NYU LANGONE MEDICAL CENTER – SCIENCE BUILDING

MANHATTAN, NEW YORK

Remedial Action Work Plan

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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/Demolition
COC	Certificate of Completion
CQAP	Construction Quality Assurance Plan
CSOP	Contractors Site Operation Plan
DCR	Declaration of Covenants and Restrictions
ECs/ICs	Engineering and Institutional Controls
HASP	Health and Safety Plan
IRM	Interim Remedial Measure
BCA	Brownfield Cleanup Agreement
MNA	Monitored Natural Attenuation
NOC	Notice of Completion
NYC BCP	New York City Brownfield Cleanup Program
NYC DEP	New York City Department of Environmental Protection
NYC DOHMH	New York State Department of Health and Mental Hygiene
NYCRR	New York Codes Rules and Regulations
NYC OER	New York City Office of Environmental Remediation
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
PE	Professional Engineer

PID	Photo Ionization 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
SVOC	Semi-Volatile Organic Compound
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

CERTIFICATION

I, Michelle Lapin, am a Professional Engineer licensed in the State of New York. I have primary direct responsibility for implementation of the remedial action for the NYU Langone Medical Center – Science Building Site, VCP No. 14CVCP211M and OER Project No. 14RHAZ138M.

I certify that 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

Name

073934

NYS PE License Number

Signature

1-13-14

Date

STATE OF NEW YORK
MICHELLE LAPIN
No. 073934
LICENSED PROFESSIONAL ENGINEER

EXECUTIVE SUMMARY

NYU Langone Medical Center (NYULMC) has enrolled in the New York City Voluntary Cleanup Program (NYC VCP) to investigate and remediate an approximately 36,000-square foot site located at 435 East 30th Street in Manhattan, New York. 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 Current Usage

The Site is located at 435 East 30th Street in the Kips Bay section of Manhattan, New York and is identified as Block 962, part of Lot 7501 on the New York City Tax Map. Figure 1 shows the Site location. The Site is approximately 36,000 square feet and part of NYULMC. The Site is bounded by NYULMC facilities to the north, East 30th Street to the south, the FDR Drive service road to the east, and the NYC Office of the Chief Medical Examiner (OCME) to the west. Currently, the Site includes three former NYULMC buildings (a dormitory, a lecture hall and offices), which are in the process of being demolished prior to construction of a new research building. The existing buildings included partial cellars.

Summary of Proposed Redevelopment Plan

The proposed redevelopment will cover the majority of the Site (with only small landscaped areas along the northern, eastern and southern edges) and will entail completing demolition of the remaining vacant buildings (which have been partially demolished), followed by the construction of a new 16-story research building with a partial cellar in its northwestern portion, as shown on Figure 2.

The new building's foundations would include pressure slabs (used as a foundation and flood-proofing measure). The bottom of the ground-floor pressure slab would be at approximately 3.5 feet Manhattan Borough Datum (MBD). The bottom of the cellar pressure

slab would be at approximately -8.5 feet MBD. The pressure slabs would be underlain by three-inch thick mud slabs.

Much of the proposed cellar area is existing cellar space, with existing tops of floor slabs ranging from approximately +8 to -5 feet MBD, as indicated on Figures 3 and 4. As such, excavation for the new construction would generally extend less than 10 feet below the existing foundation slabs, with areas of deeper excavation (up to approximately 23 feet below the existing slabs) for footings and sumps. The deepest excavation, for sump pits in the northwestern portion of the new cellar, would be to approximately -18 feet MBD. Portions of the Site in the area where no cellar is proposed would be backfilled, since existing floor grades are below the proposed new pressure slab elevation. The proposed excavation depths relative to existing foundation slab elevations are shown on Figure 4.

Previous investigations, summarized in Section 1.4, indicated that groundwater is first encountered at approximately 0 to -3 feet MBD (approximately 6 to 15 ftbg). Dewatering will be required for the deeper excavations.

The new building's approximately 34,300-square foot ground floor will include a lobby, conference rooms, offices, a kitchen, a cafeteria, loading docks, and storage and mechanical areas. The approximately 9,200-square foot cellar will include storage and mechanical areas, including a stormwater detention tank, sump rooms, a fuel oil tank room, and elevator pits. The building would be occupied by research and support space, seminar and conference rooms, and administrative offices, but no patient care space. The planting beds adjacent to the building will cover approximately 1,700 square feet.

Based on proposed excavation depths, it is estimated that approximately 5,000 cubic yards (approximately 7,500 tons) of soil would be excavated and transported off-site for disposal from the building footprint and the planting beds. Approximately 130 cubic yards of soil will be imported for use as a Site cap in landscaped areas. If additional soil needs to be imported as structural backfill, the soil importation will be in accordance with Section 1.9 of the Soil/Materials Management Plan included as *Appendix 3*.

The remedial action contemplated under this RAWP will not be implemented independently of the proposed redevelopment plan.

Summary of the Remedy

The proposed remedial action achieves protection of public health and the environment for the intended use of the Site. 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 and 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.

2. Performance of a Community Air Monitoring Program for particulates and volatile organic compounds.

3. Establishment of site-specific (Track 4) Soil Cleanup Objectives (SCOs).

4. Excavation and removal of soil/fill exceeding Track 4 Site Specific SCOs. The proposed building footprint will be generally excavated less than 10 feet below the existing foundation slabs, with areas of deeper excavation (up to approximately 23 feet below the existing slabs) for footings and sumps. Approximately 70% of the Site will be excavated to depths of up to 10 feet, 15% will be excavated to depths of 10 to 25 feet, and 15% (part of the area currently occupied by existing building basements) will be backfilled to elevate it to proposed grade. Approximately 7,500 tons of soil will be removed from the Site to make space for the new cellar, foundation slabs and Site cap.

5. Construction and maintenance of an engineered composite cover generally consisting of concrete building slabs, with concrete or asphalt pavement for adjacent walkways and a minimum of two feet of clean fill for adjacent landscaped areas, to prevent human exposure to residual soil/fill remaining under the Site. A pressure slab (a minimum of 14 inches thick) would be underlain by an approximately 3-inch thick mud slab. The cover over paved outdoor areas (i.e., concrete or asphalt plus subgrade layers) will be a minimum of 10 inches thick. Approximately 130 cubic yards of soil will be imported for use as a Site cap in landscaped areas. If additional soil needs to be imported as structural

backfill, the soil importation will be in accordance with Section 1.9 of the Soil/Materials Management Plan, included as *Appendix 3*.

6. As part of development, installation of a vapor barrier system beneath the building pressure slabs and behind below-grade foundation/cellar sidewalls. The vapor barrier will consist of 21-mil Grace Florprufe® 120, Grace Preprufe® 300R (46 mils) and 160R (32 mils), or an OER-approved equivalent.

7. Collection and analysis of end-point samples to determine the performance of the remedy with respect to attainment of SCOs.

8. Removal of underground storage tanks (if encountered) and closure of petroleum spills (if evidence of a spill/leak is encountered during Site excavation) in compliance with applicable local, State and Federal laws and regulations.

9. Demarcation of residual soil/fill.

10. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations. Approximately 130 cubic yards of soil will be imported for use as a Site cap in landscaped areas.

11. Transportation and off-site disposal of all soil/fill material at 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.

12. 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.

13. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.

14. Implementation of stormwater pollution prevention measures in compliance with applicable laws and regulations.

15. Performance of all activities required for the remedial action, including permitting requirements and pretreatment requirements, in compliance with applicable laws and regulations. Since groundwater is at a depth of approximately 6 to 15 ftbg, dewatering permits will be obtained from NYSDEC or NYCDEP, as applicable.

16. Reuse or import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.

17. Submission of a Remedial Action Report (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 Engineering and Institutional Controls to be implemented at the Site.

18. 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.

19. The Site will continue to be registered with a Restrictive Declaration at the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls and a requirement for management of these controls must be in compliance with an approved SMP. The SMP 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) a higher level of land use without OER approval.

COMMUNITY PROTECTION STATEMENT

The Office of Environmental Remediation created the New York City Voluntary Cleanup Program (NYC VCP) to provide governmental oversight for the cleanup of contaminated property in NYC. This Remedial Action Work Plan (cleanup plan) describes the findings of prior environmental studies that show the location of 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.

