and cleaned if necessary before leaving the Site;
- Ensure that all egress points for truck and equipment transport from the Site will be kept clean of Site-derived materials during Site remediation.

- Locations where vehicles exit the Site shall be inspected daily for evidence of soil tracking off premises. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.
- Open and uncontrolled mechanical processing of historical fill and contaminated soil on-Site will not be performed without prior OER approval.

1.5 OFF-SITE MATERIALS TRANSPORT

Loaded vehicles leaving the Site will comply with all applicable materials transportation requirements (including appropriate covering, manifests, and placards) in accordance with applicable laws and regulations, including use of licensed haulers in accordance with 6 NYCRR Part 364. If loads contain wet material capable of causing leakage from trucks, truck liners will be used. Queuing of trucks will be performed on-Site, when possible in order to minimize off Site disturbance. Off-Site queuing will be minimized.

Outbound truck transport routes will be established and reported to OER prior to the start of remedial work at the Site. This routing takes into account the following factors: (a) limiting transport through residential areas and past sensitive sites; (b) use of mapped truck routes; (c) minimizing off-Site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport. To the extent possible, all trucks loaded with Site materials will travel from the Site using these truck routes. Trucks will not stop or idle in the neighborhood after leaving the project Site.

1.6 MATERIALS DISPOSAL OFF-SITE

The following documentation will be established and reported by the PE/QEP for each disposal destination used in this project to document that the disposal of regulated material exported from the Site conforms with applicable laws and regulations: (1) a letter from the PE/QEP or Enrollee to each disposal facility describing the material to be disposed and requesting written acceptance of the material. This letter will state that material to be disposed is regulated material generated at an environmental remediation Site in Brooklyn, New York under a governmental remediation program. The letter will provide the project identity and the name and phone number of the PE/QEP or Enrollee. The letter will include as an attachment a summary of all chemical data for the material being transported; and (2) a letter from each disposal facility stating it is in receipt of the correspondence (1, above) and is approved to accept the material. These documents will be included in the RAR.

The Remedial Action Report will include an itemized account of the destination of all material removed from the Site during this remedial action. Documentation associated with disposal of all material will include records and approvals for receipt of the material. This information will be presented in the RAR.

All impacted soil/fill or other waste excavated and removed from the Site will be managed as regulated material and will be disposed in accordance with applicable laws and regulations. Historic fill and contaminated soils taken off-Site will be handled as solid waste and will not be disposed at a Part 360-16 Registration Facility (also known as a Soil Recycling Facility).

Waste characterization will be performed for off-site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the RAR. A manifest system for off-Site transportation of exported materials will be employed. Manifest information will be reported in the RAR. Hazardous wastes derived from on-site will be stored, transported, and disposed of in compliance with applicable laws and regulations.

If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e., clean soil removed for development purposes), including transport to a Part 360-16 Registration Facility, a formal request will be

made for approval by OER with an associated plan compliant with 6NYCRR Part 360-16. This request and plan will include the location, volume, and a description of the material to be recycled, including verification that the material is not impacted by Site uses and that the material complies with receipt requirements for recycling under 6NYCRR Part 360. This material will be appropriately handled on-site to prevent mixing with impacted material.

1.7 MATERIALS REUSE ON-SITE

Soil and fill that is derived from the property that meets the Soil Cleanup Objectives (SCOs) established in this plan may be reused on-site. The SCOs for on-site reuse are Track 2 Restricted Residential (RRSCOs) as modified by the Track 4 Site-specific SCOs (SSSCOs) listed Section 4.2. ‘Reuse on-site’ means material that is excavated during the remedy or development, does not leave the property, and is relocated within the same property and on comparable soil/fill material, and addressed pursuant to the VCP agreement subject to Engineering and Institutional Controls (ECs/ICs). The PE/QEP will ensure that reused materials are segregated from other materials to be exported from the Site and that procedures defined for material reuse in this RAWP are followed.

Organic matter (wood, roots, stumps, etc.) or other waste derived from clearing and grubbing of the Site will not be buried on-site. Soil or fill excavated from the site for grading or other purposes will not be reused within a cover soil layer or within landscaping berms.

1.8 DEMARCATION

After completion of hotspot removal and any other invasive remedial activities, and prior to backfilling, the top of the residual soil/fill will be defined by one of three methods: (1) placement of a demarcation layer. The demarcation layer will consist of geosynthetic fencing or equivalent material to be placed on the surface of residual soil/fill to provide an observable reference layer. A description or map of the approximate depth of the demarcation layer will be provided in the SMP; or (2) a land survey of the top elevation of residual soil/fill before the placement of cover soils, pavement and associated sub-soils, or other materials or structures or, (3) all materials beneath the approved cover will be considered impacted and subject to site management after the remedy is complete. Demarcation may be established by one or any combination of these three methods. As appropriate, a map showing the method of demarcation for the Site and all associated documentation will be presented in the RAR.

This demarcation will constitute the top of the site management horizon. Materials within this horizon require adherence to special conditions during future invasive activities as defined in the Site Management Plan (SMP).

1.9 IMPORT OF BACKFILL SOIL FROM OFF-SITE SOURCES

This section presents the requirements for imported fill materials to be used below the cover layer and within the clean soil cover layer. All imported soils will meet OER-approved backfill and cover soil quality objectives for this Site. The backfill and cover soil quality objectives are listed in Section 4.2.

A process will be established to evaluate sources of backfill and cover soil to be imported to the Site, and will include an examination of source location, current and historical use(s), and any applicable documentation. Material from industrial sites, spill sites, environmental remediation sites, or other potentially contaminated sites will not be imported to the Site.

The following potential sources may be used pending attainment of backfill and cover soil quality objectives:

- Clean soil from construction projects at non-industrial sites in compliance with applicable laws and regulations;

- Clean soil from roadway or other transportation-related projects in compliance with applicable laws and regulations;
- Clean recycled concrete aggregate (RCA) from facilities permitted or registered by the regulations of NYSDEC.

All materials received for import to the Site will be approved by a PE/QEP and will be in compliance with provisions in this RAWP. The RAR will report the source of the fill, evidence that an inspection was performed on the source, chemical sampling results, frequency of testing, and a Site map indicating the locations where backfill or soil cover was placed.

Source Screening and Testing

Inspection of imported fill material will include visual, olfactory, and PID screening for evidence of contamination. Materials imported to the Site will be subject to inspection, as follows:

- Trucks with imported fill material will be in compliance with applicable laws and regulations and will enter the Site at designated locations;
- The PE/QEP is responsible to ensure that every truck load of imported material is inspected for evidence of contamination; and
- Fill material will be free of solid waste including pavement materials, debris, stumps, roots, and other organic matter, as well as ashes, oil, perishables or foreign matter.

Composite samples of imported material will be taken at a minimum frequency of one sample for every 500 cubic yards of material. Once it is determined that the fill material meets imported backfill or cover soil chemical requirements and is non-hazardous, and lacks petroleum contamination, the material will be loaded onto trucks for delivery to the Site.

Recycled concrete aggregate (RCA) will be imported from facilities permitted or registered by NYSDEC. Facilities will be identified in the RAR. A PE/QEP is responsible to ensure that the facility is compliant with 6NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. RCA imported from compliant facilities will not require additional testing, unless required by NYSDEC under its terms for operation of the facility. RCA imported to the Site must be derived from recognizable and uncontaminated concrete. RCA material is not acceptable for, and will not be used as, cover material.

1.10 FLUIDS MANAGEMENT

All liquids to be removed from the Site, including potential dewatering fluids, will be handled, transported, and disposed in accordance with applicable laws and regulations. Liquids discharged into the NYC sewer system will receive prior approval by New York City Department of Environmental Protection (NYCDEP). The NYCDEP regulates discharges to the New York City sewers under Title 15, Rules of the City of New York Chapter 19. Discharge to the New York City sewer system will require an authorization and sampling data demonstrating that the groundwater meets the city's discharge criteria. The dewatering fluid will be pretreated as necessary to meet the NYCDEP discharge criteria. If discharge to the city sewer system is not appropriate, the dewatering fluids will be managed by transportation and disposal at an off-site treatment facility.

Discharge of water generated during remedial construction to surface waters (i.e. a stream or river) is prohibited without a SPDES permit issued by NYSDEC.

1.11 STORMWATER POLLUTION PREVENTION

Applicable laws and regulations pertaining to stormwater pollution prevention will be addressed during the remedial program. Erosion and sediment control measures identified in this RAWP (silt fences and barriers, and hay bale checks) will be installed around the entire perimeter of the remedial construction

area and inspected once a week and after every storm event to ensure that they are operating appropriately. Discharge locations will be inspected to determine whether erosion control measures are effective in preventing significant impacts to receptors. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by OER. All necessary repairs shall be made immediately. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion of the silt fence toe anchor will be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

1.12 CONTINGENCY PLAN

This contingency plan is developed for the remedial construction to address the discovery of unknown structures or contaminated media during excavation. Identification of unknown contamination source areas during invasive Site work will be promptly communicated to OER's project manager. Petroleum spills will be reported to the NYSDEC Spill Hotline. These findings will be included in the daily report. If previously unidentified contaminant sources are found during on-site remedial excavation or development-related excavation, sampling will be performed on contaminated source material and surrounding soils and reported to OER. Chemical analytical testing will be performed for TAL metals, TCL volatiles and semi-volatiles, TCL pesticides and PCBs, as appropriate.

1.13 ODOR, DUST, AND NUISANCE CONTROL

Odor Control

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

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. OER will be notified of all odor complaint events. Implementation of all odor controls, including halt of work, will be the responsibility of the PE/QEP's certifying the RAR.

Dust Control

Dust management during invasive on-site work will include, at a minimum:

- Use of a dedicated water spray methodology for roads, excavation areas, and stockpiles.
- Use of properly anchored tarps to cover stockpiles.
- Exercise extra care during dry and high-wind periods.
- Use of gravel or recycled concrete aggregate on egress and other roadways to provide a clean and dust-free road surface.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted and the source of dusts will be identified and corrected. Work will not resume until all nuisance dust emissions have been abated. OER will be notified of all dust complaint events. Implementation of all dust controls, including halt of work, will be the responsibility of the PE/QEP's responsible for certifying the RAR.

Other Nuisances

Noise control will be exercised during the remedial program. All remedial work will conform, at a minimum, to NYC noise control standards.

Rodent control will be provided, during Site clearing and grubbing, and during the remedial program, as necessary, to prevent nuisances.

1.14 IMPORT OF CLEAN COVER

Soil scheduled for import to the Site will be evaluated at the source location prior to import. Material from industrial sites, spill sites, environmental remediation sites or other potentially contaminated sites will not be imported to the Site. All imported soil will be uncontaminated, clean soil that meets the lesser of the appropriate NYSDEC 6 NYCRR Part 375-6.8(a) RRSCOs and the NYSDEC 6 NYCRR Part 375-6.8 Groundwater Protection SCOs.

The imported uncontaminated, clean soil cover will be from an approved source/facility and will be evaluated by the PE/QEP to ensure:

1. That a segregated stockpile for number tons (number cubic yards) is properly maintained at the source and will not be comingled with any other material prior to importing and grading the clean soil material at the Site;
2. That the material does not include any solid waste, including construction and demolition material, as it is prohibited;
3. That screening for evidence of contamination by visual, olfactory, and PID soil screening practices prior to testing at the source as well as upon importing to the Site for grading is completed; and
4. That a maximum five-part composite sample will be collected from the segregated stockpile at the source at a minimum frequency of one sample per 250 cubic yards and analyzed for the following Full List parameters:
 - VOCs by EPA Method 8260C (rev. 2006)
 - SVOCs by EPA Method 8270D (rev. 2007)
 - Pesticides by EPA Method 8081B (rev. 2000)
 - PCBs by EPA Method 8082A (rev. 2000)
 - TAL Metals by EPA Method 6010C (rev. 2007)

Upon receipt of the segregated stockpile analytical results collected at the source, a report will be submitted to OER for review/approval prior to importing. The report will include the following:

1. Summary of number of samples collected and analyzed, tabulated data and comparison to the selected Site Use SCOs;
2. Analytical data sheets and chain of custody documentation;
3. Summary of number tons (number cubic yards);
4. Photographs from the segregated stockpile at the source with sample point locations identified;
5. An affidavit from the source/facility on company letterhead stating that the segregated stockpile for number tons (number cubic yards) has been properly maintained at the source and complies with the requirements listed above; and

6. A copy of source/facility NYSDEC permit;

A highly visible demarcation barrier (i.e., orange geo-synthetic material or equivalent) will be installed beneath the clean soil/fill surface cover. Upon importing and grading the OER-approved clean soil cover for number tons (number cubic yards) on top of a highly visible demarcation barrier, the following documentation will be presented in the final RCR:

1. Copies of purchase invoices;
2. Truck transportation slips from the source to the Site;
3. Confirmation of number tons (number cubic yards) of OER approved clean soil cover material imported and graded at the site on top of highly visible demarcation barrier;
4. Site plan depicting all areas where the OER approved clean soil cover has been placed; and
5. Photographs documenting the importing and grading of the OER approved clean soil cover across the site with the underlying highly visible demarcation barrier (i.e., orange geo-synthetic material or equivalent).

APPENDIX E
MANUFACTURER SPECIFICATIONS FOR VAPOR BARRIER

FLORPRUFE® 120

Integrally bonded vapor protection for slabs on grade

Description

Florprufe® 120 is a high performance vapor barrier with Grace's Advanced Bond Technology™ that forms a unique seal to the underside of concrete floor slabs.

Comprising a highly durable polyolefin sheet and a specially developed, non-tacky adhesive coating, Florprufe 120 seals to liquid concrete to provide integrally bonded vapor protection.

Florprufe exceeds ASTM E1745 Class A rating.

Advantages

- Forms a powerful integral seal to the underside of concrete slabs
- Protects valuable floor finishes such as wood, tiles, carpet and resilient flooring from damage by vapor transmission
- Direct contact with the slab complies with the latest industry recommendations
- Remains sealed to the slab even in cases of ground settlement
- Ultra low vapor permeability
- Durable, chemical resistant polyolefin sheet
- Lightweight, easy to apply, kick out rolls
- Simple lap forming with mechanical fixings or tape

Use

Florprufe 120 is engineered for use below slabs on grade with moisture-impermeable or moisture-sensitive floor finishes that require the highest level of vapor protection.

¹ ACI 302.1R-96

Florprufe complies with the latest recommendations of ACI Committees 302 and 360, i.e. for slabs with vapor sensitive coverings, the location of the vapor barrier should always be in direct contact with the slab¹.

The membrane is loose laid onto the prepared subbase, forming overlaps that can be either mechanically secured or taped. The unique bond of Florprufe to concrete provides continuity of vapor protection at laps. Alternatively, if a taped system is preferred, self-adhered Preprufe® Tape can be used to overband the laps.

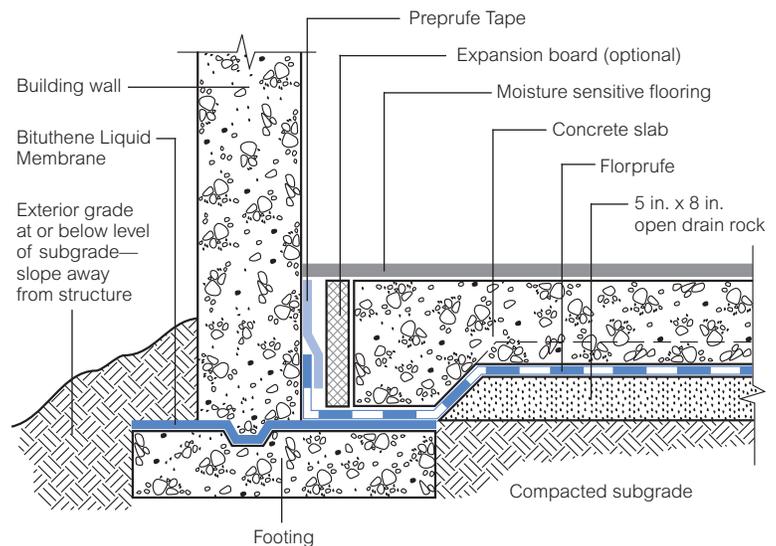
Slab reinforcement and concrete can be placed immediately. Once the concrete is poured, an integral bond develops between the concrete and membrane.

Installation

Health & Safety

Refer to relevant Material Safety Data Sheet. Complete rolls should be handled by 2 persons.

Florprufe 120 can be applied at temperatures of 25°F (-4°C) or above. Membrane installation is unaffected by wet weather. Installation and detailing of Florprufe 120 are generally in accordance with ASTM E1643-98.



Typical Assembly

Drawings are for illustration purposes only. Please refer to www.graceconstruction.com for specific application details.

Product Advantages

- Forms a powerful integral seal
- Protects valuable floor finishes
- Ultra low vapor permeability
- Durable, chemical resistant
- Lightweight and easy to apply

Supply

Florprufe 120	
Supplied in rolls	4 ft x 115 ft (1.2 m x 35 m)
Roll area	460 ft ² (42 m ²)
Roll weight	70 lbs (32 kg) approx.
Ancillary Products	
Preprufe Tape is packaged in cartons containing 4 rolls that are 4 in. x 49 ft (100 mm x 15 m).	
Bituthene Liquid Membrane is supplied in 1.5 gal (5.7 L) pails.	

Physical Properties: Exceeds ASTM E1745 Class A rating

Property	Typical Value	Test Method
Color	White	
Thickness (nominal)	0.021 in. (0.5 mm)	ASTM D3767—method A
Water vapor permeance	0.03 perms	ASTM E96—method B1
Tensile strength	65 lbs/in.	ASTM E1541
Elongation	300%	ASTM D412
Puncture resistance	3300 gms	ASTM D17091
Peel adhesion to concrete	>4 lbs/in.	ASTM D903

1. Test methods that comprise ASTM E1745 standard for vapor retarders

Prepare substrate in accordance with ACI 302.1R Section 4.1. Install Florprufe 120 over the leveled and compacted base. Place the membrane with the smooth side down and the plastic release liner side up facing towards the concrete slab. Remove and discard plastic release liner. End laps should be staggered to avoid a build up of layers. Succeeding sheets should be accurately positioned to overlap the previous sheet 2 in. (50 mm) along the marked lap line.

Laps

1. Mechanical fastening method—

To prevent the membrane from moving and gaps opening, the laps should be fastened together at 39 in. (1.0 m) maximum centers. Fix through the center of the lap area using 0.5 in. (12 mm) long washer-head, self-tapping, galvanized screws (or similar) and allowing the head of the screw to bed into the adhesive compound to self-seal. It is not necessary to fix the membrane to the substrate, only to itself. Ensure the membrane lays flat and no openings occur. (See Figure 1.) Additional fastening may be required at corners, details, etc. Continuity is achieved once the slab is poured and the bond to concrete develops.

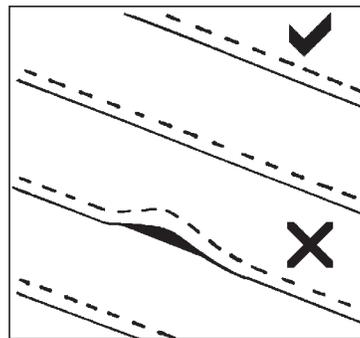


Figure 1

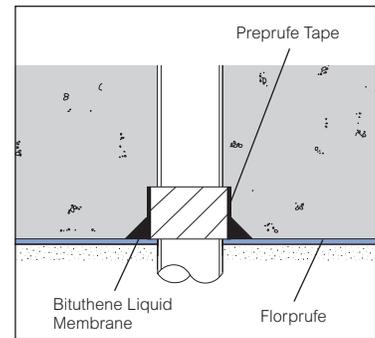


Figure 2

OR

2. Taped lap method—

For additional security use Grace Preprufe Tape to secure and seal the overlaps. Overband the lap with the 4 in. (100 mm) wide Preprufe Tape, using the lap line for alignment. Remove plastic release liner to ensure bond to concrete.

Penetrations

Mix and apply Bituthene Liquid Membrane detailing compound to seal around penetrations such as drainage pipes, etc. (See Figure 2 and refer to the Bituthene Liquid Membrane data sheet, BIT-230.)

Concrete Placement

Place concrete within 30 days. Inspect membrane and repair any damage with patches of Preprufe Tape. Ensure all liner is removed from membrane and tape before concreting.

www.graceconstruction.com

For technical assistance call toll free at 866-333-3SBM (3726)

Florprufe and Preprufe are registered trademarks of W. R. Grace & Co.—Conn.

We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate and is offered for the users' consideration, investigation and verification, but we do not warrant the results to be obtained. Please read all statements, recommendations or suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright. W. R. Grace & Co.—Conn., 62 Whittemore Avenue, Cambridge, MA 02140. In Canada, Grace Canada, Inc., 294 Clements Road, West, Ajax, Ontario, Canada L1S 3C6.

This product may be covered by patents or patents pending.
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FA/LI/1M

GRACE

APPENDIX F
MANUFACTURER SPECIFICATIONS FOR
SUB-SLAB DEPRESSURIZATION SYSTEM

NOTES

- THIS PLAN SHALL NOT BE USED FOR STRUCTURAL, ARCHITECTURAL OR OTHER REFERENCE PURPOSES EXCEPT FOR THE SUB-SLAB DEPRESSURIZATION SYSTEM (SSDS) AND VAPOR BARRIER.
- COORDINATE ALL WORK FOR SSDS INSTALLATION WITH OTHER TRADES BEFORE INSTALLATION.
- EXISTING SOIL SHALL BE EXCAVATED AND A SUBGRADE PREPARATION SHALL BE PERFORMED PER SPECIFICATIONS AND PER GEOTECHNICAL REPORT.
- THE FULL EXTENTS OF THE BUILDING CONSTRUCTION BENEATH THE FLOOR SLABS SHALL BE LINED WITH GAS PERMEABLE AGGREGATE AND VAPOR BARRIER EXCEPT AS NOTED ON THIS DRAWING AND AS REQUIRED BY FOUNDATION ELEMENT LAYOUTS IN STRUCTURAL PLANS. ALL DEVIATIONS SHALL BE PROPOSED IN SHOP DRAWING SUBMITTALS PRIOR TO INSTALLATION IN THE FIELD.
- GRACE FLOORPROF 120 OR APPROVED EQUAL AND GRACE PREPRUFE 300R AT PIS EXTENDING ABOVE THE WATER TABLE SHALL BE INSTALLED IN ACCORDANCE WITH SPECIFICATION SECTION 0221 (AND ALL OTHER APPLICABLE SPECIFICATION SECTIONS), AND RELATED DRAWINGS.
- ALL SOLID HORIZONTAL PIPE RUNS MUST BE PITCHED A MINIMUM OF 1/8 INCH VERTICAL PER FOOT HORIZONTAL (1% SLOPE) TOWARDS EACH SECTION OF SLOTTED VENTING PIPE. THE SYSTEM SHALL BE INSTALLED SUCH THAT NO PORTION WILL ALLOW EXCESS ACCUMULATION OF CONDENSATION. SOLID UNDERGROUND PIPING MAY BE PITCHED TO CONDENSATE DRAIN, SHOULD THEY BE NECESSARY (SEE DETAIL 4, ENV-200).
- REFER TO DRAWINGS ENV-200.00 AND ENV-201.00 FOR SSDS PIPING, RISER, GAS VAPOR BARRIER, GAS PERMEABLE AGGREGATE, AND FAN & EXHAUST STACK DETAILS AND SECTIONS.
- CONTRACTORS TO SUPPLY SHOP DRAWINGS OF PROPOSED PILE LAYOUTS & PIPE INVERTS IN COORDINATION WITH LATEST FOUNDATION PLANS TO ENSURE ACCEPTABLE PIPE FIT & INSTALLATION DETAILS.
- ALL DIMENSIONS AND ELEVATIONS SHALL BE CHECKED AGAINST ARCHITECTURAL AND BUILDING PLANS. NOTIFY ENGINEER OF ANY DISCREPANCY PRIOR TO CONSTRUCTION.
- BASEMAP TAKEN FROM DRAWINGS FO-100 DATED 10-01-2015 (ISSUE FOR FILING).
- MONITORING POINT LOCATIONS TO BE COORDINATED WITH FIRST FLOOR ARCHITECTURAL PLANS.



LEGEND

- SLOTTED 4" PVC PIPE BENEATH SLAB WITH ENDCAP
- SOLID 4" PVC PIPE BENEATH SLAB
- 6" VERTICAL RISER LOCATION (SEE ENV-201 DETAILS 1)
- PENETRATION LOCATIONS OF 4" SUB-SLAB PIPE (SEE ENV-201 FOR DETAILS)
- VAPOR BARRIER INSTALLATION LOCATIONS
- GRAVEL INSTALLATION LOCATIONS
- EXTENT OF BUILDING A FIRST FLOOR ENCLOSED OCCUPIED SPACE
- MONITORING POINT LOCATION (SEE ENV-200.00 DETAIL 6)

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REVISIONS

No.	DATE	DESCRIPTION
1.	10/23/2015	RAWP APPROVAL

PROJECT
 470 MANHATTAN AVENUE, BROOKLYN, NY

DRAWN BY KH	CHECKED BY MG
SCALE AS NOTED	DATE 10/23/2015

SHEET TITLE
 SUB SLAB DEPRESSURIZATION SYSTEM LAYOUT

SHEET NO.
 ENV-100
 SHEET 1 OF 4



10/23/2015 10:45 AM C:\Users\kh\AppData\Local\Temp\AKRF\10232015\10232015.dwg (10/23/2015 10:45 AM)

- GENERAL NOTES:**
- DRAWING SHALL NOT BE USED FOR STRUCTURAL, ARCHITECTURAL, UTILITY, OR OTHER REFERENCE EXCEPT FOR THE SUB-SLAB DEPRESSURIZATION SYSTEM AND VAPOR BARRIER.
 - CONTRACTOR TO SUBMIT SHOP DRAWINGS OF ALL PIPE LAYOUTS, RISER LOCATIONS, MONITORING POINT LOCATIONS FOR APPROVAL.
 - INSTALLATION OF THE SUB-SLAB COMPONENTS AND VENT AND RISER PIPING, AND ROOF PENETRATIONS MUST BE COORDINATED WITH OTHER TRADES FOR THE INSTALLATION OF OTHER UTILITIES AND STRUCTURAL COMPONENTS.
 - ALL SOLID HORIZONTAL PIPE RUNS MUST BE PITCHED A MINIMUM OF 1/8-INCH VERTICAL PER FOOT HORIZONTAL (1% SLOPE) TOWARDS EACH SECTION OF SLOTTED VENTING PIPE. THE SYSTEM SHALL BE INSTALLED SUCH THAT NO PORTION WILL ALLOW EXCESS ACCUMULATION OF CONDENSATION. SOLID UNDERGROUND PIPING MAY BE PITCHED TO CONDENSATE DRAIN, SHOULD THEY BE NECESSARY (SEE DETAIL 6, ENV-200).
 - UNLESS OTHERWISE SPECIFIED, ALL UNDERGROUND PIPING SHALL BE CONSTRUCTED OF 4-INCH SCHEDULE 40 PVC AND ALL ABOVEGROUND RISER PIPING SHALL BE CONSTRUCTED OF 6-INCH GALVANIZED STEEL.
 - RISER PIPE LOCATIONS FROM SUB-SLAB TO ROOF SHALL BE COORDINATED WITH ARCHITECT AND MECHANICAL ENGINEER. RISER PIPE SHALL BE EXTENDED TO THE ROOF WITH MINIMAL CHANGES IN DIRECTION. ANY NECESSARY LATERAL PIPE RUNS SHALL BE PROPOSED IN SHOP DRAWINGS PRIOR TO FIELD INSTALLATION.
 - ALL CONNECTIONS AT PIPE FITTINGS AND JOINTS SHALL BE LEAK FREE. THIS SHALL BE DEMONSTRATED BY THE PERFORMANCE OF A POSITIVE 5 POUNDS PER SQUARE INCH (PSI) (MIN.) PRESSURE TEST AS DETAILED IN SPECIFICATION 02 80 00 SECTION 3.01.
 - RISER PIPE SHALL BE PERMANENTLY IDENTIFIED WITHIN EACH FLOOR LEVEL. BACKGROUND SHALL BE SAFETY BLUE WITH WHITE LETTERING. LETTERING SHALL READ:
 "CAUTION: DO NOT ALTER SUBSURFACE VAPOR VENT PIPE."
 - ALL EXTERNAL PIPES OR PIPES EXPOSED TO MOISTURE AND METAL SYSTEM COMPONENTS SHALL BE PAINTED WITH A CORROSION RESISTANT COATING.
 - EXHAUST STACKS SHALL BE SECURELY ANCHORED WITH ADEQUATE STRUCTURAL SUPPORTS. SEE ENV-201, DETAIL 2.
 - SSDS DESIGN DETAILS AND DRAWINGS ARE ADAPTED FROM EPA DOCUMENT EPA/625/R-92/016.
 - VENT AND RISER PIPING SHALL BE INSTALLED IN ACCORDANCE WITH THE NEW YORK CITY PLUMBING CODE, INCLUDING, BUT NOT LIMITED TO, THOSE REQUIREMENTS PERTAINING TO:
 - PROTECTION OF SYSTEM COMPONENTS
 - TRENCHING, EXCAVATION, AND BACKFILL
 - STRUCTURAL SAFETY
 - PIPING SUPPORT
 - JOINTS
 - SYSTEM INSTALLATION SHALL ADHERE TO: OCTOBER 2009 FINAL GUIDANCE FOR EVALUATING SOIL VAPOR INTRUSION IN THE STATE OF NEW YORK PREPARED BY NEW YORK STATE DEPARTMENT OF HEALTH (NYSDOH); ALL APPLICABLE PORTIONS OF THE BUILDING CODE OF THE CITY OF NEW YORK, INCLUDING BUT NOT LIMITED TO 2014 NEW YORK CITY MECHANICAL CODE, CHAPTER 5, SECTION MC 512-SUBSLAB EXHAUST SYSTEMS AS SUCH, POINT OF EXHAUST SHALL BE:
 - AT LEAST 10 FEET ABOVE ROOF.
 - AT LEAST 10 FEET FROM ANY ADJOINING OR ADJACENT BUILDINGS, OPERABLE WINDOWS, HVAC INTAKES, SUPPLY REGISTERS, OR ANY OTHER AIR INLETS.

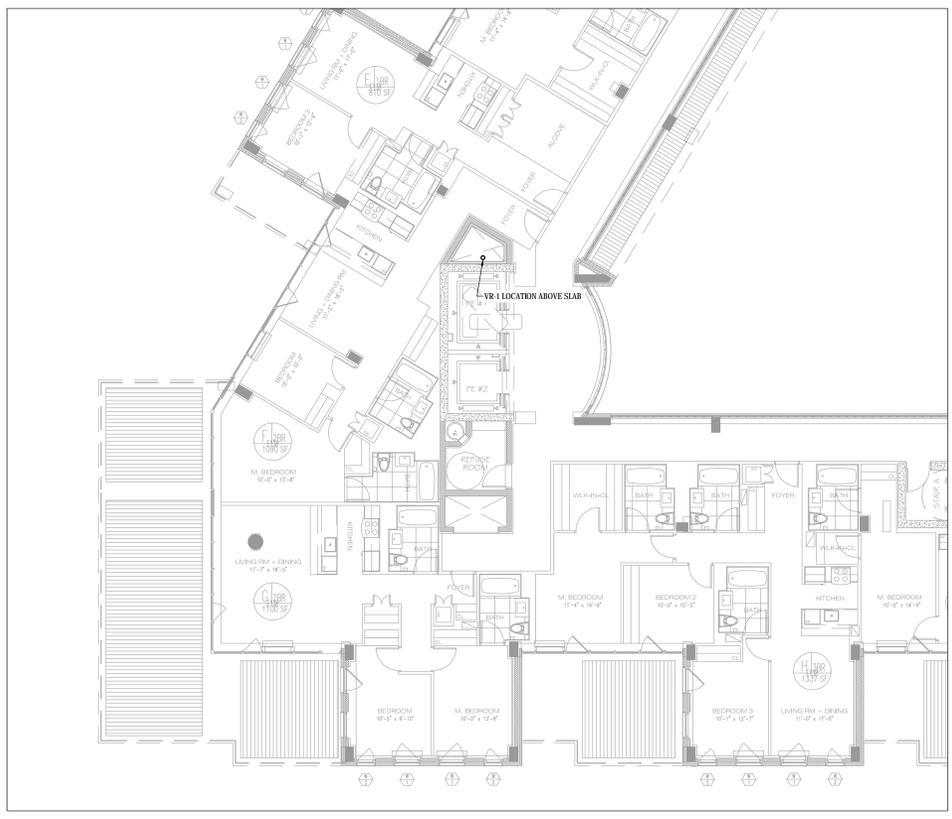


1 2ND FLOOR RISER LOCATION
 ENV101 SCALE: 1"=8"