Remedial Investigation and Cleanup Plan. Under the NYC VCP, a thorough cleanup study of this property (called a remedial investigation) has been performed to identify past property usage, to sample and test soils, groundwater and soil vapor, and 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 property.

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 the performance of a study to find all of the ways that people might come in contact with contaminants at the Site 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 plan are in compliance with safety requirements of the United States Occupational Safety and Health Administration (OSHA). This plan includes many protective elements including those discussed below.

Site Safety Coordinator. This project has a designated Site safety coordinator to implement the Health and Safety Plan. The safety coordinator maintains an emergency contact sheet and protocol for management of emergencies. The Site safety coordinator is Erik Nimlos and can be reached at 917-613-5977.

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 or CAMP. Results will be regularly reported to the NYC Office of Environmental Remediation. 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 NYC noise control standards. If you observe problems in these areas, please contact the onsite Project Manager Axel Schwendt at 646-388-9529 or NYC Office of Environmental Remediation Project Manager Cavy Chu at 212-788-3774.

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. This report will be submitted to the NYC Office of Environmental Remediation 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 for operation of cleanup will comply with the NYC Department of Buildings construction code requirements or according to specific variances issued by that agency. For this cleanup project, the hours of operation will conform to the DOB construction code requirements or specific variances issued by 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 NYC Voluntary Cleanup Program, provides project contact names and numbers, and locations 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 Construction Management Project Manager Michael Franco at 917-952-8151, the NYC Office of Environmental Remediation Project Manager Cavy Chu at 212-788-3774, or call 311 and mention the Site is in the NYC Voluntary Cleanup Program.

Utility Mark-outs. To promote safety during excavation in this cleanup, the contractor is required to first identify all utilities and must perform all excavation and construction work in compliance with NYC Department of Buildings 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 and 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, odors 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. If loads 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 all 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-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 a Remedial Action Report) that will be available for you to review in the public document repositories located at the New York Public Library, Kips Bay Branch (446 Third Avenue at East 31st Street).

Long-Term Site Management. To provide long-term protection after the cleanup is complete, the property owner will be required to comply with an ongoing Site Management Plan that calls for continued inspection of protective controls, such as Site covers. The Site Management Plan is evaluated and approved by the NYC Office of Environmental Remediation. Requirements that the property owner must comply with are defined in the property's deed or established through a city environmental designation. 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 SITE BACKGROUND

NYULMC has applied to enroll in the New York City Voluntary Cleanup Program (NYC VCP) to investigate and remediate a property located at 435 East 30th Street in the Kips Bay section of Manhattan, New York (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, 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, complies with applicable environmental standards, criteria and guidance and applicable laws and regulations.

1.1 SITE LOCATION AND CURRENT USAGE

The Site is located at 435 East 30th Street in the Kips Bay section of Manhattan, New York and is identified as Block 962, part of Lot 7501 on the New York City Tax Map. Figure 1 shows the Site location. The Site is approximately 36,000 square feet and part of NYULMC. The Site is bounded by NYULMC facilities to the north, East 30th Street to the south, the FDR Drive service road to the east, and the NYC Office of the Chief Medical Examiner (OCME) to the west. Currently, the Site includes three former NYULMC buildings (a dormitory, a lecture hall and offices), which are in the process of being demolished prior to construction of a new research building. Portions of the existing buildings contain cellars.

1.2 PROPOSED REDEVELOPMENT PLAN

The proposed redevelopment will cover the majority of the Site (with small landscaped areas along the northern, eastern and southern edges) and will entail completing demolition of the remaining vacant buildings (which have been partially demolished), followed by the construction of a new 16-story research building with a partial cellar in its northwestern portion, as shown on Figure 2.

The new building's foundations would include pressure slabs (used as a foundation and flood-proofing measure). The bottom of the ground-floor pressure slab would be at approximately 3.5 feet Manhattan Borough Datum (MBD). The bottom of the cellar pressure slab would be at approximately -8.5 feet MBD. The pressure slabs would be underlain by three-inch thick mud slabs. Much of the proposed cellar area is existing cellar space, with existing tops of floor slabs ranging from approximately +8 to -5 feet MBD, as indicated on Figures 3 and 4. Excavation for the new construction would generally extend less than 10 feet below the existing foundation slabs, with areas of deeper excavation (up to approximately 23 feet below the existing slabs) for footings and sumps. Portions of the Site in the area where no cellar is proposed would be backfilled, since existing floor grades are below the proposed new pressure slab elevation. The proposed excavation depths relative to existing foundation slab elevations are shown on Figure 4.

Previous investigations, summarized in Section 1.4, indicated that groundwater is first encountered at approximately 0 to -3 feet MBD (approximately 6 to 15 ftbg). Dewatering will be required for the deeper excavations.

The new building's approximately 34,300-square foot ground floor will include a lobby, conference rooms, offices, a kitchen, a cafeteria, loading docks, and storage and mechanical areas. The approximately 9,200-square foot cellar will include storage and mechanical areas, including a stormwater detention tank, sump rooms, a fuel oil tank room, and elevator pits. The building would be occupied by research and support space, seminar and conference rooms, and administrative offices, but no patient care space. The planting beds adjacent to the building will cover approximately 1,700 square feet.

Based on proposed excavation depths, it is estimated that approximately 5,000 cubic yards (approximately 7,500 tons) of soil would be excavated and transported off-site for disposal from the building footprint and the planting beds. Approximately 130 cubic yards of soil will be imported for use as a Site cap in landscaped areas.

The remedial action contemplated under this RAWP will not be implemented independently of the proposed redevelopment plan.

1.3 DESCRIPTION OF SURROUNDING PROPERTY

The Site is bounded by NYULMC facilities to the north, East 30th Street to the south, the FDR Drive service road to the east, and the NYC Office of the Chief Medical Examiner to the west. The off-site portion of the NYULMC superblock is occupied by medical buildings. Amtrak train tunnels pass north of the Site beneath the northern portion of the NYULMC superblock. The surrounding area is occupied by medical, office and residential buildings (many with ground-floor retail/commercial uses) and is zoned for commercial and residential uses. The NYULMC campus includes a hospital. Additional medical facilities are located to the south and elsewhere within a 500-foot radius of the Site. Figures 1 and 3 show the surrounding land usage.

1.4 REMEDIAL INVESTIGATION

A remedial investigation was performed and the results are documented in a companion document called "*Remedial Investigation Report, NYU Langone Medical Center – Science Building*", dated November 2013 (RIR). The investigation included: the installation of 8 soil borings and collection of 16 soil samples for laboratory analysis; collection of 3 soil samples for laboratory analysis from 3 hand-dug test pits; installation of 3 temporary monitoring wells in the soil borings and collection of 3 groundwater samples for laboratory analysis; collection of one groundwater sample for laboratory analysis from an existing monitoring well (installed for a geotechnical investigation); and installation of 5 soil vapor probes and collection of 5 soil vapor samples for laboratory analysis.

The remedial investigation and prior investigations indicated the following:

1. Elevation of existing foundation slabs ranges from 8 to -5 feet relative to the Manhattan Borough Datum (MBD), i.e., from approximately 2 feet above grade to 12 feet below grade (ftbg). Sidewalk grade ranges from approximately 6 to 12 feet MBD, sloping down toward the east.

2. Groundwater elevation ranges from approximately 0 to -3 feet MBD (i.e., approximately 6 to 15 feet below the existing sidewalk grade).

3. Groundwater flow is believed to be generally from west to east (toward the East River). Groundwater elevation and flow direction may be tidally influenced as the East River is approximately 200 feet away.

4. Depth to decomposed bedrock is approximately 95 to 120 ftbg.

5. Stratigraphy, from the surface down, consists of an approximately 17.5 to 40-foot thick layer of urban fill material including sand, gravel, silt, brick and concrete with some timber and rubble (likely associated with a historical East River bulkhead), underlain by a layer of silty clay, silty sand, and/or silt throughout most borings. A layer of decomposed bedrock was encountered in two borings at depths of approximately 95 and 120 feet respectively, and likely extends more than 190 feet below grade based on historical data. Historical East River bulkhead appears to run north-south through the central portion of the Site.