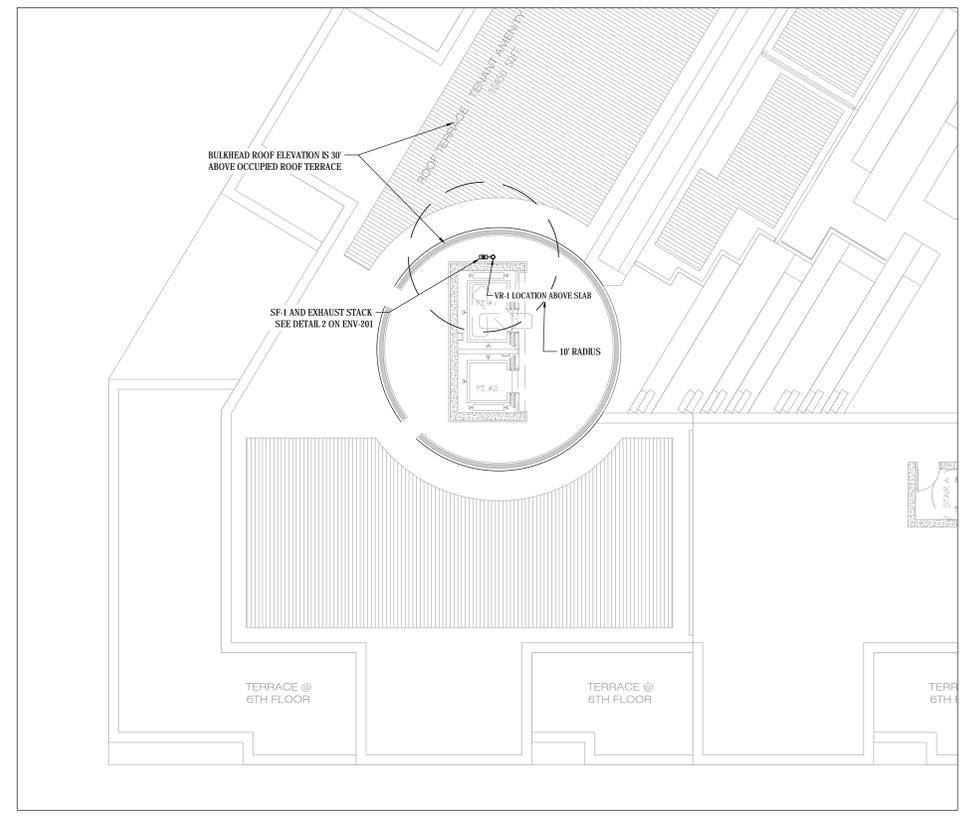


2 3RD-6TH FLOORS RISER LOCATION
 ENV101 SCALE: 1"=8"

- LEGEND:**
- RISER PENETRATION LOCATION
 - SUCTION FAN AND EXHAUST STACK LOCATION



3 7TH FLOORS RISER LOCATION
 ENV101 SCALE: 1"=8"



4 BULKHEAD ROOF RISER LOCATION
 ENV101 SCALE: 1"=8"

REVISIONS		
No.	DATE	DESCRIPTION
1.	10/23/2015	RAWF APPROVAL

PROJECT
 470 MANHATTAN AVENUE, BROOKLYN, NY

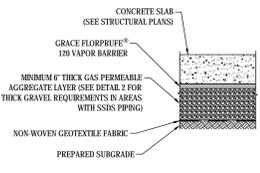
DRAWN BY KH
CHECKED BY MG
SCALE AS NOTED
DATE 10/23/2015

SHEET TITLE
 RISER LOCATION

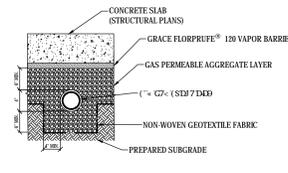
SHEET NO. ENV-101
 SHEET 2 OF 4



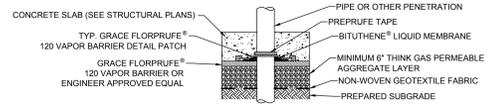
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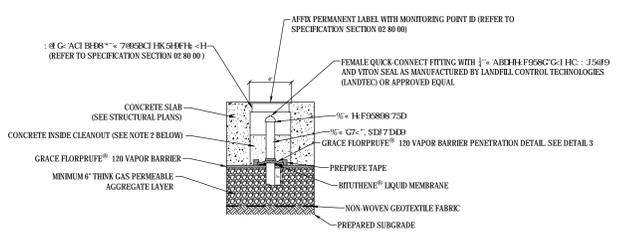
1 TYPICAL SECTION THROUGH SUB-SLAB
SCALE: NTS



2 TYPICAL SECTION THROUGH SUB-SLAB PIPING TRENCH
SCALE: NTS

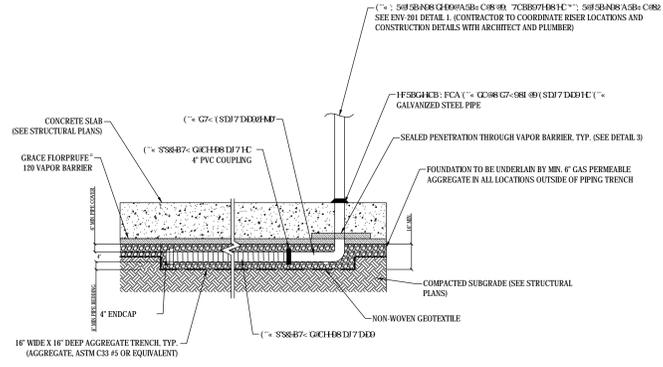


3 TYPICAL VAPOR BARRIER PENETRATION
SCALE: NTS

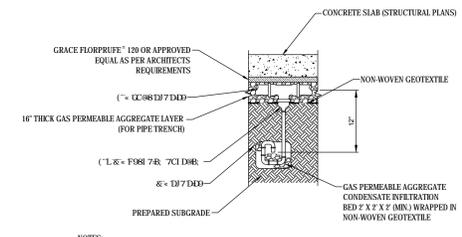


- NOTES:
1. PROPERLY SEAL ALL PENETRATIONS THROUGH VAPOR BARRIER ACCORDING TO MANUFACTURER'S SPECIFICATIONS. SEE DETAIL 3.
 2. 3' OF CONCRETE TO BE POURED INSIDE OF CLEANOUT ON TOP OF PROPERLY SEALED PENETRATION.

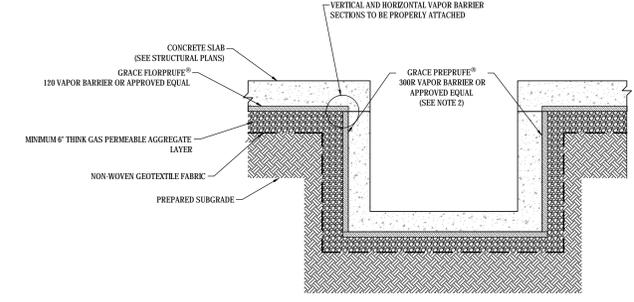
4 TYPICAL MONITORING POINT
SCALE: NTS



5 TYPICAL SSSD PIPING PROFILE
SCALE: NTS

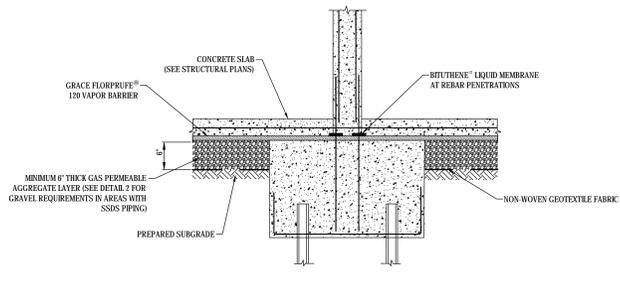


6 TYPICAL LOW POINT CONDENSATE DRAIN
SCALE: NTS



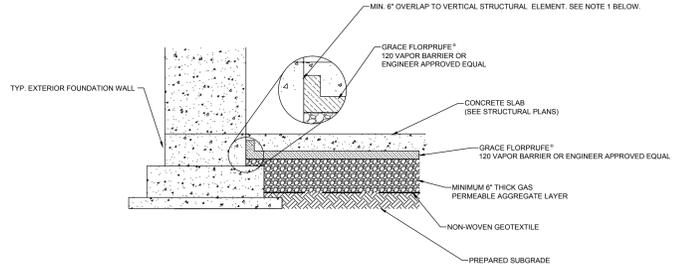
- NOTES:
1. SEAL ANY PIPE PENETRATIONS IN PIT WALL IN ACCORDANCE WITH DETAIL 3 OF THIS DRAWING.
 2. WATERPROOFING REQUIRED IN PITS AT OR BELOW WATER TABLE.

7 VAPOR BARRIER DETAIL AT TYPICAL ELEVATOR PIT
SCALE: NTS



- NOTES:
1. PROPERLY SEAL VAPOR BARRIER ACCORDING TO MANUFACTURER'S SPECIFICATIONS. SEE GRACE PREPRUFFE DETAIL 37 OR 38 IN GRACE WATERPROOFING SYSTEMS CONTRACTOR'S HANDBOOK.

8 VAPOR BARRIER DETAIL AT TYPICAL INTERIOR PILE CAP
SCALE: NTS



- NOTES:
1. INSTALL VAPOR BARRIER AT FOUNDATION WALL PER MANUFACTURER'S SPECIFICATIONS. REFER TO PREPRUFFE DETAIL 6 IN GRACE WATERPROOFING SYSTEMS CONTRACTOR'S HANDBOOK FOR SEAL DETAIL.
 2. REFER TO STRUCTURAL DRAWINGS FOR EXTERIOR FOUNDATION WALL DETAILS.

9 VAPOR BARRIER DETAIL AT TYPICAL EXTERIOR FOUNDATION WALL
SCALE: NTS

GENERAL NOTES:

1. DRAWING SHALL NOT BE USED FOR STRUCTURAL, ARCHITECTURAL, UTILITY, OR OTHER REFERENCE EXCEPT FOR THE SUB-SLAB DEPRESSURIZATION SYSTEM AND VAPOR BARRIER.
2. CONTRACTOR TO SUBMIT SHOP DRAWINGS OF ALL PIPE LAYOUTS, RISER LOCATIONS, MONITORING POINT LOCATIONS FOR APPROVAL.
3. INSTALLATION OF THE SUB-SLAB COMPONENTS AND VENT AND RISER PIPING, AND ROOF PENETRATIONS MUST BE COORDINATED WITH OTHER TRADES FOR THE INSTALLATION OF OTHER UTILITIES AND STRUCTURAL COMPONENTS.
4. ALL SOLID HORIZONTAL PIPE RUNS MUST BE PITCHED A MINIMUM OF 1/8-INCH VERTICAL PER FOOT HORIZONTAL (1% SLOPE) TOWARDS EACH SECTION OF SLOTTED VENTING PIPE. THE SYSTEM SHALL BE INSTALLED SUCH THAT NO PORTION WILL ALLOW EXCESS ACCUMULATION OF CONDENSATION. SOLID UNDERGROUND PIPING MAY BE PITCHED TO CONDENSATE DRAIN, SHOULD THEY BE NECESSARY (SEE DETAIL 6).
5. UNLESS OTHERWISE SPECIFIED, ALL UNDERGROUND PIPING SHALL BE CONSTRUCTED OF 4-INCH SCHEDULE 40 PVC AND ALL ABOVEGROUND RISER PIPING SHALL BE CONSTRUCTED OF 6-INCH GALVANIZED STEEL.
6. RISER PIPE LOCATIONS FROM SUB-SLAB TO ROOF SHALL BE COORDINATED WITH ARCHITECT AND MECHANICAL ENGINEER. RISER PIPE SHALL BE EXTENDED TO THE ROOF WITH MINIMAL CHANGES IN DIRECTION. ANY NECESSARY LATERAL PIPE RUNS SHALL BE PROPOSED IN SHOP DRAWINGS PRIOR TO FIELD INSTALLATION.
7. ALL CONNECTIONS AT PIPE FITTINGS AND JOINTS SHALL BE LEAK FREE. THIS SHALL BE DEMONSTRATED BY THE PERFORMANCE OF A POSITIVE 5 POUNDS PER SQUARE INCH (PSI) (MIN.) PRESSURE TEST AS DETAILED IN SPECIFICATION 02 80 00 SECTION 3.01.

8. RISER PIPE SHALL BE PERMANENTLY IDENTIFIED WITHIN EACH FLOOR LEVEL. BACKGROUND SHALL BE SAFETY BLUE WITH WHITE LETTERING. LETTERING SHALL READ:
 - * CAUTION: DO NOT ALTER SUBSURFACE VAPOR VENT PIPE.*
9. ALL EXTERNAL PIPES OR PIPES EXPOSED TO MOISTURE AND METAL SYSTEM COMPONENTS SHALL BE PAINTED WITH A CORROSION RESISTANT COATINGS.
10. EXHAUST STACKS SHALL BE SECURELY ANCHORED WITH ADEQUATE STRUCTURAL SUPPORTS. SEE ENV-201, DETAIL 2.
11. SSSD DESIGN DETAILS AND DRAWINGS ARE ADAPTED FROM EPA DOCUMENT EPA/625/R-92/016.
12. VENT AND RISER PIPING SHALL BE INSTALLED IN ACCORDANCE WITH THE NEW YORK CITY PLUMBING CODE, INCLUDING, BUT NOT LIMITED TO, THOSE REQUIREMENTS PERTAINING TO:
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 - TRENCHING, EXCAVATION, AND BACKFILL
 - STRUCTURAL SAFETY
 - PIPING SUPPORT
 - JOINTS
14. SYSTEM INSTALLATION SHALL ADHERE TO: OCTOBER 2006 FINAL GUIDANCE FOR EVALUATING SOIL VAPOR INTRUSION IN THE STATE OF NEW YORK PREPARED BY NEW YORK STATE DEPARTMENT OF HEALTH (NYSDOH). ALL APPLICABLE PORTIONS OF THE BUILDING CODE OF THE CITY OF NEW YORK, INCLUDING BUT NOT LIMITED TO 2014 NEW YORK CITY MECHANICAL CODE, CHAPTER 5, SECTION MC 512-SUBSLAB EXHAUST SYSTEMS AS SUCH, POINT OF EXHAUST SHALL BE:
 - AT LEAST 10 FEET ABOVE ROOF.
 - AT LEAST 10 FEET FROM ANY ADJOINING OR ADJACENT BUILDINGS, OPERABLE WINDOWS, HVAC INTAKES, SUPPLY REGISTERS, OR ANY OTHER AIR INLETS.

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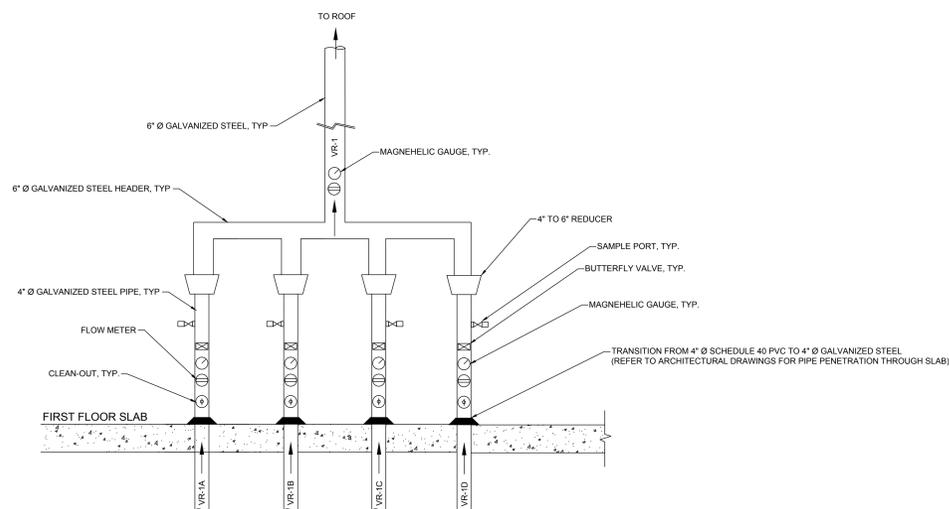
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REVISIONS		
No.	DATE	DESCRIPTION
1.	10/23/2015	RAWP APPROVAL

PROJECT
470 MANHATTAN AVENUE, BROOKLYN, NY

DRAWN BY: KH
CHECKED BY: MG
SCALE: AS NOTED
DATE: 10/23/2015

SHEET TITLE
SUB SLAB DEPRESSURIZATION SYSTEM DETAILS
SHEET NO.
ENV-200
SHEET 3 OF 4



NOTES:

- NOT ALL FITTINGS SHOWN. CONTRACTOR SHALL SUBMIT TO SCALE SKETCH SHOWING PROPOSED PIPE JOINT LOCATIONS. ENGINEER'S APPROVAL OF PIPE JOINT LOCATIONS SHALL BE REQUIRED PRIOR TO CONSTRUCTION.
- FURNISH ESCUTCHEONS AS SPECIFIED.
- FURNISH PIPE HANGERS AND WALL MOUNTS AS SPECIFIED IN PLUMBING AND HVAC SPECIFICATIONS AND DRAWINGS.
- ALL HORIZONTAL PIPE RUNS (ABOVE GROUND AND UNDERGROUND) MUST BE PITCHED A MINIMUM OF 1/8 INCH VERTICAL PER FOOT HORIZONTAL (1% SLOPE) TOWARDS SLOTTED PIPE. THE SYSTEM SHALL BE INSTALLED SUCH THAT NO PORTION WILL ALLOW EXCESS ACCUMULATION OF CONDENSATION.
- FLOW SENSORS TO BE INSTALLED WITH MINIMUM CLEARANCE AS PER MANUFACTURER SPECIFICATIONS. ELECTRICAL CONTRACTOR TO PROVIDE POWER PANEL FOR FLOW SENSOR DISPLAYS.
- PROVIDE ACCESS DOORS FOR CLEAN OUTS AND GAUGES (SEE ARCHITECTURAL DRAWINGS).