6. The Site was created by filling of the East River in the mid-1800s and early 1900s. Geotechnical borings encountered an approximately 17.5 to 40-foot thick layer of urban fill including sand, gravel, silt, brick and concrete with some timber and rubble (likely associated with historical East River bulkhead). Prior to being developed with the NYU buildings, the Site had a variety of uses including a warehouse, a lumber yard, an airplane factory and a hangar, and a laboratory. The NYU buildings were constructed between approximately 1952 and 1973.

7. Analytical results for soil/fill samples were compared to 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs) and Restricted - Commercial Use Soil Cleanup Objectives (CSCOs). Soil/fill samples collected during the RI showed detections of low levels of VOCs. Petroleum-related VOCs were detected in four soil samples at concentrations ranging from 0.028 milligrams per kilogram (mg/kg) of p-isopropyltoluene to 1.3 mg/kg p&m-xylene, with three VOCs (benzene, o-xylene and p&m-xylene) slightly exceeding their USCOs, but all VOCs present well below their CSCOs. The VOC methylene chloride, a common laboratory contaminant, was detected in three soil samples at estimated concentrations ranging from 0.0033 to 0.0048 mg/kg, well below its USCO and CSCO. Seven SVOCs including benzo(a)anthracene (max. of 4 ppm), benzo(a)pyrene (max. of 4.4 ppm), benzo(b)fluoranthene (max. of 5.3 ppm), benzo-(k)fluoranthene (max. of 2.2 ppm), chrysene (max. of 4 ppm), dibenzo(a,h)anthracene (max. of 1 ppm), and indeno(1,2,3-

cd)pyrene (max. of 3.7 ppm) were detected above their respective USCOs. Two SVOCs, benzo(a)pyrene and benzo(b)fluoranthene, also exceeded CSCOs in three soil samples. Six metals including arsenic (max. of 38 ppm), copper (max. of 110 ppm), chromium (max. of 39 ppm), lead (max. of 280 ppm), mercury (max. of 0.71 ppm) and zinc (max. of 290 ppm) exceeded USCOs in all shallow soil samples. Of these metals, arsenic also exceeded CSCOs. Three pesticides: 4,4'-DDD (max. of 5.8 ppb), 4,4'-DDE (max. of 5.3 ppb), and 4,4'-DDT (max. of 21.8 ppb) were detected above USCOs in three shallow soil samples. All pesticide concentrations were well below CSCOs. The detected concentrations of VOC, SVOCs, metals, PCBs, and pesticides are likely attributable to historical use at the Site and/or urban fill materials, but were not indicative of a spill or release. No visual, olfactory, or PID readings indicative of a spill or release were noted during field screening.

8. Analytical results for groundwater samples were compared to NYSDEC Class GA Ambient Water Quality Standards (AQWS). Groundwater samples collected during the RI showed two VOCs (benzene and acetone) at concentrations below Class GA standards. The groundwater samples also contained several SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene] and metals (antimony, iron, manganese, selenium and sodium) in exceedance of Class GA standards, which appeared to be attributable to sediment entrained in the samples. No pesticides or PCBs were detected in the groundwater samples. No visual, olfactory, or PID readings indicative of a spill or release were noted.

9. Soil vapor samples collected during the RI showed concentrations of VOCs generally associated with petroleum and solvents, in exceedance of certain indoor air background levels published in the 2006 *New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (which were used for comparison). The solvent-related VOC methylene chloride was present at a concentration of 65.3 $\mu g/m^3$ in soil vapor, slightly exceeding the NYSDOH Indoor Air Guideline Value (AGV) of 60 $\mu g/m^3$. The solvent-related VOC tetrachloroethylene (PCE) was present at concentrations ranging from 6.69 to 80.7 $\mu g/m^3$, exceeding its AGV of 30 $\mu g/m^3$ in three of five samples. Trichloroethylene (TCE) was detected at a maximum concentration of 1.76 $\mu g/m^3$, 1,1,1-trichloroethane (1,1,1-TCA) was detected at maximum of 2.62 $\mu g/m^3$, and carbon

tetrachloride was not detected. Overall the highest reported concentrations were for acetone (maximum of 1,310 $\mu g/m^3$) and p&m-xylene (maximum of 764 $\mu g/m^3$). As previously noted, some petroleum-related VOCs were detected at low concentrations in soil and/or groundwater samples. Thus, the VOCs detected in soil vapor appeared to be attributable to some combination of historical use at the Site, off-site sources and urban fill materials.

For more detailed results, consult the RIR. Based on an evaluation of the data and information from the RIR and this RAWP, disposal of significant amounts of hazardous waste is not suspected 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 this Site:

Groundwater

- Remove any contaminant sources causing impact to groundwater.
- Prevent direct exposure to contaminated groundwater.
- Prevent exposure to any contaminants volatilizing from contaminated groundwater.

Soil

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

Soil Vapor

- Prevent exposure to contaminants in soil vapor.
- Prevent migration of soil vapor into 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 remedial action objectives (RAOs) for media in which chemical constituents were found in exceedance of applicable standards, criteria and guidance values (SCGs). A remedy is then developed 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.

The following is a detailed description of the alternatives analysis and remedy selection to address impacted media at the Site. As required, two remedial alternatives (including a Track 1 scenario) are evaluated, as follows:

Alternative 1 involves:

- Establishment of Unrestricted Use (Track 1) Soil Cleanup Objectives (SCOs).
- Removal of all soil/fill exceeding Track 1 Unrestricted Use SCOs throughout the Site and confirmation that Track 1 SCOs have been achieved with post-excavation endpoint sampling. Based on the results of the remedial investigation, it is expected that this alternative would require excavation to approximately 17.5 to 40 feet below grade throughout the Site to remove all historic fill. If soil/fill containing analytes at concentrations above Track 1 Unrestricted Use SCOs is still present beneath the Site after removal of all soil required for the new construction is complete, additional excavation

would be performed to ensure complete removal of soil that does not meet Track 1 Unrestricted Use SCOs.

- No engineering or institutional controls are required for a Track 1 cleanup, but a vapor barrier beneath the pressure slab foundation and behind foundation sidewalls of the new building would be installed as part of new development to prevent future exposures from off-site soil vapor.
- Placement of a final cover over the entire Site as part of new construction.

Alternative 2 involves

- Establishment of Track 4 Site-Specific SCOs.
- Removal or capping of all soil/fill exceeding Track 4 Site-Specific SCOs and confirmation that Track 4 SCOs have been achieved with post-excavation endpoint sampling. Excavation for development purposes would generally take place to less than 10 feet below the existing foundation slabs, with areas of deeper excavation (up to approximately 23 feet below the existing slabs) for footings and sumps.
- Placement of a final cover over the entire Site to eliminate exposure to remaining soil/fill;
- Placement of a vapor barrier beneath the building slab and basement/foundation sidewalls to prevent soil vapor entering the new building.
- Establishment of use restrictions including prohibitions on the use of groundwater from the Site and prohibitions on sensitive site uses, such as farming or vegetable gardening, to eliminate future exposure pathways.
- Establishment of an approved Site Management Plan to ensure long-term management of these engineering and institutional controls including the performance of periodic inspections and certification that the controls are performing as they were intended; and
- The Site will continue to be registered with a Restrictive Declaration at the NYC Buildings Department.

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 Engineering Controls or Institutional Controls. 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 the historic fill and contaminated soil exceeding Track 1 Unrestricted Use SCOs and groundwater protection standards, thus eliminating potential for direct contact with contaminated soil/fill once construction is complete and eliminating the risk of contamination leaching into groundwater.

Alternative 2 would achieve comparable protections of human health and the environment by excavating the historic fill/contaminated soil to a depth ranging from less than 10 to approximately 23 feet for purposes of new development, ensuring that remaining soil/fill on-site meets Track 4 Site-Specific SCOs to the extent practicable, as well as by placement of Institutional and Engineering controls, including a vapor barrier and a composite cover system. The composite cover system would prevent direct contact with any remaining on-site soil/fill. Implementing Institutional Controls, including a Site Management Plan and continued RD designation of the property, would ensure that the composite cover system remains intact and protective. The vapor barrier would prevent vapor intrusion in new development and the composite cover system would prevent direct contact with any remaining on-site soil/fill and groundwater. Implementing institutional controls including continuation of the Restrictive Declaration and a Site Management Plan would ensure that the composite cover system remains intact and protective. Establishment of Track 4 Site-Specific SCOs would minimize the risk of contamination leaching into groundwater.