1 PIPING MANIFOLD
SCALE: NTS

INSTRUMENT SCHEDULE							
ITEM	DESCRIPTION	SERVICE	LOCATION	REQUIREMENTS	RANGE	REMARKS	MANUFACTURER/MODEL
VI	VACUUM INDICATOR	SSDS	EACH MANIFOLD LEG AND MANIFOLDED RISER PIPE	NA	0-10" WC	FOR EACH RISER LEG, MANIFOLDED RISER PIPE	DWYER INSTRUMENTS INC. SERIES 2000 (MAGNETIC GAUGE)
DPS	DIFFERENTIAL PRESSURE SWITCH	AIS	RISER OR SUCTION FAN	NA	3.0 - 11"	CONNECT TO AIS	DWYER INSTRUMENTS INC. SERIES 1900 MODEL 1910-10
CONTROL PANEL	SUCTION FAN	SSDS	TBD	1 PHASE, 60 HZ, 115 VOLT	NA	COORDINATE LOCATION WITH ARCHITECT	
FLOW METER	FLOW	SSDS	EACH MANIFOLD LEG AND MANIFOLDED RISER PIPE	1 PHASE, 60 HZ, 115 VOLT	NA	FOR EACH RISER LEG AND MANIFOLDED RISER PIPE	VORTEX VT-5000 AIRFLOW MEASUREMENT PROBE, TRANSMITTER AND OPTIONAL DISPLAY
VG	VACUUM GAUGE	SSDS	BLOWER INLET	NA	0-15" WC	BLOWER INLET	NOSBROK 25-2500 15 INCHES SLAB VAC-14 BPS
PG	PRESSURE GAUGE	SSDS	STACK	NA	0-10" WC	STACK	NOSBROK 25-2500 10 INCHES R.P. 114 BPS

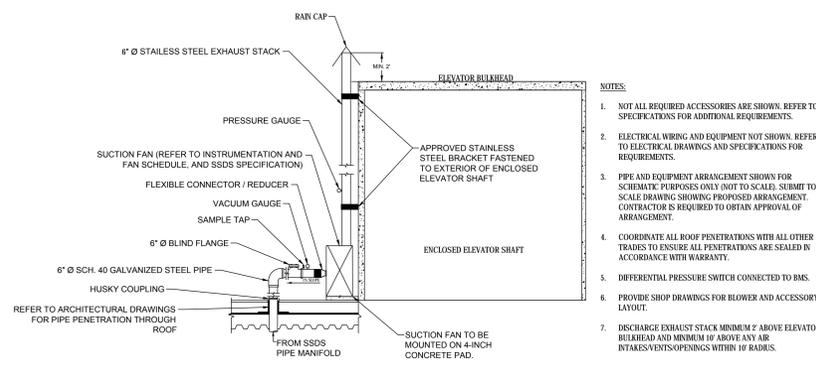
FAN SCHEDULE								
UNIT NO.	AREAS SERVED	SERVICE	LOCATION	MOTOR SIZE	MIN. CFM	MIN. RATE (INCHES WC)	MOTOR REQUIREMENTS	MANUFACTURER/MODEL
SF-1	ENTIRE BUILDING	SSDS	ELEVATOR BULKHEAD ROOF	0.5 hp	250	7	60 HZ, 3 PHASE, 230 OR 460 VOLT	IPF COLASIT - CHVS 125

GENERAL NOTES:

- DRAWING SHALL NOT BE USED FOR STRUCTURAL, ARCHITECTURAL, UTILITY, OR OTHER REFERENCE EXCEPT FOR THE SUB-SLAB DEPRESSURIZATION SYSTEM.
- CONTRACTOR TO SUBMIT SHOP DRAWINGS OF ALL EQUIPMENT, PIPING, MONITORING POINT LOCATIONS FOR APPROVAL BY THE ENVIRONMENTAL ENGINEER BEFORE CONSTRUCTION.
- DESIGN DETAILS AND DRAWINGS ARE ADAPTED FROM EPA DOCUMENT EPA/825/R-92/016.
- SYSTEM INSTALLATION SHALL ADHERE TO: OCTOBER 2006 FINAL GUIDANCE FOR EVALUATING SOIL VAPOR INTRUSION IN THE STATE OF NEW YORK PREPARED BY NEW YORK STATE DEPARTMENT OF HEALTH (NYSDOH), ALL APPLICABLE PORTIONS OF THE BUILDING CODE OF THE CITY OF NEW YORK, INCLUDING BUT NOT LIMITED TO 2014 NEW YORK CITY MECHANICAL CODE, CHAPTER 5, SECTION MC 512-SUBSLAB EXHAUST SYSTEMS, AS SUCH, POINT OF EXHAUST SHALL BE:
 - AT LEAST 10 FEET ABOVE ROOF.
 - AT LEAST 10 FEET FROM ANY ADJOINING OR ADJACENT BUILDINGS, OPERABLE WINDOWS, HVAC INTAKES, SUPPLY REGISTERS, OR ANY OTHER AIR INTAKES.
- EXHAUST STACKS SHALL BE SECURELY ANCHORED WITH ADEQUATE STRUCTURAL SUPPORTS AS SHOWN ON DETAILS.
- VENT AND RISER PIPING SHALL BE INSTALLED IN ACCORDANCE WITH THE NEW YORK CITY PLUMBING CODE, INCLUDING, BUT NOT LIMITED TO, THOSE REQUIREMENTS PERTAINING TO:
 - PROTECTION OF SYSTEM COMPONENTS
 - TRENCHING, EXCAVATION, AND BACKFILL
 - STRUCTURAL SAFETY
 - PIPING SUPPORT
 - JOINTS
- REFER TO DRAWINGS ENV-100, ENV-101 AND ENV-200 FOR SSDS PIPING, RISER, GAS VAPOR BARRIER, GAS PERMEABLE AGGREGATE, AND FAN & EXHAUST STACK LOCATIONS DETAILS AND SECTIONS
- ALL SOLID HORIZONTAL PIPE RUNS (ABOVEGROUND AND UNDERGROUND) MUST BE PITCHED A MINIMUM OF 1/8 INCH VERTICAL PER FOOT HORIZONTAL (1% SLOPE) TOWARDS EACH SUB-SLAB DEPRESSURIZATION PIT OR TO UNDERGROUND CONDENSATE DRAIN WITHIN THE SUB-SLAB WHEN UNDERGROUND PIPING CANNOT BE SLOPED TOWARDS PIT. THE SYSTEM SHALL BE INSTALLED SUCH THAT NO PORTION WILL ALLOW EXCESS ACCUMULATION OF CONDENSATION.
- ALL CONNECTIONS AT PIPE FITTINGS AND JOINTS SHALL BE LEAK FREE. THIS SHALL BE DEMONSTRATED BY THE PERFORMANCE OF A POSITIVE 5 POUNDS PER SQUARE INCH (PSI) (MIN.) PRESSURE TEST FOLLOWING PIPE FITTINGS ASSEMBLY BY THE CONTRACTOR.
- ENVIRONMENTAL ENGINEER WILL INSPECT DURING VERTICAL RISER PRESSURE TEST AND OTHER MILESTONE INSPECTIONS AS REQUIRED IN SPEC 02 80 00.
- RISER PIPE SHALL BE PERMANENTLY IDENTIFIED WITHIN EACH FLOOR LEVEL. BACKGROUND SHALL BE SAFETY BLUE WITH WHITE LETTERING. LETTERING SHALL READ:
 - "CAUTION: DO NOT ALTER SUBSURFACE VAPOR VENT PIPE"
- ALL EXTERNAL PIPES OR PIPES EXPOSED TO MOISTURE AND METAL SYSTEM COMPONENTS SHALL BE PAINTED WITH A CORROSION RESISTANT COATING.
- INSTALLATION OF THE SUB-SLAB COMPONENTS AND VENT AND RISER PIPING, FANS AND ROOF PENETRATIONS MUST BE COORDINATED WITH OTHER TRADES FOR THE INSTALLATION OF OTHER UTILITIES AND STRUCTURAL COMPONENTS.
- LOCATIONS RISER PIPE FROM SUB-SLAB TO ROOF SHALL BE COORDINATED WITH ARCHITECT AND MECHANICAL ENGINEER. RISER PIPE SHALL BE EXTENDED TO THE ROOF WITH MINIMAL CHANGES IN DIRECTION. SEE ENV-101 FOR RISER LOCATIONS.

BLOWER NOTES:

- THE SUCTION FAN SCHEMATICS ARE SHOWN TO ILLUSTRATE THE REQUIRED COMPONENTS AND THE GENERAL LOCATIONS IN THE PIPING RUN AND SHALL NOT BE CONSIDERED TO BE ACCURATE. THE ACTUAL CONFIGURATION AND DIMENSIONS OF THE SUCTION FAN ASSEMBLY WILL VARY BASED ON MANUFACTURING METHODS AND FIELD CONDITIONS. FINAL DESIGN AND SUCTION FAN SYSTEM SELECTED SHALL BE DETAILED IN SUBMISSIONS TO THE ENGINEER AND ARE SUBJECT TO APPROVAL BY THE ENVIRONMENTAL ENGINEER. CONTRACTOR SHALL PROVIDE ALL SUCTION FAN SPECIFICATIONS AND CUT SHEETS FOR THE ENVIRONMENTAL ENGINEER APPROVAL PRIOR TO INSTALLATION.
- A DIFFERENTIAL PRESSURE SWITCH SHALL BE INSTALLED ON THE RISER PIPE BEFORE THE SUCTION FAN. THE DIFFERENTIAL PRESSURE SWITCH SHALL BE CONNECTED TO THE ALARM INDICATOR SYSTEM (AIS) ACCORDANCE WITH SPECIFICATION SECTIONS 0222.1.
- SUCTION FAN MOTOR WILL REQUIRE A THREE-PHASE, 60HZ, 230 OR 460 VOLT POWER SUPPLY. THE CONTROL PANEL FOR THE SUCTION FAN WILL REQUIRE A ONE-PHASE, 60 HZ, 115 VOLT POWER SUPPLY. THE AIS WILL REQUIRE A ONE-PHASE, 115 VOLT POWER SUPPLY FROM THE BUILDING'S ELECTRICAL SYSTEM. EACH FLOW METER & DIGITAL DISPLAY WILL REQUIRE A ONE-PHASE 60 HZ, 115 VOLT POWER SUPPLY. THE ELECTRICAL SERVICE TO THE BLOWER MOTOR IS SHOWN ON THE ELECTRICAL DRAWINGS. COORDINATE POWER SUPPLIES WITH BUILDING POWER FLOOR PLAN. COORDINATE POWER SUPPLY FOR FLOW METERS AT RISERS THROUGH FLOOR SLAB.
- CONTRACTOR TO PROVIDE CONNECTION TO GROUNDING FOR ROOF TOP FANS.
- REFER TO SPECIFICATION SECTION 02 80 00 - FOR REQUIREMENTS RELATING TO SUB-SLAB DEPRESSURIZATION SYSTEM ACCESSORIES.
- CONTRACTOR TO PROVIDE SOUND ENCLOSURES IF REQUIRED TO MEET NEW YORK CITY NOISE CODE AND/OR FURTHER ATTENUATE NOISE FOR NEARBY RESIDENTIAL UNITS.



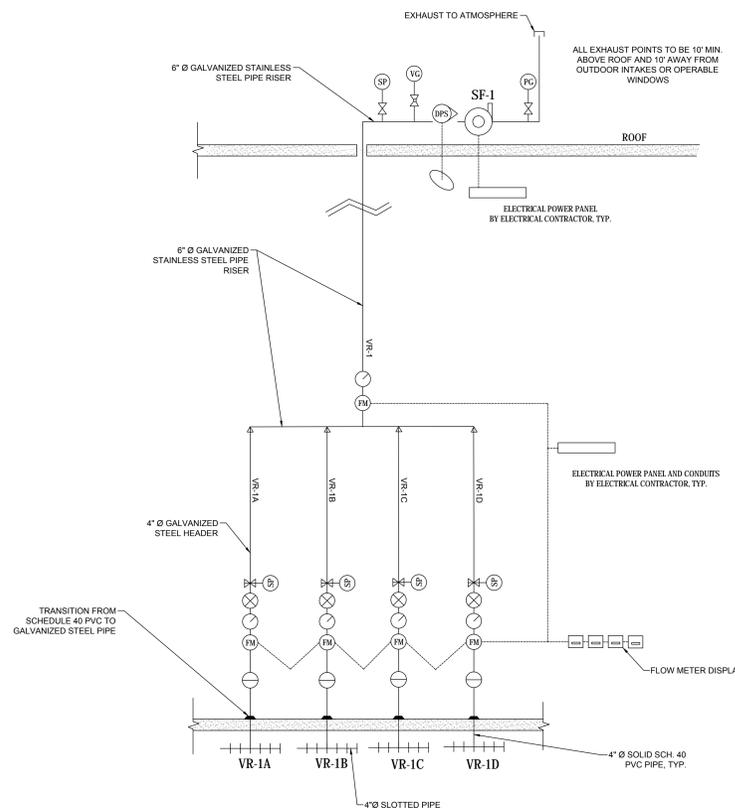
NOTES:

- ADD ADDITIONAL BRACKETS, AS NECESSARY, TO ADEQUATELY SUPPORT STACK.

2 EXHAUST FAN AND STACK ON BULKHEAD ROOF
SCALE: NTS

LEGEND:

- PIPE
- ELECTRICAL CONDUIT
- SLOTTED PIPE
- PRESSURE GAUGE
- VACUUM GAUGE
- FAN
- SAMPLE PORT
- DIFFERENTIAL PRESSURE SWITCH
- REDUCER
- BALL VALVE (NORMALLY CLOSED)
- FLOW METER
- RAIN CAP
- BUTTERFLY VALVE
- MAGNETIC GAUGE
- CLEAN-OUT
- FLOW METER DISPLAY



3 PROCESS FLOW DIAGRAM
SCALE: NTS

REVISIONS

No.	DATE	DESCRIPTION
1.	10/23/2015	RAWP APPROVAL

PROJECT
470 MANHATTAN AVENUE, BROOKLYN, NY

DRAWN BY: KH CHECKED BY: MG

SCALE: AS NOTED DATE: 10/23/2015

SHEET TITLE

SSDS ABOVE SLAB DETAILS

SHEET NO.
ENV-201

APPENDIX G
CONSTRUCTION HEALTH AND SAFETY PLAN

470 Manhattan Avenue

BROOKLYN, NEW YORK

CONSTRUCTION HEALTH AND SAFETY PLAN

OER Project Number: 16EH-A093K

CEQR Number 04DCP003K

E-Designation Number E-318

Prepared for:

470 Manhattan Ave LLC

c/o J. Petrocelli Contracting, Inc.

100 Comac Street

Ronkonkoma, New York 11779

Prepared by:



AKRF, Inc.

440 Park Avenue South, 7th Floor

New York, NY 10016

212-696-0670

OCTOBER 2015

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Figure 1 – Hospital Location Map

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- Appendix A – Potential Health Effects from On-site Contaminants
- Appendix B – Report Forms
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1.0 PURPOSE

The purpose of this Construction Phase Environmental Health and Safety Plan (CHASP) is to assign responsibilities, establish personnel protection standards and mandatory safety practices and procedures, and provide for contingencies that may arise during construction at the project Site. The CHASP is intended to minimize health and safety risks resulting from the known and potential presence of hazardous materials on the Site.

This plan is not designed to address potential geotechnical, mechanical, or structural safety concerns, nor to supersede or replace any OSHA regulation and/or local and state construction codes or regulations.

2.0 APPLICABILITY

Work subject to this CHASP includes activities that disturb the existing soil or groundwater on-site. The contractors and their subcontractors involved in the construction project will provide a copy of this CHASP to their employees whose work involves any potential exposure to the on-site chemical hazards, and will complete all work in accordance with this CHASP. All work outlined within the CHASP is subject to the Remedial Action Work Plan (RAWP) developed for the Site.

3.0 SITE DESCRIPTION

3.1 General Information

470 Manhattan Ave LLC plans to investigate and remediate a 31,450 square foot site located at 470 Manhattan Avenue in the Greenpoint section of Brooklyn, New York. Residential use is proposed for the property. The RI work was performed between September 28 and 30, 2015 and on October 9, 2015. The RIR summarized the nature and extent of contamination and provided sufficient information for establishment of remedial action objectives, evaluation of remedial action alternatives, and selection of a remedy that is protective of human health and the environment consistent with the use of the property pursuant to RCNY§ 43-1407(f).