For both Alternatives, potential exposure to contaminated soil during construction would be minimized by implementing a Construction Health and Safety Plan, an approved Soil and Materials Management Plan (SMMP) and Community Air Monitoring Plan (CAMP). Groundwater encountered during construction would be appropriately managed in accordance

with NYSDEC and/or NYCDEP requirements for dewatering. Groundwater is not used for potable water supply. Potential migration of soil vapors into the new building would be prevented by installing a vapor barrier beneath the new pressure slab as part of new construction.

3.2. BALANCING CRITERIA

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 to Track 1 Unrestricted Use SCOs and Groundwater Protection Standards. Compliance with SCGs for soil vapor would also be achieved by installation of a vapor barrier system below the new building's pressure slab and continuing the vapor barrier around foundation/basement walls, and a concrete building slab would be constructed over the entirety of the building footprint as part of new construction.

Alternative 2 would achieve compliance with the remedial goals, chemical-specific SCGs and RAOs for soil through removal of soil to meet Track 4 Site Specific SCOs. Compliance with SCGs for soil vapor would also be achieved by installation of a vapor barrier system below the new building's pressure slab and continuing the vapor barrier around foundation/basement walls, and a concrete building slab would be constructed over the entirety of the building footprint. A Site Management Plan would ensure that these controls remained protective for the long term.

Health and safety measures contained in the CHASP and CAMP that comply with the applicable SCGs would 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 would protect on-site workers and the surrounding community from exposure to Site-related contaminants.

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 effects on public health and the environment during implementation of the remedial action, including protection of the community, environmental impacts, time until remedial response objectives are achieved, and protection of workers during remedial actions.

Both Alternatives 1 and 2 have similar short-term effectiveness during their respective implementations, 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 significantly higher for Alternative 1 as excavation of significantly greater amounts of historical fill material would be anticipated (approximately 17.5 to 40 feet, compared to the proposed excavation depths of less than 10 feet to approximately 23 feet). However, focused attention to means and methods during the remedial 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. Up to approximately 300, 25-ton capacity truck trips would be necessary to transport fill and soil excavated during Site development under Alternative 2, whereas under Alternative 1, assuming average fill thickness of 30 feet, approximately 2,400 truck trips would be required.

Both remedial alternatives would also employ appropriate measures to prevent short-term impacts through the use of a Construction Health and Safety Plan, an SMMP and a Community Air Monitoring Plan (CAMP), during all on-site soil disturbance activities, and would effectively mitigate the release of significant contaminants into the environment by properly handling and disposing of soil encountered during the development. 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 (site-specific CHASP) would be protected from on-site contaminants through the use of the appropriate personal protective equipment.

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/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 Engineering Controls.

Alternative 1 would achieve long-term effectiveness and permanence by permanently removing all impacted soil/fill material. Removal of on-site contaminant sources would prevent future groundwater contamination.

Alternative 2 would provide long-term effectiveness by removing a significant quantity of on-site contamination (up to approximately 7,500 tons of soil/fill are anticipated to be removed), installing a composite cover system across the Site, installing a vapor barrier, maintaining use restrictions, establishing a Site Management Plan to ensure long-term management of Institutional Controls (ICs) and Engineering Controls (ECs), and leaving the Restrictive Declaration in place 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 use restrictions continue to be in place and are functioning as they were intended, assuring that protections designed into the remedy will provide continued high level of protection in perpetuity.

Both alternatives would result in removal of soil contamination exceeding the SCOs providing the highest level, most effective and permanent remedy over the long-term with respect to contaminated soil, which would eliminate any migration to groundwater. Potential sources of soil vapor and groundwater contamination would also be eliminated as part of the remedy.

Reduction of Toxicity, Mobility, or Volume of Contaminated Material

This evaluation criterion assesses the remedial alternative's 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, 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 would permanently eliminate the toxicity, mobility, and volume of contaminants from on-site soil by meeting Track 1 Unrestricted Use SCOs.

Alternative 2 would permanently reduce the toxicity, mobility, and volume of contaminants by removing approximately 7,500 tons of soil/fill present on the Site. Any remaining soil/fill beneath the new Site would meet Track 4 Site-Specific SCOs or would be handled as residual contamination addressed via the composite site cover, vapor barrier, and implementation of the SMP. Alternative 1 would eliminate a greater total mass of contaminants on Site due to the additional excavation that would be required under this alternative.

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 proposed remedial action under either Alternative 1 would likely be significantly more difficult compared to Alternative 2 due to the much greater depth of excavation, and associated requirements for excavation support, dewatering and protection of adjacent buildings. Alternative 2 is feasible and implementable and uses reliable methods and standard construction technologies. Standard construction equipment utilized for the overall earthwork would be used. The techniques, materials and equipment to implement Alternative 2 are readily available and have been proven effective in remediating and/or mitigating the contaminants associated with the Site. OSHA trained personnel would complete all activities that include excavation and handling of any petroleum-contaminated or other soil with contamination beyond that associated with typical historical fill material. The reliability of Alternative 2 is also high. There are no special difficulties associated with any of the activities proposed.

Cost Effectiveness

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

Although Alternative 1 would eliminate potential costs for investigation or remediation by future landowners or lessees, it would not be cost effective to remove all historic fill and other contaminated soil that exceeds the Unrestricted Use Track 1 SCOs during redevelopment due to the greater difficulty of excavation support, dewatering and protection of adjacent buildings compared to Alternative 2 and the significantly higher volume of soil to be removed (approximately 35,000 to 80,000 tons, depending on the overall thickness of the fill layer). Initial costs associated with Alternative 1 would thus be significantly higher than Alternative 2. Long-term costs are anticipated to be slightly higher for Alternative 2 than Alternative 1, based on the need to implement a Site Management Plan as part of Alternative 2. In both cases, appropriate public health and environmental protections are achieved.

The remedial plan creates an approach that combines the remedial action with the redevelopment of the Site, including the construction of the building cellar, foundation and subgrade structures. The remedial plan is also cost effective in that it will take into consideration the selection of the closest and most appropriate disposal facilities to reduce transportation and disposal costs during the excavation of historic fill and other soil during the redevelopment of the Site.

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.

Based on the overall goals of the remedial program and the proposed Site development, no adverse community opinion is anticipated during the project. This RAWP will be subject to and undergo public review under the NYC VCP and will provide the opportunity for detailed public input on the remedial alternatives and the selected remedial action. Any public comments related to environmental remediation will be considered by OER and NYULMC prior to the

approval and execution of the remedial plan. The Citizen Participation Plan for the project is provided in Appendix 1.

Land Use

This evaluation criterion addresses the proposed use of the Site. 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; NYS Department of 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 Institutional Controls applicable to the Site.

The remedial alternatives are appropriate with respect to the proposed use and to land uses in the vicinity of the Site. The proposed redevelopment of the Site is compatible with the existing zoning designation and is consistent with recent development patterns. Following remediation, the Site will meet either Track 1 Unrestricted Use or Track 4 Site-Specific SCOs (with residual contamination addressed by Engineering Controls and Institutional Controls), both of which are appropriate for its planned scientific research use. The Site is surrounded by medical and laboratory uses including the remainder of the NYULMC campus (which includes a hospital), offices, residential buildings (many with ground-floor retail/commercial uses), and two Amtrak ventilation towers for tunnels that pass north of the Site. The proposed cleanup provides comprehensive protection of public health and the environment for these uses. Improvements in the current environmental condition of the Site achieved by both alternatives are also consistent with the City's goals for cleanup of contaminated land and bringing such land into productive reuse. Both alternatives are equally protective of natural resources and cultural resources.

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.

The remedial plan would take into consideration the shortest trucking routes during off-site disposal of historic fill and other soil, which would reduce greenhouse gas emissions and conserve energy used to fuel trucks. To the extent practicable, energy efficient building materials, appliances, and equipment will be utilized to complete the development. A sustainability statement is provided in Appendix 2.

4.0 REMEDIAL ACTION

4.1 SUMMARY OF PREFERRED REMEDIAL ACTION

The preferred remedial action alternative is Alternative 2, the Track 4 Alternative. The preferred remedial action alternative achieves protection of public health and the environment for the intended use of the property. The preferred remedial action alternative will achieve all of the remedial action objectives established for the project and addresses applicable SCGs. The preferred remedial action alternative 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 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.
2. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.
3. Establishment of site-specific (Track 4) Soil Cleanup Objectives (SCOs).
4. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.
5. Excavation and removal of soil/fill exceeding Track 4 Site Specific SCOs. The proposed building footprint will generally be excavated less than 10 feet below the existing foundation slabs, with areas of deeper excavation (up to approximately 23 feet below the existing slabs) for footings and sumps. Approximately 70% of the Site will be excavated to depths of up to 10 feet, 15% will be excavated to depths of 10 to 25 feet, and 15% (part of the area currently occupied by existing building basements) will be backfilled to elevate it to proposed grade. Approximately 7,500 tons of soil will be removed from the Site to make space for the new cellar, foundation slabs and Site cap.

6. Removal of underground storage tanks (if encountered) and closure of petroleum spills (if evidence of a spill/leak is encountered during Site excavation) in compliance with applicable local, State and Federal laws and regulations.

7. 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.

8. Transportation and off-site disposal of all soil/fill material at 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.

9. Collection and analysis of end-point samples to determine the performance of the remedy with respect to attainment of SCOs.

10. Demarcation of residual soil/fill in the areas not capped by building slab.

11. Installation of a vapor barrier system beneath the building pressure slabs and behind foundation/cellar sidewalls below grade. The vapor barrier will consist of 21-mil Grace Florprufe® 120, Grace Preprufe® 300R (46 mils) and 160R (32 mils), or an OER-approved equivalent.

12. Construction and maintenance of an engineered composite cover generally consisting concrete building slabs, with concrete or asphalt pavement for adjacent walkways and a minimum of two feet of clean fill for adjacent landscaped areas, to prevent human exposure to residual soil/fill remaining under the Site. A pressure slab (a minimum of 14 inches thick) would be underlain by an approximately 3-inch thick mud slab. The cover over paved outdoor areas (i.e., concrete or asphalt plus subgrade layers) will be a minimum of 10 inches thick.

13. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations. Approximately 130 cubic yards of soil will be imported for use as a Site cap in landscaped areas.

14. Implementation of stormwater pollution prevention measures in compliance with applicable laws and regulations.

15. Performance of all activities required for the remedial action, including permitting requirements and pretreatment requirements, in compliance with applicable laws and regulations. Since groundwater is at a depth of approximately 6 to 15 ftbg, dewatering permits will be obtained from NYSDEC or NYCDEP, as applicable.

16. Reuse or import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.

17. Submission of a Remedial Action Report (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 Engineering and Institutional Controls to be implemented at the Site.

18. 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.

19. The Site will continue to be registered with a Restrictive Declaration at the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls and a requirement for management of these controls must be in compliance with an approved SMP. The SMP 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) a higher level of land use without OER approval.

4.2 SOIL CLEANUP OBJECTIVES AND SOIL/FILL MANAGEMENT

Track 4 Soil Cleanup Objectives (SCOs) are proposed for this project. The SCOs for this Site are the 6 NYCRR Part 375 Restricted - Commercial Use Soil Cleanup Objectives (CSCOs) as modified below:

Total SVOCs:	500 PPM
PCBs (total):	1 PPM
Arsenic:	23 PPM
Barium:	500 PPM
Lead:	1,200 PPM

Soil and materials management on-site and off-site, including excavation, handling and disposal, will be conducted in accordance with the Soil/Materials Management Plan in Appendix 3. The location of planned excavations is shown in Figure 4.

If encountered, discrete contaminant sources (such as hotspots) identified during the remedial action will be identified by GPS or surveyed. This information will be provided in the Remedial Action Report.

Estimated Soil/Fill Removal Quantities

The total quantity of soil/fill expected to be excavated and disposed off-site is approximately 7,500 tons.

The proposed disposal locations for Site-derived affected materials are listed below. Additional disposal locations established at a later date will be reported promptly to the OER Project Manager. Disposal facilities will be reported to OER when they are identified and prior to the start of remedial action.

Table 1

Proposed Soil Disposal Locations

Disposal Facility	**Waste Type**	**Estimated Quantities**
TBD	Historical fill	Up to 7,500 tons
TBD	Petroleum contaminated soil (if any)	As needed

End-Point Sampling

Soil removal for development purposes under this plan will be performed in conjunction with sampling required by disposal facilities. Confirmation end-point soil sampling for attainment of Track 4 SCOs will be performed at select locations to be determined by OER. The final number and locations of samples will be subject to OER approval. Analytes will include those compounds and elements that exceeded Track 4 SCOs.

If any hot-spots are identified during the remedial program, hot-spot removal will be performed in conjunction with post remedial end-point samples to ensure that hot-spots are fully removed. Analytes for hot-spot end-point sampling will be those parameters that are driving the hot-spot removal action and will be approved by OER. Frequency for hot-spot end-point sample collection is as follows:

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 organic compounds, 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 1-3 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.

New York State ELAP certified labs will be used for all confirmation and end-point sample analyses. Laboratories performing confirmation and end-point sample analyses will be reported in the RAR. The RAR will provide a tabular and map summary of all confirmation and end-point sample results and will include all data including non-detects and applicable standards and/or guidance values. End-point samples will be Confirmation samples will be analyzed for compounds and elements as described above utilizing the following methodology:

Soil analytical methods will include:

- Volatile organic compounds by EPA Method 8260;
- Semi-volatile organic compounds by EPA Method 8270;
- Target Analyte List metals; and
- Pesticides/PCBs by EPA Method 8081/8082.

If either LNAPL and/or DNAPL are detected, appropriate samples will be collected for characterization and "fingerprint analysis" and required regulatory reporting (i.e. NYS spills hotline) will be performed.

Quality Assurance/Quality Control

Samples will be collected in accordance with the following procedures:

- Record sample observations (evidence of contamination, PID readings, soil classification) in field log book.
- Collect an aliquot of soil or groundwater using a dedicated and disposable plastic sample spoon or sample bailer and place in laboratory-supplied sample jars. One grab sample will be collected for VOC analysis, if applicable. One composite sample will be collected for all other analyses.
- Seal and label the sample jars as described below and place in a chilled cooler.

Decontamination Procedures

To avoid contamination and cross-contamination of samples, only dedicated or disposable sampling equipment may be used to collect these samples. All non-disposable equipment involved in field sampling must be decontaminated before being brought to the sampling location, and must be properly decontaminated after use.

Sample Identification

All samples will be consistently identified in all field documentation, chain-of-custody documents and laboratory reports using an alpha-numeric or alpha-alpha code. For stockpiled soil, the alpha prefix will be "SP" and the numbers following the alpha prefix will correspond to excavated stockpiles, beginning with "1, 2, 3…etc." For example, the first sample collected from the first stockpile will be labeled "SP-1-1" and the first sample collected from the second stockpile will be labeled "SP-2-1."

For groundwater samples, the alpha prefix will be "GW" and the number following the prefix will correspond to the sample number. For example, the first groundwater sample collected for sample analysis will be labeled "GW-1" and the second sample will be "GW-2."

Sample Labeling and Shipping

All sample containers will be labeled with the following information:

- Site identification
- Sample identification
- Date and time of collection
- Analysis(es) to be performed
- Sampler's initials

Once the samples are collected and labeled, they will be placed in chilled coolers and stored in a cool area away from direct sunlight to await shipment to the laboratory. Soil samples will be shipped to the laboratory at a frequency that will not result in an exceedance of applicable holding times for sample methods. At the start and end of each workday, field personnel will add ice to the coolers as needed.