The proposed development project consists of the demolition of the remaining Site buildings and the construction of a seven-story building with mechanical space, amenities, and a lobby on the first floor, and 135 residential units above. The 142,115-square foot proposed building will occupy the southern and western portion of the Property with 57 tenant parking spaces on the northern and eastern portions of the Site. Excavation is expected to extend to approximately 4 feet below grade at the location of the proposed building, to approximately 6 feet below grade at the location of the proposed covered parking garage, and to approximately 8 feet in the central portion of the Site for the installation of an elevator pit. A small landscaped area is proposed along the Eckford Street frontage of the building. The current zoning designation is M1-2/R6A (light manufacturing and residential), which is consistent with the proposed use.

3.2 Hazard Potential

A Phase I Summary Report and a Remedial Investigation (RI) were performed by AKRF, Inc. (AKRF) and an Asbestos Report and Phase I Environmental Site Assessments were performed previously by others at the Site to compile and evaluate data and information necessary to develop this CHASP. Significant findings of the RI which are pertinent to the development activities proposed for the Site include the following:

- The Site is relatively level and lies at an elevation of approximately 16 feet above sea level.

- Depth to groundwater ranges from 10.0 to 12.3 feet below grade at the Site.
- Groundwater is expected to flow generally from east to west towards the East River.
- Bedrock was not encountered during the RI.
- The stratigraphy of the Site, from the surface down, consists of approximately 12 feet of historic fill, characterized by sand, gravel, silt, concrete, asphalt, brick, and ash. Below the historic fill is a sand, gravel, and silt stratum to the termination of each boring.
- Twenty soil samples were collected for laboratory analysis from soil borings SB-1 through SB-10. Soil sample analytical results were compared to NYSDEC 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (UUSCOs) and Part 375 Soil Cleanup Objectives for Restricted Residential Soil Cleanup Objectives (RRSCOs). VOCs were detected in 16 of the 20 samples analyzed during the investigation. Acetone and benzene were detected above the respective UUSCOs but below the RRSCOs in two soil samples. No other VOCs were detected above UUSCOs or RRSCOs in any of the soil samples analyzed as part of the investigation.

SVOCs were detected in 19 of the 20 soil samples analyzed during the investigation. Total SVOC concentrations ranged between an estimated concentration of 1.98 mg/kg in soil sample SB-4 (4-6) and an estimated concentration of 291 mg/kg in soil sample SB-10 (4-6). Four SVOCs [3-methylphenol/4-methylphenol, benzo(k)fluoranthene, chrysene, and phenol] were detected in at least one soil sample at concentrations exceeding the respective UUSCOs, but below the respective RRSCOs. Seven SVOCs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected at concentrations ranging between 0.62 mg/kg and 21 mg/kg, exceeding the respective UUSCOs and RRSCOs. The SVOC exceedances were generally polycyclic aromatic hydrocarbons (PAHs), which are a class of compounds found in some petroleum products, coal ash, and in other combustion products that are commonly found in urban fill, which was observed in each of the soil borings advanced during the investigation.

Metals were detected in each of the 20 soil samples analyzed during the investigation. Metals exceedances of UUSCOs and RRSCOs were not detected in soil samples SB-4 (4-6) or SB-5 (4-6). Up to six metals were detected in 18 of the soil samples at concentrations exceeding respective UUSCOs, but below respective RRSCOs. The metals arsenic (maximum concentration of 39 mg/kg), cadmium (maximum concentration of 5.1 mg/kg), copper (maximum concentration of 8,500 mg/kg), lead (maximum concentration of 14,000 mg/kg), and mercury (maximum concentration of 7.6 mg/kg), were detected at concentrations exceeding respective UUSCOs and RRSCOs. The metals exceedances are most likely attributable to historic fill material observed in each of the soil borings during the investigation, which often contain highly variable concentrations of metals.

One PCB, Aroclor 1254, was detected at a low-level estimated concentration of 0.012 mg/kg, below the total PCB UUSCO and RRSCO. No other PCBs were detected in any of the soil samples analyzed during the investigation. The presence of Aroclor 1254 is most likely attributable to the presence of historic fill material observed in the soil boring, and is not indicative of a spill or a release.

Pesticides were detected in 10 of the 20 soil samples analyzed during the investigation. One pesticide, 4,4,'-DDD, was detected at a concentration of 0.00434 mg/kg, exceeding the respective UUSCO, but below the respective RRSCO. No other pesticides were detected above the respective UUSCOs or RRSCO in any of the soil samples. The presence of 4,4,'-DDD is most likely attributable to the presence of historic fill material observed in the soil boring, and is not indicative of a spill or a release.

- Five groundwater samples were collected for laboratory analysis from temporary groundwater monitoring wells GW-1 through GW-5. Groundwater sample analytical results were compared to the New York State 6 NYCRR Part 703.5 Class GA Ambient Water Quality Standards (AWQS). VOCs were detected in each of the five groundwater samples analyzed during the investigation. 1,1-Dichlorethane was detected in groundwater sample GW-4 at a concentration of 14 µg/L, above the respective AWQS of 5 µg/L. Methyl tert-butyl ether (MTBE) was detected in groundwater samples GW-1 and GW-5 at concentrations of 20 µg/L and 48 µg/L, respectively, which exceeded the AWQS of 10 µg/L. No other VOCs were detected above AWQS in any of the groundwater samples analyzed during the investigation.

SVOCs were detected in four of the five groundwater samples analyzed during the investigation. SVOCs were not detected in groundwater sample GW-4. Three SVOCs [benzo(a)anthracene, benzo(b)fluoranthene, and chrysene] were detected in groundwater sample GW-2 at estimated concentrations between 0.05 µg/L and 0.18 µg/L, exceeding the AWQS of 0.002 µg/L for these compounds. No other SVOCs were detected above AWQS in any of the groundwater samples analyzed during the investigation.

Metals were detected in each of the five groundwater samples analyzed during the investigation. Five metals (lead, magnesium, mercury, nickel, and sodium) were detected in the unfiltered samples at concentrations exceeding the respective AWQS. Of these, magnesium and sodium were detected in the filtered groundwater samples exceeding the respective AWQS. The presence of the metals in the unfiltered groundwater samples is likely a result of sediment entrained in the samples, which was observed during groundwater sampling at each of the five groundwater monitoring well sampling locations. The presence of these metals in the filtered groundwater samples are typical of groundwater quality in Brooklyn and do not appear to be related to a spill or release at the Site.

PCBs were not detected in any of the groundwater samples analyzed during the investigation.

Pesticides were detected in two of the five groundwater samples analyzed during the investigation. 4,4'-DDT was detected at a low-level estimated concentration in groundwater sample GW-2. Chlordane was detected at an estimated concentration of 0.116 µg/L in groundwater sample GW-4, above the respective AWQS of 0.05 µg/L. No other pesticides were detected in the groundwater samples analyzed during the investigation.

- Seven soil vapor samples were collected for laboratory analysis from soil vapor points SV-1 through SV-7. Soil vapor sample analytical results were compared to the NYSDOH 2006 Guidance for Evaluating Soil Vapor Intrusion soil vapor intrusion air guidance values (AGVs) and matrices, the September 2013 NYSDOH Fact Sheet update for

tetrachloroethene (PCE), and the August 2015 NYSDOH Fact Sheet update for trichloroethene (TCE).

A review of the soil vapor sample analytical results identified 31 VOCs detected in the seven soil vapor samples. VOCs associated with petroleum [including benzene, toluene, ethylbenzene, xylenes (collectively referred to as BTEX), 1,3-butadiene, 2-butanone, 1,3-dichlorobenzene, 1,2,4- and 1,3,5-trimethylbenzene, 2-hexanone, chloroethane, chloromethane, cyclohexane, ethyl alcohol, heptane, tert-butyl alcohol, hexane, styrene, 4-ethyltoluene, and 2,2,4-trimethylpentane] were detected at individual concentrations up to 279 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Solvent-related VOCs [including acetone, carbon disulfide, carbon tetrachloride, chloroform, dichlorodifluoromethane, isopropyl alcohol, PCE, TCE, trans-1,2-dichloroethene, trichlorofluoromethane, 1,1,1-trichloroethane, and 1,1-dichloroethane] were detected at individual concentrations up to 2,580 $\mu\text{g}/\text{m}^3$.

PCE was detected in six of the seven soil vapor samples at concentrations up to 22.4 $\mu\text{g}/\text{m}^3$, below the respective AGV of 30 $\mu\text{g}/\text{m}^3$. TCE was detected in soil vapor samples SV-1 and SV-6 at concentrations of 14.6 $\mu\text{g}/\text{m}^3$ and 46 $\mu\text{g}/\text{m}^3$, respectively, above the AGV of 2 $\mu\text{g}/\text{m}^3$.

3.3 Hazard Evaluation

The most likely routes of exposure are breathing of volatile and semi-volatile compounds or particulate-laden air released during soil disturbing activities, dermal contact, and accidental ingestion. Appendix A includes specific health effects from chemicals present or potentially present on-site. Although some of the chemicals of concern listed in the sections below were not detected during the subsurface investigation, they are included here as a precaution. The remaining sections of this CHASP address procedures (including training, air monitoring, work practices and emergency response) to reduce the potential for unnecessary and unacceptable exposure to these contaminants.

The potential adverse health effects from these contaminants are diverse. Many of these compounds are known or suspected to result in chronic illness from long-term exposures. However, due to the limited nature of the proposed construction, only acute effects are a potential concern.

This CHASP addresses potential environmental hazards from the presence of hazardous materials. It is not intended to address the normal hazards of construction work, which are separately covered by OSHA regulations and/or local and state construction codes and regulations.

3.3.1 Hazards of Concern

Check all that apply		
<input checked="" type="checkbox"/> Organic Chemicals	<input checked="" type="checkbox"/> Inorganic Chemicals	<input type="checkbox"/> Radiological
<input type="checkbox"/> Biological	<input type="checkbox"/> Explosive/Flammable	<input type="checkbox"/> Oxygen Deficient Atm.
<input checked="" type="checkbox"/> Heat Stress	<input checked="" type="checkbox"/> Cold Stress	<input type="checkbox"/> Other
Comments: No personnel are permitted to enter permit confined spaces		

3.3.2 Physical Characteristics

Check all that apply		
<input checked="" type="checkbox"/> Liquid	<input checked="" type="checkbox"/> Solid	<input type="checkbox"/> Sludge
<input checked="" type="checkbox"/> Vapors	<input type="checkbox"/> Unknown	<input type="checkbox"/> Other

3.3.3 Hazardous Materials

Check all that apply					
Chemicals	Solids	Sludges	Solvents	Oils	Other
<input type="checkbox"/> Acids	<input type="checkbox"/> Ash	<input type="checkbox"/> Paints	<input type="checkbox"/> Halogens	<input type="checkbox"/> Transformer	<input type="checkbox"/> Lab
<input type="checkbox"/> Caustics	<input type="checkbox"/> Asbestos	<input type="checkbox"/> Metals	<input checked="" type="checkbox"/> Petroleum	<input type="checkbox"/> Other DF	<input type="checkbox"/> Pharm.
<input type="checkbox"/> Pesticides	<input type="checkbox"/> Tailings	<input type="checkbox"/> POTW	<input type="checkbox"/> Other	<input type="checkbox"/> Motor or Hydraulic Oil	<input type="checkbox"/> Hospital
<input type="checkbox"/> Petroleum	<input checked="" type="checkbox"/> Other: Fill Material	<input type="checkbox"/> Other – Tars & Other NAPL		<input checked="" type="checkbox"/> Gasoline	<input type="checkbox"/> Rad.
<input type="checkbox"/> Inks				<input checked="" type="checkbox"/> Fuel Oil	<input type="checkbox"/> MGP
<input type="checkbox"/> PCBs					<input type="checkbox"/> Mold
<input checked="" type="checkbox"/> Metals					<input type="checkbox"/> Cyanide
<input checked="" type="checkbox"/> Other: VOCs & SVOCs					

3.3.4 Known and Suspect Chemicals of Concern

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
Arsenic	REL = 0.02 mg/m ³ PEL = 0.01 mg/m ³	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen].
Barium	REL = 0.5 mg/m ³ PEL = 0.5 mg/m ³	Irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia.
Benzene	REL = 0.1 ppm PEL = 1 ppm STEL = 5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude, dermatitis; bone marrow depression, potential occupational carcinogen.
Cadmium	PEL = 5 mg/m ³	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]
Copper	REL = 1 mg/m ³ PEL = 1 mg/m ³	Irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; in animals: lung, liver, kidney damage; anemia.
DDE, DDD, DDT (pesticide)	REL = 0.5 mg/m ³ PEL = 1 mg/m ³ [skin]	Irritation eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; potential carcinogen.
Ethylbenzene	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma.
Fuel Oil	REL = 350 mg/m ³ PEL = 400 ppm	Nausea, irritation – eyes, hypertension, headache, light-headedness, loss of appetite, poor coordination; long-term exposure – kidney damage, blood clotting problems; potential carcinogen.
Lead	REL = 0.05 mg/m ³ PEL = 0.05 mg/m ³	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension.
Mercury	REL = 0.1 mg/m ³ PEL = 0.05 mg/m ³	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria.
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m ³	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; potential carcinogen.
PCBs	PCB-1242: REL = 1 mg/m ³ PEL = 0.001 mg/m ³ PCB-1254: REL = 0.5 mg/m ³ PEL = 0.001 mg/m ³	Rash; anemia, liver, stomach, thyroid damage; reduced ability to fight disease; impaired reproduction.
Tetrachloroethene (PCE)	PEL = 100 ppm STEL = 200 ppm	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, poor coordination; headache, drowsiness; skin erythema (skin redness); liver damage; potential occupational carcinogen
Toluene	REL = 100 ppm PEL = 200 ppm STEL = 300 ppm	Irritation eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia (skin tingling or numbness); dermatitis; liver, kidney damage.
Trichloroethene (TCE)	REL = 25 ppm PEL = 100 ppm	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen].
Xylenes	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, poor coordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.
Zinc	REL = 5 mg/m ³	Metal fume fever: chills, muscle ache, nausea, fever, dry throat,

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
	PEL = 5 mg/m ³	cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function.
Particulate	PEL = 15 mg/m ³ (total) PEL = 5 mg/m ³ (respirable)	Irritation eyes, skin, throat, upper respiratory system.
Comments: REL = National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit PEL = OSHA Permissible Exposure Limit STEL = OSHA Short Term Exposure Limit ppm = parts per million mg/m ³ = milligrams per cubic meter		

4.0 HEALTH AND SAFETY OFFICER

The contractor or engineer will designate one of its personnel as the Site Safety Officer (SSO). The SSO will be a competent person responsible for the implementation of this plan. The SSO will have completed a 40-hour training course (updated by an annual refresher) that meets OSHA requirements of 29 CFR Part 1910, Occupational Safety and Health Standards. The SSO has stop-work authorization, which he/she will execute on his/her determination of an imminent safety hazard, emergency situation, or other potentially dangerous situation. If the SSO must be absent from the site, he/she will designate a suitably qualified replacement that is familiar with the CHASP. If work is stopped for any reason, the NYC OER will be notified immediately.

5.0 TRAINING

All those who enter the work area while intrusive activities are being performed must recognize and understand the potential hazards to health and safety. All construction personnel upon entering the Site must attend a brief training meeting, its purpose being to:

- Make workers aware of the potential hazards they may encounter;
- Instruct workers on how to identify potential hazards,
- Provide the knowledge and skills necessary for them to perform the work with minimal risk to health and safety;
- Make workers aware of the purpose and limitations of safety equipment; and
- Ensure that they can safely avoid or escape from emergencies.

Each member of the construction crew will be instructed in these objectives before he/she goes onto the Site. Construction personnel will be responsible for identifying potential hazards in the work zone. The SSO or other suitably trained individual will be responsible for conducting the training program. Others who enter the Site must be accompanied by a suitably-trained construction worker.

6.0 GENERAL WORK PRACTICES

To protect the health and safety of the field personnel, all field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance in contaminated areas.

- Eating, drinking, chewing gum and tobacco, and smoking are prohibited, except in designated areas on the Site. These areas will be designated by the SSO.

- Workers must wash their hands and face thoroughly on leaving the work area and before eating, drinking, or any other such activity. The workers should shower as soon as possible after leaving the Site.
- Contact with contaminated or suspected surfaces should be avoided.
- The buddy system should always be used; each buddy should watch for signs of fatigue, exposure, and heat stress.

7.0 PERSONAL PROTECTIVE EQUIPMENT & AIR MONITORING

7.1 Personal Protective Equipment

The personal protection equipment required for various kinds of site investigation tasks are based on 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, Appendix B, “General Description and Discussion of the Levels of Protection and Protective Gear.”

AKRF field personnel and other Site personnel will wear, at a minimum, Level D personal protective equipment. The protection will be based on the air monitoring described in Section 7.2.

Level of Protection Summary

LEVEL OF PROTECTION & PPE	Excavation and Other Earth Moving Activities
Level D <input checked="" type="checkbox"/> Steel Toe Shoes <input checked="" type="checkbox"/> Hard Hat (within 25 ft of excavator) <input checked="" type="checkbox"/> Work Gloves <input checked="" type="checkbox"/> Safety Glasses <input type="checkbox"/> Face Shield <input checked="" type="checkbox"/> Ear Plugs (within 25 ft of excavator or jackhammer) <input type="checkbox"/> Latex Gloves	Yes
Level D – Modified (in addition to Level D) <input checked="" type="checkbox"/> Tyvek Coveralls <input checked="" type="checkbox"/> Nitrile Gloves <input type="checkbox"/> Overboots <input type="checkbox"/> Saranex Coveralls	As necessary
Level C (in addition to Level D – Modified) <input checked="" type="checkbox"/> Half-Face Respirator <input type="checkbox"/> Full Face Respirator <input type="checkbox"/> Full-Face PAPR <input type="checkbox"/> Particulate Cartridge <input type="checkbox"/> Organic Cartridge <input checked="" type="checkbox"/> Dual Organic/Particulate Cartridge	If PID > 10 ppm or particulate > 5 mg/m ³ (in breathing zone)
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breath or any odors detected).	

7.2 Work Zone Air Monitoring

As outlined in the RAWP, real time air monitoring will be performed with a photoionization detector (PID) and with a particulate air monitor during sampling and excavation work in areas where petroleum or other contamination is encountered. Community air monitoring will be conducted during all intrusive Site activities. The air monitoring protocols, action levels and required responses are provided in the October 2015 RAWP prepared for the Site.

Real time air monitoring will be performed with a PID and with a particulate air monitor during sampling and excavation work required for Site development. Measurements would be taken prior to commencement of work and continuously during the work as outlined in the following

table. Measurements will be made as close to the workers as practicable and at the breathing height of the workers. The SSO will set up the equipment and confirm that it is working properly. His/her designee may oversee the air measurements during the day. The initial measurement for the day will be performed before the start of work and will establish the background level for that day. The final measurement for the day will be performed after the end of work. The action levels and required responses are listed in the following table.

Action Levels and Required Safety Response Actions

Instrument	Task to be Monitored	Action Level	Response Action
PID (PID MiniRae 2000 or equivalent)	All Soil Movement Activities	Less than 10 ppm in breathing zone.	Level D or D-Modified
		Between 10 and 50 ppm	Level C
		More than 50 ppm	Stop work. Resume work when readings are less than 50 ppm.
Particulate monitor (Dustrak, MIE 1000 Personal DataRam or equivalent)	All Soil Movement Activities	Less than 5 mg/m ³	Level D
		Between 5 mg/m ³ and 125 mg/m ³	Level C. Apply dust suppression measures. If < 2.5 mg/m ³ , resume work using Level D. Otherwise, use Level C.
		Above 125 mg/m ³	Stop work. Apply additional dust suppression measures. Resume work when less than 125 mg/m ³ .

7.3 Community Air Monitoring Plan

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

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

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

All 15-minute readings must be recorded and be available for OER personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded. Field personnel will be trained in the proper operation of all field instruments at the start of the field program. Instruction manuals for the equipment will be on file at the site for referencing proper operation, maintenance and calibration procedures.

The equipment will be calibrated according to manufacturer specifications at the start of each day of fieldwork. If an instrument fails calibration, the project manager will be contacted immediately to obtain a replacement instrument and arrange for repairs. A calibration log will be maintained to record the date of each calibration, any failure to calibrate and corrective actions taken. The PID will be calibrated each day using 100 parts per million (ppm) isobutylene standard gas.

8.0 DECONTAMINATION PROCEDURES

8.1 Personnel Decontamination

Personnel decontamination (decon), if deemed necessary by the SSO, will take place in a designated decontamination area. This area will be delineated during each stage of work. Personnel decontamination will consist of the following steps:

- Soap and potable water wash and potable water rinse of gloves;
- Coverall removal (if applicable);
- Glove removal;
- Disposable clothing removal; and
- Field wash hands and face.

8.2 Sampling Equipment Decontamination

Any non-disposable sampling equipment for confirmatory sampling or other equipment that is in contact with contaminated materials will be decontaminated in accordance with the following procedure:

- Double wash with solution of Simple Green[®] and clean tap water;
 - Double rinse with clean tap water;
 - Rinse with clean distilled water; and
 - Allow equipment to air dry.

8.3 Heavy Equipment Decontamination

If heavy equipment comes in contact with contaminated materials, it will be decontaminated prior to being relocated to a clean area or leaving the Site. A designated decontamination pad will be constructed, where soil, dust, or oil will be washed off the exterior, undercarriage, and wheels or tracks of the equipment.

9.0 EMERGENCY RESPONSE

9.1 Emergency Procedures

In the event that an emergency develops on-site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on-site; and
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.
- A spill of oil or other hazardous materials.

General emergency procedures, and specific procedures for personal injury, chemical exposure and radiation exposure, are described below. In the event of an accident or emergency, an Incident Report form should be filled out and placed in the project file. An example Weekly Safety Report Form and Incident Report Form is provided as Appendix B. Information on emergency hand signals are provided as Appendix C.

9.1.1 Chemical Exposure

If a member of the field crew demonstrates symptoms of chemical exposure the procedures outlined below should be followed:

- Another team member (buddy) should remove the individual from the immediate area of contamination. The buddy should communicate to the SSO (via voice and hand signals) of the chemical exposure. The SSO should contact the appropriate emergency response agency.
- Precautions should be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the chemical should be neutralized or removed if it is safe to do so.
- If the chemical has contacted the skin, the skin should be washed with copious amounts of water.
- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.
- All chemical exposure incidents must be reported in writing to the SSO. The SSO is responsible for completing the Incident Report Form.

9.1.2 Personal Injury

In case of personal injury at the Site, the following procedures should be followed:

- Another team member (buddy) should signal the SSO that an injury has occurred.
- A field team member trained in first aid can administer treatment to an injured worker.
- If deemed necessary, the victim should then be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim.
- The SSO is responsible for making certain that an Incident Report Form is completed. This form is to be submitted to the SSO. Follow-up action should be taken to correct the situation that caused the accident.

- Any incident (near miss, property damage, first aid, medical treatment, etc.) must be reported.

A first-aid kit and eye-wash kit will be kept on-site during the field activities.

9.1.3 Evacuation Procedures

- The SSO will initiate evacuation procedures by signaling to leave the Site or containment structure.
- All personnel in the work area should evacuate the area and meet in the common designated area.
- All personnel suspected to be in or near the contract work area should be accounted for and the whereabouts or missing persons determined immediately.
- The SSO will then give further instruction.

9.1.4 Procedures Implemented in the Event of a Major Fire, Explosion, or Emergency

- Notify the paramedics and/or fire department, as necessary;
- Signal the evacuation procedure previously outlined and implement the entire procedure;
- Isolate the area;
- Stay upwind of any fire;
- Keep the area surrounding the problem source clear after the incident occurs; and
- Complete accident report for and distribute to appropriate personnel.

9.1.5 Spill Response

All personnel must take every precaution to minimize the potential for spills during Site operations. Any spill will be reported immediately to the SSO. The SSO will then determine and report any required spills to the NYCDEP and/or NYSDEC Hotlines.

Spill control apparatus (sorberent materials) will be located on-site. All materials used for the clean up of spills will be containerized and labeled separately from other wastes. The SSO, in consultation with AKRF's Project Manager, will determine if additional spill response measures are required.

9.2 Hospital Directions

The location of the nearest hospital, as shown on Figure 1, is **Woodhull Medical Center**. The address of the hospital is 760 Broadway, Brooklyn, New York. Directions to the hospital are provided below.

Hospital Information and Directions

Hospital Name:	Woodhull Medical Center
Phone Number:	(718) 963-8000
Address/Location:	760 Broadway, Brooklyn, New York 11206
Directions:	<ol style="list-style-type: none"> 1. Head northwest on Manhattan Avenue. 2. Turn left onto Leonard Street. 3. Turn left onto Broadway.

	4. The emergency room will be on the right.
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9.3 CHASP Contact Information

- AKRF Project Director/ Manager – Marc Godick..... (914) 922-2356 (office)
- Site Safety Officer (SSO) – Amy Jordan (610) 405-2847 (cell)
- Alternate Site Safety Officer (SSO) – Kevin Hennigan (603) 546-5106 (cell)
- Client – John Petrocelli..... (631) 981-5200 (office)
- OER Project Manager – Isabel McRae..... (212) 341-2034 (office)
- Ambulance, Fire and Police Departments..... 911
- Local Poison Control (212) 764-7667
pm/weekend (212) 340-4494
- NYCDEC Spill Response Team (800) 457-7362
- NYCDEP Hotline (718) DEP-HELP

10.0 APPROVAL & ACKNOWLEDGMENTS OF CHASP

APPROVAL

Signed: _____ Date: _____

Project Manager

Signed: _____ Date: _____

Health and Safety Officer

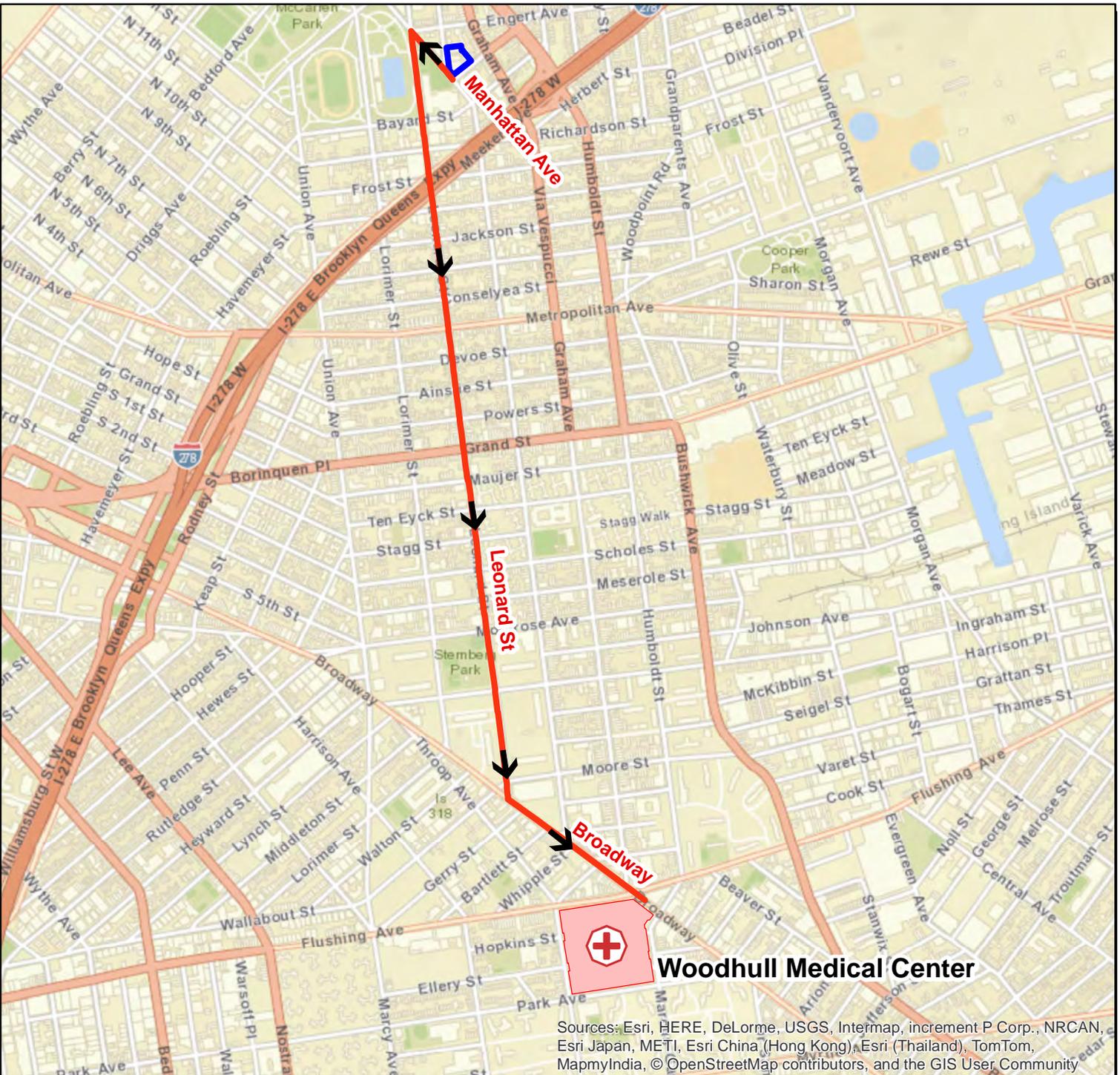
Below is an affidavit that must be signed by all workers who enter the site. A copy of the CHASP must be on-site at all times and will be kept by the SSO.

AFFIDAVIT

I, _____ (name), of _____ (company name), have read the Construction Health and Safety Plan for the 470 Manhattan Avenue site in Brooklyn, New York. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this CHASP could lead to my removal from the site.

Signed: _____ Company: _____ Date: _____

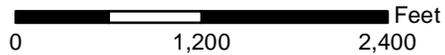
FIGURE



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Legend

-  Route to Hospital
-  Project Site Location
-  Hospital Location



Woodhull Medical Center
760 Broadway
Brooklyn, NY 11206

470 Manhattan Avenue
Block 2714, Lots 1, 30, 32, and 33
Brooklyn, New York



DATE
10/22/2015

PROJECT No.
12306

HOSPITAL LOCATION MAP

Environmental Consultants
440 Park Avenue South, New York, N.Y. 10016

FIGURE
1

APPENDIX A
POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List sites identified by the Environmental Protection Agency.

What is mercury?

(Pronounced mŭr/kyə-rē)

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

What happens to mercury when it enters the environment?

- Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.

- Methylmercury may be formed in water and soil by small organisms called bacteria.
- Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

- Eating fish or shellfish contaminated with methylmercury.
- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- Release of mercury from dental work and medical treatments.
- Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- Practicing rituals that include mercury.

How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea,

ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>

vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from

rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

Is there a medical test to show whether I've been exposed to mercury?

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m³) and 0.05 mg/m³ of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html> ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl'ī-sī'klīk ār'ə-măt'īk hī'drə-kar'bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.

- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smoke-houses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.

ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>

- ❑ Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any

health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html> ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

What happens to PCBs when they enter the environment?

- PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
- PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
- PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
- PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these

aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

- Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
- Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
- Breathing air near hazardous waste sites and drinking contaminated well water.
- In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects

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of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

How can PCBs affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported. In most cases, the benefits of breastfeeding outweigh any risks from exposure to PCBs in mother's milk.

How can families reduce the risk of exposure to PCBs?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances,

electrical equipment, or transformers, since they may contain PCBs.

- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to PCBs?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs™ Internet address is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

- ❑ Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- ❑ Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- ❑ Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- ❑ Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- ❑ Trichloroethylene does not build up significantly in

plants and animals.

How might I be exposed to trichloroethylene?

- ❑ Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- ❑ Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- ❑ Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- ❑ Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

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Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is “reasonably anticipated to be a human carcinogen.” The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is “probably carcinogenic to humans.”

Is there a medical test to show whether I've been exposed to trichloroethylene?

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood

and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or gas.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

(Pronounced tět'rə-klôr' 0-ěth'ə-lēn')

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part tetrachloroethylene per million parts of air (1 ppm) or more, although some can smell it at even lower levels.

What happens to tetrachloroethylene when it enters the environment?

- Much of the tetrachloroethylene that gets into water or soil evaporates into the air.
- Microorganisms can break down some of the tetrachloroethylene in soil or underground water.
- In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.
- It does not appear to collect in fish or other animals that live in water.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it.

How can tetrachloroethylene affect my health?

High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known.

Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethyl-

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ene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if tetrachloroethylene was responsible for these problems because other possible causes were not considered.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that tetrachloroethylene can cause liver and kidney damage. Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

How likely is tetrachloroethylene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

One way of testing for tetrachloroethylene exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood.

Because it is stored in the body's fat and slowly released into the bloodstream, tetrachloroethylene can be detected in the breath for weeks following a heavy exposure.

Tetrachloroethylene and trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene, can be detected in the blood. These tests are relatively simple to perform. These tests aren't available at most doctors' offices, but can be per-

formed at special laboratories that have the right equipment.

Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to tetrachloroethylene or the other chemicals.

Has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of tetrachloroethylene that can be in drinking water is 0.005 milligrams tetrachloroethylene per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that tetrachloroethylene be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

Glossary

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Tetrachloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html> ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about toluene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, in automobile exhaust, some consumer products paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found at 959 of the 1,591 National Priority List sites identified by the Environmental Protection Agency

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

What happens to toluene when it enters the environment?

Toluene enters the environment when you use materials that contain it. It can also enter surface water and groundwater from spills of solvents and petroleum products as well as from leaking underground storage tanks at gasoline stations and other facilities.

When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil or water near the waste site.