The samples will be prepared for shipment by placing each sample jar in a sealable plastic bag, then wrapping each bag in bubble wrap to prevent breakage, adding freezer packs and/or fresh ice in sealable plastic bags and the chain-of-custody form. Samples will be shipped overnight (e.g., Federal Express) or transported by a laboratory courier. All coolers shipped to the laboratory will be sealed with mailing tape and a chain-of-custody (COC) seal to ensure that the coolers remain sealed during delivery.

Sample Custody

Field personnel will be responsible for maintaining the sample coolers in a secured location until they are picked up and/or sent to the laboratory. The record of possession of samples from the time they are obtained in the field to the time they are delivered to the laboratory or shipped off-site will be documented on COC forms. The COC forms will contain the following information: project name; names of sampling personnel; sample number; date and time of collection and matrix; and signatures of individuals involved in sample transfer, and the dates and times of transfers. Laboratory personnel will note the condition of the custody seal and sample containers at sample check-in.

Documentation

A sample log book will be maintained. The following information, as a minimum will be recorded to the log.

- Sample identification number
- Sample location
- Field Observations
- Sample Type
- Analyses
- Date/Time of collection
- Collector's name
- Sample procedures and equipment utilized
- Date sent to laboratory/name of laboratory
- Copies of site drawings indicating stockpile numbers and locations. At least one duplicate sample will be collected for each of 20 samples collected and sufficient field and lab blank samples will be collected to assess sampling and lab artifacts.

Import and Reuse of Soil

Import of soil onto the Site and reuse of soil already on-site will be performed in conformance with the Soil/Materials Management Plan in *Appendix 3*. The estimated quantity of soil to be imported onto the Site for use as a Site cap in landscaped areas is 130 cubic yards or 200 tons. Safe construction of the new building's cellar and (especially deeper) foundation elements will require temporary relocation of soil to create excavations with sloping walls, with some portion of the relocated soil replaced around these structural elements following their construction. Unless it exhibits evidence of contamination (e.g., odors, staining and/or elevated PID readings), soil relocated during foundation construction will be reused within or adjacent to the building footprint without additional testing, and will be capped by the building's concrete foundations, paving or clean cover soil in areas to be landscaped. Soil exhibiting gross contamination will not be reused on the Site but will be appropriately sampled and disposed offsite.

4.3 ENGINEERING CONTROLS

The excavation required for the proposed Site development will achieve Track 4 Site Specific SCOs to the extent practicable. Engineering Controls will be employed in the remedial action to address residual contamination remaining at the Site. The Site has two primary Engineering Control Systems. These are:

- Composite cover system consisting of asphalt covered roads, concrete covered sidewalks, clean cover soil in landscaped areas, and concrete building slabs; and
- Vapor barrier system.

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 is comprised of:

- Two feet of clean cover soil in any landscaped areas;
- Concrete/asphalt-covered pavement (a minimum of 10 inches thick including sub-base layers); and/or

- Concrete building pressure slab of at least 14-inch thickness underlain by vapor barrier and a 3-inch mud slab. Note that the slab design incorporates sophisticated measures to ensure waterproofness.

Drawing A-102 in Appendix 5 shows the location of the proposed new building and outdoor areas. The outdoor areas will be capped with impervious pavement (e.g., asphalt or concrete) and/or two feet of clean cover soil. The remainder of the Site will be covered by the building's concrete foundation slabs (with underlying vapor barrier).

The composite cover system is a permanent engineering control for the Site. The system will be inspected and remedial performance certified at specified intervals as required by this RAWP and the SMP. A Soil Management Plan will be included in the Site Management Plan 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 Site Management Plan in the RAR.

Vapor Barrier

Migration of soil vapor will be mitigated with a combination of building pressure slab and vapor barrier. The vapor barrier will be installed beneath the new building pressure slabs and outside of below-grade cellar and foundation sidewalls. The barrier will consist of 21-mil Grace Florprufe® 120, Grace Preprufe® 300R (46 mils) and 160R (32 mils), or an OER-approved equivalent. The vapor barrier would mitigate subsurface vapors from entering the building and also serve as additional waterproofing. The barrier will be installed in accordance with the manufacturer's specifications, including those for sealing penetrations. Proof of installation will be included in the Professional Engineer (P.E.) certified Remedial Action Report discussed in Section 6.0. The stamped design drawings are included in Appendix 6.

At a minimum, field quality control of the integrity of the vapor barrier installation will include:

- The sealing of all penetrations per the manufacturer's specifications using Preprufe® tape and Bituthene® liquid membrane to ensure a single membrane layer;
- Notifying the manufacturer or third-party certifying inspector of the waterproofing installation in sufficient time to allow for inspection of substrates and membranes;

- Sufficient site visits by the membrane manufacturer or third-party certifying inspector to provide certification of proper installation;
- Thorough inspection of all joints prior to concrete placement or the product being covered with other materials; and
- Providing copies of field notes and photographs to OER following each inspection.

The vapor barrier specifications and a letter from the manufacturer certifying the Grace product's resistance to gasoline-range and solvent-related organics are provided in Appendix 6. Appendix 6 also includes a technical letter from Grace noting that test studies published by the American Society for Testing and Materials (ASTM) indicate that the vapor barrier material is resistant to petroleum-based and solvent-related hydrocarbons and is expected to last for several hundred years, beyond the life expectancy of the proposed building. The sub-slab vapor barrier would be further protected from direct contact with contaminants in groundwater by the installation of a mud slab beneath it.

The vapor barrier system is a permanent engineering control for the Site. The project's Professional Engineer licensed by the State of New York will have primary direct responsibility for overseeing the implementation of the vapor barrier. The Remedial Action Report will include photographs of the installation process, PE/RA 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.

Flood-Proofing Measures

To account for future sea level rise, NYU had designed the building to be flood-proofed to two feet above the 14.35 MBD 500-year floor elevation, i.e., 16.35 MBD. The flood protection system includes:

- Operable flood gates where necessary as part of a campus-wide perimeter flood wall; and
- A structural spanning slab (pressure slab) beneath the building.

The pressure slab has been designed to maximize the effectiveness and redundancy of the flood proofing, with no utility penetrations. All utilities would enter and exit above the pressure slab, through exterior walls, with penetrations sealed using Preprufe tape and Bituthene liquid

membrane. Penetrating the pressure slab would be contrary to the flood proofing efforts and would compromise the integrity of the flood proofing system.

Feasibility of and Need for Vapor Depressurization

Although the proposed building design includes a highly engineered permanent pressure slab and vapor barrier (as previously discussed), the need for additional vapor control, i.e., a sub-slab depressurization system (SSDS), was evaluated.

Feasibilty Based on Slab Elevation

An SSDS does not function when inundated with water and the water table fluctuates with the tides between 0 and -3 feet MBD. The base of the cellar pressure slab is at (or below) approximately -8.5 feet MBD, i.e., well below the water table, and as such, an SSDS would not be feasible in areas with a cellar. The base of the pressure slab varies from 0.5 to 2 feet MBD in the loading dock area on the east side of the ground floor, i.e., too close to the water table for an SSDS to be feasibly installed, but one would not be required anyway, as this is not enclosed space.

Need for System in Areas without Cellar

The base of the ground-floor pressure slab in areas without a cellar is approximately 3.5 feet MBD, underlain by a 3-inch "mud slab." Three soil vapor samples were collected in this area: SV-2, SV-4 and SV-5 (see Figure 3) and results were compared to the NYSDOH Air Guidance Values (AGVs) contained in the 2006 *NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York:*

- Trichloroethene (TCE) was detected in SV-2 at 1.76 $\mu g/m^3$, below the AGV of 5 $\mu g/m^3$, but TCE was not detected in the other two samples.
- Methylene chloride, a potential laboratory contaminant, was detected in SV-4 at 65.3 $\mu g/m^3$, slightly above the AGV of 60 $\mu g/m^3$, but below the AGV in both SV-2 (4.62 $\mu g/m^3$) and SV-5 (29.5 $\mu g/m^3$).
- Tetrachloroethene (PCE) was detected at levels less than three times the AGV of 30 $\mu g/m^3$ in SV-2 (80.7 $\mu g/m^3$), SV-4 (36.4 $\mu g/m^3$), and SV-5 (39.1 $\mu g/m^3$).

Since the AGV relates to residential exposure in indoor air rather than levels in soil vapor, in reality, even without a vapor barrier, levels inside any future building (let alone one with such a sophisticated pressure slab) would be expected to be much (probably at least an order of magnitude) lower than those found in soil gas (i.e., indoor air levels would be expected to be

well below the AGV). Although soil gas levels of some other VOCs, for which there are no AGVs, were found to be above typical indoor air levels (cited in the NYSDOH guidance), the levels that would be anticipated inside a future building would also be likely orders of magnitude lower inside a building with a sophisticated pressure slab and vapor barrier (such as is proposed for the new building). As such, an SSDS in these areas is not warranted based on the results of the soil gas sampling.

Conclusion

Given the proposed slab elevations, measured soil vapor VOC levels, and proposed foundation design (particularly the sophisticated pressure slab with no utility penetrations and proposed water/vapor barrier system), an SSDS is either not feasible or not warranted for the proposed building.

4.4 INSTITUTIONAL CONTROLS

Institutional Controls (IC) have been incorporated in this remedial action to manage residual soil/fill and other media and render the Site protective of public health and the environment. Institutional Controls are listed below. Long-term employment of EC/ICs will be implemented under a site-specific Site Management Plan (SMP) that will be included in the RAR.

Institutional Controls for this remedial action are:

- The Site will continue to be registered with a Restrictive Declaration at the NYC Buildings Department. This RAWP includes a description of all ECs and ICs and summarizes the requirements of the Site Management Plan which will note that the Site owner and Site owner's successors and assigns must comply with the approved SMP.

- Submittal of a Site Management Plan in the RAR for approval by OER that provides procedures for appropriate operation, maintenance, monitoring, inspection, reporting and certification of ECs. 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(l)(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 commercial/scientific research use and will not be used for a higher use than Restricted Commercial without prior approval by OER.

4.5 SITE MANAGEMENT PLAN

Site Management is the last phase of remediation and begins with the approval of the Remedial Action Report and issuance of the Notice of Completion (NOC) for the Remedial Action. The Site Management Plan (SMP) describes appropriate methods and procedures to ensure implementation of all ECs and ICs that are required by this RAWP. The Site Management Plan 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 Site Management Plan 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 Brownfield Cleanup Agreement with OER. This includes a plan for: (1) implementation of EC's and IC's; (2) implementation of monitoring programs; (3) operation and maintenance of EC's; (4) inspection and certification of EC's; and (5) reporting.

Site management activities, reporting, and EC/IC certification will be scheduled by OER on a periodic basis to be established in the SMP and will be subject to review and modification by

OER. The Site Management Plan will be based on a calendar year and certification reports will be due for submission to OER by March 31 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.

Investigations reported in the Remedial Investigation Report (RIR) are sufficient to complete a Qualitative Human Health Exposure Assessment (QHHEA). 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 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 Draft DER-10 Technical Guidance for Site Investigation and Remediation.

Known and Potential Sources

A Phase I ESA and a Remedial Investigation have been performed at the Site to identify Areas of Concern (AOCs). The identified AOCs included:

1. Urban fill materials beneath the Site;
2. Past Site uses including a lumber yard, an airplane factory and a hangar, and a laboratory; and
3. Past and present uses in the surrounding area, including manufacturing, a Standard Gas Light Co. facility manufactured gas holder facility, garages and filling stations, and hospital/laboratory buildings.

Soil:

- VOCs including benzene, o-xylene and p/m-xylene slightly exceeding USCOs, but well below CSCOs, in 2 of 16 samples.

- 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 exceeding USCOs, with benzo(a)pyrene and dibenzo(a,h)anthracene also exceeding CSCOs in 2 samples;
- Metals including chromium, copper, lead, mercury, and zinc exceeding USCOs, with arsenic also exceeding its CSCO in one sample;
- Pesticides including 4,4'-DDD, 4,4'-DDE and 4,4'-DDT exceeding USCOs, but well below CSCOs; and
- PCBs were identified, but were well below USCOs and CSCOs.

Groundwater:

- The VOCs benzene and acetone were identified, but were well below their NYS drinking water quality standards (GQSs);
- SVOCs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene at concentrations slightly exceeding their GQSs; and
- The metals antimony, iron, magnesium, selenium, and sodium, detected in all samples above their GQSs.

Soil Vapor:

- Petroleum/gasoline related compounds including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 4-ethyltoluene, 4-methyl-2-pentanone, benzene, ethylbenzene, heptane, n-hexane, xylenes, propylene, and toluene were detected at moderate concentrations; and
- Chlorinated VOCs including tetrachloroethene, trichloroethene, and TCA were present in one or more soil vapor samples. Based on the detected concentrations of tetrachloroethene, trichloroethene, and TCA, the NYSDOH decision matrices recommended either no further action or "reasonable and practical action to identify source(s) and reduce exposures."

Nature, Extent, Fate and Transport of Contaminants

SVOCs and metals are present within the historic fill throughout the Site. These contaminants are constituents of the historic fill material that was used to fill the land for development purposes. Previous studies indicate that the Site was created by landfilling and is

underlain by approximately 17.5 to 40 feet of urban fill; deeper fill materials which were not sampled may contain similar contaminant concentrations. SVOCs found in soil were also detected in the on-site groundwater samples collected from temporary monitoring wells, but not the sample collected from a permanent monitoring well. These findings suggest that the elevated SVOC concentrations in the on-site groundwater samples may be due to sediment temporarily disturbed by the sampling method, rather than dissolved contaminants migrating through groundwater. The metals detected at elevated concentrations in the dissolved groundwater sample are attributed to natural sources, including saline intrusion from the East River. Petroleum and solvent-related VOCs were also detected in the soil vapor. The VOC methylene chloride (a common laboratory contaminant) slightly exceeded its NYSDOH AGV in one soil vapor sample, and tetrachloroethene (PCE) exceeded its AGV (but by a factor less than three) in all three samples. PCE was not detected in soil samples.

Potential Routes of Exposure

The five elements of an exposure pathway are: 1) the source of contamination; 2) the environmental media and transport mechanisms; 3) the point of exposure; 4) the route of exposure; and 5) the receptor population.

An exposure pathway is considered complete when all five elements of an exposure pathway are documented. A potential exposure pathway exists when any one or more of the five elements comprising an exposure pathway cannot be ruled out. An exposure pathway may be eliminated from further evaluation when any one of the five elements comprising an exposure pathway has not existed in the past, does not exist in the present, and will never exist in the future. Three potential primary routes exist by which chemicals can enter the body:

- Ingestion of water, fill, or soil;
- Inhalation of vapors and particulates; and
- Dermal contact with fill or soil.

These routes of exposure are possible before, during and after the remedial action if proper precautions are not taken. The remedial plan outlined in this RAWP will ensure that routes of exposure are prevented during the development of the Site.

Existence of Human Health Exposure

Current Conditions: The potential for exposure to historic fill exists under current conditions but is limited due to building slabs across much of the Site. Currently, there are minimal potential migration pathways for absorption, ingestion, and inhalation for soil, and absorption and ingestion for groundwater since the majority of Site soils are covered by building slabs. Although small areas of exposed soil exist at the Site since demolition is in progress, these areas are generally covered with a gravel layer and access is limited to demolition personnel. Groundwater is marginally contaminated but is not exposed at the Site, and because the Site is served by the public water supply and groundwater use for potable supply is prohibited, groundwater is not used at the Site and there is no potential for exposure. Soil vapor could pose an intrusion threat to any existing buildings within the site area.

Construction/Remediation Activities: The work performed at the Site will include excavation of some soil/fill material and general construction activities, and has the potential to affect the on-site construction/remediation workers and the off-site local population. Once redevelopment activities begin, construction workers will come into direct contact with surface and subsurface soils. On-site construction workers potentially could ingest, inhale or have dermal contact with any exposed impacted soil, and fill. Similarly, off-site receptors could be exposed to dust and vapors from on-site activities. During construction, on-site and off-site exposures to contaminated dust from on-site will be addressed through the Soil/Materials Management Plan, dust controls, and the implementation of the Community Air-Monitoring Program and Construction Health and Safety Plan.