Toluene does not usually stay in the environment long.

Toluene does not concentrate or buildup to high levels in animals.

How might I be exposed to toluene?

Breathing contaminated workplace air or automobile exhaust.

Working with gasoline, kerosene, heating oil, paints, and lacquers.

Drinking contaminated well-water.

Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levels can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and

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hearing and color vision loss. These symptoms usually disappear when exposure is stopped.

Inhaling High levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death.

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

Studies in humans and animals generally indicate that toluene does not cause cancer.

The EPA has determined that the carcinogenicity of toluene can not be classified.

How can toluene affect children?

It is likely that health effects seen in children exposed to toluene will be similar to the effects seen in adults. Some studies in animals suggest that babies may be more sensitive than adults.

Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard mental abilities, and growth. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

How can families reduce the risk of exposure to toluene?

- Use toluene-containing products in well-ventilated areas.

- When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.

Is there a medical test to show whether I've been exposed to toluene?

There are tests to measure the level of toluene or its breakdown products in exhaled air, urine, and blood. To determine if you have been exposed to toluene, your urine or blood must be checked within 12 hours of exposure. Several other chemicals are also changed into the same breakdown products as toluene, so some of these tests are not specific for toluene.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 1 milligram per liter of drinking water (1 mg/L).

Discharges, releases, or spills of more than 1,000 pounds of toluene must be reported to the National Response Center.

The Occupational Safety and Health Administration has set a limit of 200 parts toluene per million of workplace air (200 ppm).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Toluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. This substance has been found in at least 658 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

(Pronounced zī'lēn)

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar and is formed during forest fires. You can smell xylene in air at 0.08–3.7 parts of xylene per million parts of air (ppm) and begin to taste it in water at 0.53–1.8 ppm.

Chemical industries produce xylene from petroleum. It's one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

- Xylene has been found in waste sites and landfills when discarded as used solvent, or in varnish, paint, or paint thinners.
- It evaporates quickly from the soil and surface water into the air.

- In the air, it is broken down by sunlight into other less harmful chemicals.
- It is broken down by microorganisms in soil and water.
- Only a small amount of it builds up in fish, shellfish, plants, and animals living in xylene-contaminated water.

How might I be exposed to xylene?

- Breathing xylene in workplace air or in automobile exhaust.
- Breathing contaminated air.
- Touching gasoline, paint, paint removers, varnish, shellac, and rust preventatives that contain it.
- Breathing cigarette smoke that has small amounts of xylene in it.
- Drinking contaminated water or breathing air near waste sites and landfills that contain xylene.
- The amount of xylene in food is likely to be low.

How can xylene affect my health?

Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of

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people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How likely is xylene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that xylene is not classifiable as to its carcinogenicity in humans.

Human and animal studies have not shown xylene to be carcinogenic, but these studies are not conclusive and do not provide enough information to conclude that xylene does not cause cancer.

Is there a medical test to show whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 10 ppm of xylene in drinking water.

The EPA requires that spills or accidental releases of xylenes into the environment of 1,000 pounds or more must be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum level of 100 ppm xylene in workplace air for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) also recommend exposure limits of 100 ppm in workplace air.

NIOSH has recommended that 900 ppm of xylene be considered immediately dangerous to life or health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

Glossary

Evaporate: To change from a liquid into a vapor or a gas.

Carcinogenic: Having the ability to cause cancer.

CAS: Chemical Abstracts Service.

ppm: Parts per million.

Solvent: A liquid that can dissolve other substances.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for xylenes (update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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This fact sheet answers the most frequently asked health questions (FAQs) about zinc. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to high levels of zinc occurs mostly from eating food, drinking water, or breathing workplace air that is contaminated. Exposure to large amounts of zinc can be harmful. However, zinc is an essential element for our bodies, so too little zinc can also be harmful. This chemical has been found in at least 801 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is zinc?

(Pronounced zīngk)

Zinc is one of the most common elements in the earth's crust. It's found in air, soil, and water, and is present in all foods. Pure zinc is a bluish-white shiny metal.

Zinc has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass and bronze. A zinc and copper alloy is used to make pennies in the United States.

Zinc combines with other elements to form zinc compounds. Common zinc compounds found at hazardous waste sites include zinc chloride, zinc oxide, zinc sulfate, and zinc sulfide. Zinc compounds are widely used in industry to make paint, rubber, dye, wood preservatives, and ointments.

What happens to zinc when it enters the environment?

- Some is released into the environment by natural processes, but most comes from activities of people like mining, steel production, coal burning, and burning of waste.
- It attaches to soil, sediments, and dust particles in the air.
- Rain and snow remove zinc dust particles from the air.

- Zinc compounds can move into the groundwater and into lakes, streams, and rivers.
- Most of the zinc in soil stays bound to soil particles.
- It builds up in fish and other organisms, but it doesn't build up in plants.

How might I be exposed to zinc?

- Ingesting small amounts present in your food and water.
- Drinking contaminated water near manufacturing or waste sites.
- Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust.
- Eating too many dietary supplements that contain zinc.
- Breathing zinc particles in the air at manufacturing sites.

How can zinc affect my health?

Zinc is an essential element in our diet. **Too** little zinc can cause health problems, but too much zinc is also harmful.

The recommended dietary allowance (RDA) for zinc is 15 milligrams a day for men (15 mg/day); 12 mg/day for women; 10 mg/day for children; and 5 mg/day for infants. Not enough zinc in your diet can result in a loss of appetite, a decreased sense of taste and smell, slow wound healing and

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skin sores, or a damaged immune system. Young men who don't get enough zinc may have poorly developed sex organs and slow growth. If a pregnant woman doesn't get enough zinc, her babies may have growth retardation.

Too much zinc, however, can also be damaging to your health. Harmful health effects generally begin at levels from 10-15 times the RDA (in the 100 to 250 mg/day range). Eating large amounts of zinc, even for a short time, can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia, pancreas damage, and lower levels of high density lipoprotein cholesterol (the good form of cholesterol).

Breathing large amounts of zinc (as dust or fumes) can cause a specific short-term disease called metal fume fever. This is believed to be an immune response affecting the lungs and body temperature. We do not know the long-term effects of breathing high levels of zinc.

It is not known if high levels of zinc affect human reproduction or cause birth defects. Rats that were fed large amounts of zinc became infertile or had smaller babies. Irritation was also observed on the skin of rabbits, guinea pigs, and mice when exposed to some zinc compounds. Skin irritation will probably occur in people.

How likely is zinc to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified zinc for carcinogenicity.

Is there a medical test to show whether I've been exposed to zinc?

Zinc can be measured in your blood or feces. This can tell you how much zinc you have been exposed to. Zinc can

also be measured in urine, saliva, and hair. The amount of zinc in your hair tells us something about long-term exposure, but the relationship between levels in your hair and the amount that you were exposed to is not clear. These tests are not routinely performed at doctors' offices, but your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

EPA recommends that there be no more than 5 parts of zinc in 1 million parts of drinking water (5 ppm) because of taste. EPA also requires that releases of more than 1,000 (or in some cases 5,000) pounds of zinc or its compounds into the environment be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum concentration limit for zinc chloride fumes in workplace air of 1 milligram of zinc per cubic meter of air (1 mg/m³) for an 8-hour workday over a 40-hour work week and 5 mg/m³ for zinc oxide fumes. The National Institute for Occupational Safety and Health (NIOSH) has set the same standards for up to a 10-hour workday over a 40-hour workweek.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.
Carcinogenicity: Ability to cause cancer.
Milligram (mg): One thousandth of a gram.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. Toxicological profile for zinc. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html> ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occurs mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found at 1,014 of the 1,598 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides, primarily on cotton plants.

What happens to arsenic when it enters the environment?

- Arsenic cannot be destroyed in the environment. It can only change its form.
- Arsenic in air will settle to the ground or is washed out of the air by rain.
- Many arsenic compounds can dissolve in water.
- Fish and shellfish can accumulate arsenic, but the arsenic in fish is mostly in a form that is not harmful.

How might I be exposed to arsenic?

- Eating food, drinking water, or breathing air containing arsenic.
- Breathing contaminated workplace air.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living near uncontrolled hazardous waste sites containing arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the

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appearance of small “corns” or “warts” on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Organic arsenic compounds are less toxic than inorganic arsenic compounds. Exposure to high levels of some organic arsenic compounds may cause similar effects as inorganic arsenic.

How likely is arsenic to cause cancer?

Several studies have shown that inorganic arsenic can increase the risk of lung cancer, skin cancer, bladder cancer, liver cancer, kidney cancer, and prostate cancer. The World Health Organization (WHO), the Department of Health and Human Services (DHHS), and the EPA have determined that inorganic arsenic is a human carcinogen.

How can arsenic affect children?

We do not know if exposure to arsenic will result in birth defects or other developmental effects in people. Birth defects have been observed in animals exposed to inorganic arsenic.

It is likely that health effects seen in children exposed to high amounts of arsenic will be similar to the effects seen in adults.

How can families reduce the risk of exposure to arsenic?

- If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
- If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

Is there a medical test to show whether I've been exposed to arsenic?

There are tests to measure the level of arsenic in blood, urine, hair, or fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict how the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or canceled many uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration has set limits of 10 µg arsenic per cubic meter of workplace air (10 µg/m³) for 8 hour shifts and 40 hour work weeks.

Source of Information

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Arsenic. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about barium and barium compounds. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to barium occurs mostly in the workplace or from drinking contaminated water. Ingesting drinking water containing levels of barium above the EPA drinking water guidelines for relatively short periods of time can cause gastrointestinal disturbances and muscle weakness. Ingesting high levels for a long time can damage the kidneys. Barium and barium compounds have been found in at least 798 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is barium?

Barium is a silvery-white metal which exists in nature only in ores containing mixtures of elements. It combines with other chemicals such as sulfur or carbon and oxygen to form barium compounds.

Barium compounds are used by the oil and gas industries to make drilling muds. Drilling muds make it easier to drill through rock by keeping the drill bit lubricated. They are also used to make paint, bricks, ceramics, glass, and rubber.

Barium sulfate is sometimes used by doctors to perform medical tests and to take x-rays of the gastrointestinal tract.

What happens to barium when it enters the environment?

- Barium gets into the air during the mining, refining, and production of barium compounds, and from the burning of coal and oil.
- The length of time that barium will last in air, land, water, or sediments depends on the form of barium released.
- Barium compounds, such as barium sulfate and barium carbonate, which do not dissolve well in water, can last a long time in the environment.

Barium compounds, such as barium chloride, barium nitrate, or barium hydroxide, that dissolve easily in water usually do not last in these forms for a long time in the environment. The barium in these compounds that is dissolved in water quickly combines with sulfate or carbonate that are naturally found in water and become the longer lasting forms (barium sulfate and barium carbonate).

Fish and aquatic organisms can accumulate barium.

How might I be exposed to barium?

- Ingesting small amounts present in your food and water or breathing air containing very low levels of barium.
- Living in areas with unusually high natural levels of barium in the drinking water.
- Working in a job that involves barium production or use.
- Living or working near waste sites where barium has been disposed of.

How can barium affect my health?

The health effects of the different barium compounds depend on how well the compound dissolves in water or in the stomach contents. Barium compounds that do not dissolve well, such as barium sulfate, are not generally harmful.

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Barium has been found to potentially cause gastrointestinal disturbances and muscular weakness when people are exposed to it at levels above the EPA drinking water standards for relatively short periods of time. Some people who eat or drink amounts of barium above background levels found in food and water for a short period may experience vomiting, abdominal cramps, diarrhea, difficulties in breathing, increased or decreased blood pressure, numbness around the face, and muscle weakness. Eating or drinking very large amounts of barium compounds that easily dissolve can cause changes in heart rhythm or paralysis and possibly death. Animals that drank barium over long periods had damage to the kidneys, decreases in body weight, and some died.

How likely is barium to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified barium as to its carcinogenicity. The EPA has determined that barium is not likely to be carcinogenic to humans following ingestion and that there is insufficient information to determine whether it will be carcinogenic to humans following inhalation exposure.

How can barium affect children?

We do not know whether children will be more or less sensitive than adults to barium toxicity. A study in rats that swallowed barium found a decrease in newborn body weight; we do not know if a similar effect would be seen in humans.

How can families reduce the risks of exposure to barium?

The greatest potential source of barium exposure is through food and drinking water. However, the amount of barium in foods and drinking water are typically too low to be of concern.

Is there a medical test to determine whether I've been exposed to barium?

There is no routine medical test to determine whether you have been exposed to barium. Doctors can measure barium in body tissues and fluids, such as bones, blood, urine, and feces, using very complex instruments. These tests cannot be used to predict the extent of the exposure or potential health effects.

The geometric mean barium level measured in the U.S. general population aged 6 and older is reported by the Centers for Disease Control and Prevention (CDC) as 1.44 µg/g creatinine (measured in urine).

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2.0 milligrams of barium per liter of drinking water (2.0 mg/L), which is the same as 2 ppm.

The Occupational Safety and Health Administration (OSHA) has set Permissible Exposure Limits (PELs) of 0.5 milligrams of soluble barium compounds per cubic meter of workplace air (0.5 mg/m³) for 8 hour shifts and 40 hour work weeks. The OSHA limits for barium sulfate dust are 15 mg/m³ of total dust and 5 mg/m³ for respirable fraction.

The National Institute for Occupational Safety and Health (NIOSH) has set Recommended Exposure Limits (RELs) of 0.5 mg/m³ for soluble barium compounds. The NIOSH has set RELs of 10 mg/m³ (total dust) for barium sulfate and 5 mg/m³ (respirable fraction).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Barium and Compounds (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 813 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is benzene?

(Pronounced bĕn'zĕn')

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.

- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Indoor air generally contains higher levels of benzene from products that contain it such as glues, paints, furniture wax, and detergents.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Leakage from underground storage tanks or from hazardous waste sites containing benzene can result in benzene contamination of well water.
- People working in industries that make or use benzene may be exposed to the highest levels of it.
- A major source of benzene exposures is tobacco smoke.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

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The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men.

Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How likely is benzene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

Is there a medical test to show whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood, however, since benzene disappears rapidly from the blood, measurements are accurate only for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 0.005 milligrams per liter (0.005 mg/L). The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 1 part of benzene per million parts of air (1 ppm) in the workplace during an 8-hour workday, 40-hour workweek.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Chromosomes: Parts of the cells responsible for the development of hereditary characteristics.

Metabolites: Breakdown products of chemicals.

Milligram (mg): One thousandth of a gram.

Pesticide: A substance that kills pests.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Benzene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html> ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about cadmium. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to cadmium happens mostly in the workplace where cadmium products are made. The general population is exposed from breathing cigarette smoke or eating cadmium contaminated foods. Cadmium damages the lungs, can cause kidney disease, and may irritate the digestive tract. This substance has been found in at least 776 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is cadmium?

(Pronounced kăd/mĕ-əm)

Cadmium is a natural element in the earth's crust. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide).

All soils and rocks, including coal and mineral fertilizers, contain some cadmium. Most cadmium used in the United States is extracted during the production of other metals like zinc, lead, and copper. Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics.

What happens to cadmium when it enters the environment?

- Cadmium enters air from mining, industry, and burning coal and household wastes.
- Cadmium particles in air can travel long distances before falling to the ground or water.
- It enters water and soil from waste disposal and spills or leaks at hazardous waste sites.
- It binds strongly to soil particles.
- Some cadmium dissolves in water.

- It doesn't break down in the environment, but can change forms.
- Fish, plants, and animals take up cadmium from the environment.
- Cadmium stays in the body a very long time and can build up from many years of exposure to low levels.

How might I be exposed to cadmium?

- Breathing contaminated workplace air (battery manufacturing, metal soldering or welding).
- Eating foods containing it; low levels in all foods (highest in shellfish, liver, and kidney meats).
- Breathing cadmium in cigarette smoke (doubles the average daily intake).
- Drinking contaminated water.
- Breathing contaminated air near the burning of fossil fuels or municipal waste.

How can cadmium affect my health?

Breathing high levels of cadmium severely damages the lungs and can cause death. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease.

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Other long-term effects are lung damage and fragile bones. Animals given cadmium in food or water had high blood pressure, iron-poor blood, liver disease, and nerve or brain damage.

We don't know if humans get any of these diseases from eating or drinking cadmium. Skin contact with cadmium is not known to cause health effects in humans or animals.

How likely is cadmium to cause cancer?

The Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens.

How can cadmium affect children?

The health effects in children are expected to be similar to those in adults (kidney, lung and intestinal damage).

We don't know if cadmium causes birth defects in people. Cadmium does not readily go from a pregnant woman's body into the developing child, but some portion can cross the placenta. It can also be found in breast milk. The babies of animals exposed to high levels of cadmium during pregnancy had changes in behavior and learning ability. Cadmium may also affect birth weight and the skeleton in developing animals.

Animal studies also indicate that more cadmium is absorbed into the body if the diet is low in calcium, protein, or iron, or is high in fat. A few studies show that younger animals absorb more cadmium and are more likely to lose bone and bone strength than adults.

How can families reduce the risk of exposure to cadmium?

In the home, store substances that contain cadmium safely, and keep nickel-cadmium batteries out of reach of young

children. If you work with cadmium, use all safety precautions to avoid carrying cadmium-containing dust home from work on your clothing, skin, hair, or tools.

A balanced diet can reduce the amount of cadmium taken into the body from food and drink.

Is there a medical test to show whether I've been exposed to cadmium?

Tests are available in some medical laboratories that measure cadmium in blood, urine, hair, or nails. Blood levels show recent exposure to cadmium, and urine levels show both recent and earlier exposure. The reliability of tests for cadmium levels in hair or nails is unknown.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 5 parts of cadmium per billion parts of drinking water (5 ppb). EPA doesn't allow cadmium in pesticides.

The Food and Drug Administration (FDA) limits the amount of cadmium in food colors to 15 parts per million (15 ppm).

The Occupational Safety and Health Administration (OSHA) limits workplace air to 100 micrograms cadmium per cubic meter (100 $\mu\text{g}/\text{m}^3$) as cadmium fumes and 200 $\mu\text{g}/\text{m}^3$ as cadmium dust.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for cadmium. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html> ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about copper. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Copper is a reddish metal that occurs naturally in the environment. It also occurs naturally in plants and animals. Low levels of copper are essential for maintaining good health. High levels can cause harmful effects such as irritation of the nose, mouth and eyes, vomiting, diarrhea, stomach cramps, and nausea. Copper has been found in at least 884 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is copper?

Copper is a reddish metal that occurs naturally in rocks, soil, water, and air. Copper also occurs naturally in plants and animals.

Metallic copper can be easily molded or shaped. Metallic copper can be found in the U.S. penny, electrical wiring, and some water pipes. Metallic copper is also found in mixtures (called alloys) with other metals such as brass and bronze. Copper is also found as part of other compounds forming salts. Copper salts occur naturally, but are also manufactured. The most common copper salt is copper sulfate. Most copper compounds are blue-green in color. Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics.

What happens to copper when it enters the environment?

- Copper can enter the environment from the mining of copper and other metals and from factories that make or use metallic copper or copper compounds.
- It can also enter the environment through domestic waste water, combustion of fossil fuels and wastes, wood production, phosphate fertilizer production, and natural sources (e.g., windblown dust from soils, volcanoes, decaying vegetation, forest fires, and sea spray).
- Copper in soil strongly attaches to organic material and minerals.

- Copper that dissolves in water becomes rapidly bound to particles suspended in the water.
- Copper does not typically enter groundwater.
- Copper carried by particles emitted from smelters and ore processing plants is carried back to the ground by gravity or in rain or snow.
- Copper does not break down in the environment.

How might I be exposed to copper?

- Breathing air, drinking water, eating food, and by skin contact with soil, water, or other copper-containing substances.
- Some copper in the environment can be taken up by plants and animals.
- Higher exposure may occur if your water is corrosive and you have copper plumbing and brass water fixtures. You may be exposed to higher amounts of copper if you drink water or swim in lakes or reservoirs recently treated with copper to control algae or receive cooling water from a power plant that may have high amounts of dissolved copper.
- Using some garden products (e.g., fungicides) to control plant diseases.
- Living near bronze and brass production facilities may expose you to higher copper levels in soil.
- You may breathe copper-containing dust or have skin contact if you work in the industry of mining copper or

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processing the ore. You may breathe high levels if you grind or weld copper metal.

How can copper affect my health?

Copper is essential for good health, but high amounts can be harmful. Long-term exposure to copper dust can irritate your nose, mouth, and eyes, and cause headaches, dizziness, nausea, and diarrhea.

Drinking water with higher than normal levels of copper may cause vomiting, diarrhea, stomach cramps, and nausea. Intentionally high intakes of copper can cause liver and kidney damage and even death.

How likely is copper to cause cancer?

We do not know whether copper can cause cancer in humans. The EPA has determined that copper is not classifiable as to carcinogenicity.

How can copper affect children?

Exposure to high levels of copper will result in the same type of effects in children and adults. Studies in animals suggest that the young children may have more severe effects than adults; we do not know if this would also be true in humans. There is a very small percentage of infants and children who are unusually sensitive to copper.

We do not know if copper can cause birth defects or other developmental effects in humans. Studies in animals suggest that ingestion of high levels of copper may cause a decrease in fetal growth.

How can families reduce the risk of exposure to copper?

- The greatest potential source of copper exposure is through drinking water, especially in water that is first drawn in the morning after sitting in copper pipes and brass faucets overnight.
- To reduce exposure, run the water for at least 15-30 seconds before using it.
- If you are exposed to copper at work, you may carry

copper home on your skin, clothes, or tools. You can avoid this by showering, and changing clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to copper?

Copper is normally found in all tissues of the body, blood, urine, feces, hair, and nails. High levels of copper in these samples can show that you have been exposed to higher than normal levels of copper. Tests to measure copper levels in the body are not routinely available at the doctor's office because they require special equipment. These tests cannot tell the extent of exposure or whether you will experience harmful effects.

Has the federal government made recommendations to protect human health?

The EPA has determined that drinking water should not contain more than 1.3 milligrams of copper per liter of water (1.3 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.1 mg per cubic meter (0.1 mg/m³) of copper fumes (vapor generated from heating copper) and 1 mg/m³ of copper dusts (fine metallic copper particles) and mists (aerosol of soluble copper) in workroom air during an 8-hour work shift, 40-hour workweek.

The Food and Nutrition Board of the Institute of Medicine recommends dietary allowances (RDAs) of 340 micrograms (340 µg) of copper per day for children aged 1-3 years, 440 µg/day for children aged 4-8 years, 700 µg/day for children aged 9-13 years, 890 µg/day for children aged 14-18 years, and 900 µg/day for adults.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Copper (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about DDT, DDE, and DDD. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to DDT, DDE, and DDD occurs mostly from eating foods containing small amounts of these compounds, particularly meat, fish and poultry. High levels of DDT can affect the nervous system causing excitability, tremors and seizures. In women, DDE can cause a reduction in the duration of lactation and an increased chance of having a premature baby. DDT, DDE, and DDD have been found in at least 441 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are DDT, DDE, and DDD?

DDT (dichlorodiphenyltrichloroethane) is a pesticide once widely used to control insects in agriculture and insects that carry diseases such as malaria. DDT is a white, crystalline solid with no odor or taste. Its use in the U.S. was banned in 1972 because of damage to wildlife, but is still used in some countries.

DDE (dichlorodiphenyldichloroethylene) and DDD (dichlorodiphenyldichloroethane) are chemicals similar to DDT that contaminate commercial DDT preparations. DDE has no commercial use. DDD was also used to kill pests, but its use has also been banned. One form of DDD has been used medically to treat cancer of the adrenal gland.

What happens to DDT, DDE, and DDD when they enter the environment?

- DDT entered the environment when it was used as a pesticide; it still enters the environment due to current use in other countries.
- DDE enters the environment as contaminant or breakdown product of DDT; DDD also enters the environment as a breakdown product of DDT.
- DDT, DDE, and DDD in air are rapidly broken down by sunlight. Half of what's in air breaks down within 2 days.
- They stick strongly to soil; most DDT in soil is broken down slowly to DDE and DDD by microorganisms; half the DDT in soil will break down in 2-15 years, depending on the type of soil.

- Only a small amount will go through the soil into groundwater; they do not dissolve easily in water.
- DDT, and especially DDE, build up in plants and in fatty tissues of fish, birds, and other animals.

How might I be exposed to DDT, DDE, and DDD?

- Eating contaminated foods, such as root and leafy vegetables, fatty meat, fish, and poultry, but levels are very low.
- Eating contaminated imported foods from countries that still allow the use of DDT to control pests.
- Breathing contaminated air or drinking contaminated water near waste sites and landfills that may contain higher levels of these chemicals.
- Infants fed on breast milk from mothers who have been exposed.
- Breathing or swallowing soil particles near waste sites or landfills that contain these chemicals.

How can DDT, DDE, and DDD affect my health?

DDT affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects went away after the exposure stopped. No effects were seen in people who took small daily doses of DDT by capsule for 18 months. A study in humans showed that women who had high amounts of a form of DDE in their breast milk were unable to

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breast feed their babies for as long as women who had little DDE in the breast milk. Another study in humans showed that women who had high amounts of DDE in breast milk had an increased chance of having premature babies. In animals, short-term exposure to large amounts of DDT in food affected the nervous system, while long-term exposure to smaller amounts affected the liver. Also in animals, short-term oral exposure to small amounts of DDT or its breakdown products may also have harmful effects on reproduction.

How likely are DDT, DDE, and DDD to cause cancer?

Studies in DDT-exposed workers did not show increases in cancer. Studies in animals given DDT with the food have shown that DDT can cause liver cancer. The Department of Health and Human Services (DHHS) determined that DDT may reasonably be anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) determined that DDT may possibly cause cancer in humans. The EPA determined that DDT, DDE, and DDD are probable human carcinogens.

How can DDT, DDE, and DDD affect children?

There are no studies on the health effects of children exposed to DDT, DDE, or DDD. We can assume that children exposed to large amounts of DDT will have health effects similar to the effects seen in adults. However, we do not know whether children differ from adults in their susceptibility to these substances.

There is no evidence that DDT, DDE, or DDD cause birth defects in people. A study showed that teenage boys whose mothers had higher DDE amounts in the blood when they were pregnant were taller than those whose mothers had lower DDE levels. However, a different study found the opposite in preteen girls. The reason for the discrepancy between these studies is unknown.

Studies in rats have shown that DDT and DDE can mimic the action of natural hormones and in this way affect the development of the reproductive and nervous systems. Puberty was delayed in male rats given high amounts of DDE as juveniles. This could possibly happen in humans.

A study in mice showed that exposure to DDT during the first weeks of life may cause neurobehavioral problems later in life.

How can families reduce the risk of exposure to DDT, DDE, and DDE?

- Most families will be exposed to DDT by eating food or drinking liquids contaminated with small amounts of DDT.
- Cooking will reduce the amount of DDT in fish.
- Washing fruit and vegetables will remove most DDT from their surface.
- Follow health advisories that tell you about consumption of fish and wildlife caught in contaminated areas.

Is there a medical test to show whether I've been exposed to DDT, DDE, and DDD?

Laboratory tests can detect DDT, DDE, and DDD in fat, blood, urine, semen, and breast milk. These tests may show low, moderate, or excessive exposure to these compounds, but cannot tell the exact amount you were exposed to, or whether you will experience adverse effects. These tests are not routinely available at the doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) sets a limit of 1 milligram of DDT per cubic meter of air (1 mg/m³) in the workplace for an 8-hour shift, 40-hour workweek.

The Food and Drug Administration (FDA) has set limits for DDT, DDE, and DDD in foodstuff at or above which the agency will take legal action to remove the products from the market.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for DDT/DDE/DDD (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Ethylbenzene has been found in at least 731 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

(Pronounced ĕth' əl bĕn' zĕn')

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- Ethylbenzene moves easily into the air from water and soil.
- It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- Ethylbenzene may be released to water from industrial discharges or leaking underground storage tanks.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- In soil, it is broken down by soil bacteria.

How might I be exposed to ethylbenzene?

- Breathing air containing ethylbenzene, particularly in areas near factories or highways.
- Drinking contaminated tap water.
- Working in an industry where ethylbenzene is used or made.
- Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Limited information is available on the effects of ethylbenzene on people's health. The available information shows dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes of people exposed to high levels of ethylbenzene in air.

Animals studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

How likely is ethylbenzene to cause cancer?

The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity.

ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>

No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

How can ethylbenzene affect children?

Children may be exposed to ethylbenzene through inhalation of consumer products, including gasoline, paints, inks, pesticides, and carpet glue. We do not know whether children are more sensitive to the effects of ethylbenzene than adults.

It is not known whether ethylbenzene can affect the development of the human fetus. Animal studies have shown that when pregnant animals were exposed to ethylbenzene in air, their babies had an increased number of birth defects.

How can families reduce the risk of exposure to ethylbenzene?

Exposure to ethylbenzene vapors from household products and newly installed carpeting can be minimized by using adequate ventilation.

Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and

some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. This test needs to be done within a few hours after exposure occurs, because the substances leave the body very quickly.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level of 0.7 milligrams of ethylbenzene per liter of drinking water (0.7 mg/L).

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of ethylbenzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 100 parts of ethylbenzene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html> ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about fuel oils. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fuel oils?

(Pronounced fyoo'el oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

- Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.

- Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

- Using a home kerosene heater or stove, or using fuel oils at work.
- Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- Touching soil contaminated with fuel oils.
- Using fuel oils to wash paint or grease from skin or equipment.

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene

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stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, lightheadedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of

the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/m³) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html> ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

- Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
- When lead is released to the air, it may travel long distances before settling to the ground.
- Once lead falls onto soil, it usually sticks to soil particles.
- Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

- Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.

- Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.

- Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.

- Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services

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(DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

- Avoid exposure to sources of lead.
- Do not allow children to chew on mouth surfaces that may have been painted with lead-based paint.
- If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.
- Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children
- If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces

often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter ($\mu\text{g}/\text{dL}$). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers a blood lead level of 10 $\mu\text{g}/\text{dL}$ to be a level of concern for children.

EPA limits lead in drinking water to 15 μg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



APPENDIX B
REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: _____ Project Name/Number: _____

Report Date: _____ Project Manager Name: _____

Summary of any violations of procedures occurring that week:

Summary of any job related injuries, illnesses, or near misses that week:

Summary of air monitoring data that week (include and sample analyses, action levels exceeded, and actions taken):

Comments:

Name: _____ Company: _____

Signature: _____ Title: _____

INJURED - ILL:

Name: _____ SSN: _____

Address: _____ Age: _____

Length of Service: _____ Time on Present Job: _____

Time/Classification: _____

SEVERITY OF INJURY OR ILLNESS:

___ Disabling ___ Non-disabling ___ Fatality

___ Medical Treatment ___ First Aid Only

ESTIMATED NUMBER OF DAYS AWAY FROM JOB: _____

NATURE OF INJURY OR ILLNESS: _____

CLASSIFICATION OF INJURY:

- | | | |
|--------------------|-----------------------|----------------------------|
| ___ Abrasions | _____ Dislocations | _____ Punctures |
| ___ Bites | _____ Faint/Dizziness | _____ Radiation Burns |
| ___ Blisters | _____ Fractures | _____ Respiratory Allergy |
| ___ Bruises | _____ Frostbite | _____ Sprains |
| ___ Chemical Burns | _____ Heat Burns | _____ Toxic Resp. Exposure |
| ___ Cold Exposure | _____ Heat Exhaustion | _____ Toxic Ingestion |
| ___ Concussion | _____ Heat Stroke | _____ Dermal Allergy |
| ___ Lacerations | | |

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____

Where Medical Care was Received: _____

Address (if off-site): _____

(If two or more injuries, record on separate sheets)

PROPERTY DAMAGE:

Description of Damage: _____

Cost of Damage: \$ _____

ACCIDENT/INCIDENT LOCATION: _____

ACCIDENT/INCIDENT ANALYSIS: Causative agent most directly related to accident/incident
(Object, substance, material, machinery, equipment, conditions)

Was weather a factor?: _____

Unsafe mechanical/physical/environmental condition at time of accident/incident (Be specific):

Personal factors (Attitude, knowledge or skill, reaction time, fatigue):

ON-SITE ACCIDENTS/INCIDENTS:

Level of personal protection equipment required in Site Safety Plan:

Modifications:

Was injured using required equipment?:

If not, how did actual equipment use differ from plan?:

ACTION TAKEN TO PREVENT RECURRENCE: (Be specific. What has or will be done? When will it be done? Who is the responsible party to insure that the correction is made?)

ACCIDENT/INCIDENT REPORT REVIEWED BY:

SSO Name Printed

SSO Signature

OTHERS PARTICIPATING IN INVESTIGATION:

Signature

Title

Signature

Title

Signature

Title

ACCIDENT/INCIDENT FOLLOW-UP: Date: _____

Outcome of accident/incident: _____

Physician's recommendations: _____

Date injured returned to work: _____
Follow-up performed by: _____

Signature

Title

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

APPENDIX C
EMERGENCY HAND SIGNALS

EMERGENCY SIGNALS

In most cases, field personnel will carry portable radios for communication. If this is the case, a transmission that indicates an emergency will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communications is not available, the following air-horn and/or hand signals will be used:

EMERGENCY HAND SIGNALS

OUT OF AIR, CAN'T BREATHE!



Hand gripping throat

**LEAVE AREA IMMEDIATELY,
NO DEBATE!**

**(No Picture) Grip partner's wrist or place
both hands around waist**

NEED ASSISTANCE!



Hands on top of head

OKAY! – I'M ALL RIGHT!

- I UNDERSTAND!



Thumbs up

NO! - NEGATIVE!



Thumbs down