Proposed Future Conditions: Upon the completion of remediation and construction activities, there will be no exposures because contaminants exceeding Track 4 SCOs will be removed from the Site and/or covered by an engineered composite cover and vapor barrier as part of development, and an SMP will address long-term management of residual contamination. The Site will be fully capped, limiting potential direct exposure to soil and groundwater remaining in place, and a vapor barrier system will prevent any exposure to potential off-site soil vapors in the future. The Site is served by a public water supply, and groundwater is not used at the Site for potable supply. There are no plausible off-site pathways for ingestion, inhalation, or dermal exposure to contaminants derived from the Site under future conditions.

Receptor Populations

On-Site Receptors – The receptors identified under current conditions include on-site workers and NYULMC visitors. During redevelopment of the Site, the on-site potential receptors will include construction workers, Site representatives, and visitors. Once the Site is redeveloped, the on-site potential sensitive receptors will include on-site workers and NYULMC visitors.

Off-Site Receptors – Potential off-site receptors within a 0.25-mile radius of the Site include: adult and child residents, NYULMC and other workers, NYULMC patients and visitors, commercial and construction workers, pedestrians, and cyclists, based on the following:

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

Overall Human Health Exposure Assessment

There are limited potential complete exposure pathways present during the current unremediated conditions. There is a potential complete exposure pathway that requires mitigation during implementation of the remedy. There is no complete exposure pathway under future conditions after the Site is developed. This assessment takes into consideration the reasonably anticipated use of the Site, which includes a NYULMC research and office building with small areas of paved and landscaped open space adjacent, a site-wide impervious surface cover cap, and a subsurface vapor barrier system for the building. Potential post-construction use of groundwater is not considered an option because groundwater in this area of New York City is not used as a potable water source.

Exposure of both on-site workers and the off-site local population to Site contaminated media (soil and soil vapor) has the greatest potential during the remedial and construction work. To mitigate possible exposure levels, a Construction Health and Safety Plan (CHASP) will be implemented during construction and remedial work for the safety of the on-site workers and off-site local population. Other measures include conducting a community air monitoring programs (CAMP) for dust and VOCs to track on-site and off-site conditions, requiring personal protective equipment, provisions for upgrading the level of personal protective equipment when needed, applying dust and vapor suppression measures, requiring truck inspection and washing prior to departure from the Site, and stormwater controls. After the remedial action is complete, there

will be no remaining exposure pathways to on-Site soil/fill, as most of the soil above Track 4 SCOs will have been removed and a composite cover system with a waterproofing/vapor barrier system will have been installed as part of development.

5.0 REMEDIAL ACTION MANAGEMENT

5.1 PROJECT ORGANIZATION AND OVERSIGHT

Principal personnel who will participate in the remedial action include Michelle Lapin, Principal and Axel Schwendt, Project Manager. The Professional Engineer (PE) for this project is Michelle Lapin.

5.2 SITE SECURITY

Site access will be controlled by secure construction fencing and security guards. No unauthorized personnel will be able to access the Site. During off hours, the Site will be completely enclosed with a locked gate.

5.3 WORK HOURS

The hours for operation of remedial construction will be from approximately 7:00 AM to 5:00 PM. These hours conform to the New York City Department of Buildings construction code requirements.

5.4 CONSTRUCTION HEALTH AND SAFETY PLAN

The Health and Safety Plan is included in Appendix 4. The Site Safety Coordinator will be Erik Nimlos of AKRF. Remedial work performed under this RAWP will be in full compliance with applicable health and safety laws and regulations, including Site and OSHA worker safety requirements and 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 HASP 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, including 40-hour hazardous waste operator training and annual 8-hour refresher training. Site Safety Officer will be responsible for maintaining workers training records.

Personnel entering any exclusion zone will be trained in the provisions of the CHASP and be required to sign a CHASP acknowledgment. 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

Real-time air monitoring for volatile organic compounds (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 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, monitoring during well baling/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. Exceedences of action levels observed during performance of the Community Air Monitoring Plan (CAMP) will be reported to the OER Project Manager and included in the Daily Report.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (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 parts per million (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 shut down.

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.

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

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.

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.

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 incompliance with applicable laws and regulations to assure safety. Utility companies and other responsible authorities will be contacted to locate and mark the locations, and a copy of the Markout 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.

Dewatering

Based on the proposed depth of excavation, dewatering will be required for the proposed project, particularly the deeper excavations (depths of up to approximately 23 feet below existing foundations for sump pits and footings). Water would likely be discharged to sewers/outfalls leading directly to the East River. Groundwater testing, and, if necessary, pre-treatment (depending upon the testing results) would be conducted to comply with NYSDEC State Pollution Discharge Elimination System (SPDES) requirements. If discharge to sewers

connected to an NYCDEP wastewater treatment plant is contemplated, NYCDEP requirements would be followed instead.

Equipment and Material Staging

Equipment and materials will be stored and staged in a manner that complies with applicable laws and regulations. Staging and storage of equipment and materials will be contained within the secured Site. By the nature of the work involved in this project, equipment and materials will be moved to different areas within the secured Site as work progresses.

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 roads 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.

Truck Inspection Station

An outbound-truck inspection station will be set up close to the Site exit. Before exiting the NYC VCP 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 potable water will be utilized for the removal of soil from vehicles and equipment, as necessary.

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.

Storm Preparedness

Preparations in advance of an extreme storm event will include the following: containerized hazardous materials and fuels will be removed from the Site; 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 holes, trenches and depressions on the Site to high ground or removed from the Site; an inventory of the Site 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 Site; and stormwater management systems will be inspected and fortified, including, as necessary, clean and reposition silt fences, haybales, clean storm sewer filters and traps, and secure and protect pumps and hosing.

Storm Response

At the conclusion of an extreme storm event, as soon as it is safe to access the Site, a complete inspection of the Site will be performed. A Site inspection report will be submitted to OER at the completion of Site inspection and after 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 NYS DEC within 2 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 by collected and appropriately managed. Support of excavation structures 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 a corrective

measure plan designed to remove and clean dislocated material will be submitted to OER and implemented following approval by OER and granting of access by the property owner. Affected off-site areas may require characterization based on site conditions, at the discretion of OER. If an on-site petroleum spill is identified, a qualified environmental professional will determine the nature and extent of the spill and report to NYS DEC's spill hotline at DEC 800-457-7362. 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 NYS DEC.

Storm Response Reporting

A Site inspection report will be submitted to OER at the completion of the 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, and 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 onsite or offsite exposure pathways caused by the storm; presence of petroleum or other spills and status of spill reporting to NYS DEC; 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 Site after the storm event.

5.8 TRAFFIC CONTROL

Drivers of trucks leaving the NYC VCP 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 to go east on East 30th Street, south on the FDR Drive

service road, west on West 26th Street, north on First Avenue, west on East 34th Street, north on Tenth Avenue and west on West 41st Street for access to Lincoln Tunnel.

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

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 day. Those reports will include:

- Project number and statement of the activities and an update of progress made and locations of 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 excursions, if any; and
- Photograph 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 Remedial Action Report.

An alpha-numeric site map will be used to identify locations described in reports submitted to OER and is shown on drawing A-102 in Appendix 5.

Record Keeping and Photo-Documentation

Job-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 the OER Project Manager and will be documented in daily reports and reported in the Remedial Action Report. 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 that the remedial action with the deviation(s) is protective of public health and the environment.

6.0 REMEDIAL ACTION REPORT

A Remedial Action Report (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.
- As-built drawings for all constructed remedial elements, required certifications, manifests and other written and photographic documentation of remedial work performed under this remedy.
- Site Management Plan.
- 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 and all material characterization results, QA/QC results for end-point sampling, and other 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 contaminated material removed from the Site including a map showing source areas.
- Account 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 Restrictive Declaration for the Site by the NYC Department of Buildings.

Reports and supporting material will be submitted in digital form.

Remedial Action Report Certification

The following certification will appear in front of the Executive Summary of the Remedial Action Report. The certification will include the following statements:

I, Michelle Lapin, am currently a professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the NYULMC Science Building Site 14RHAZ138M.

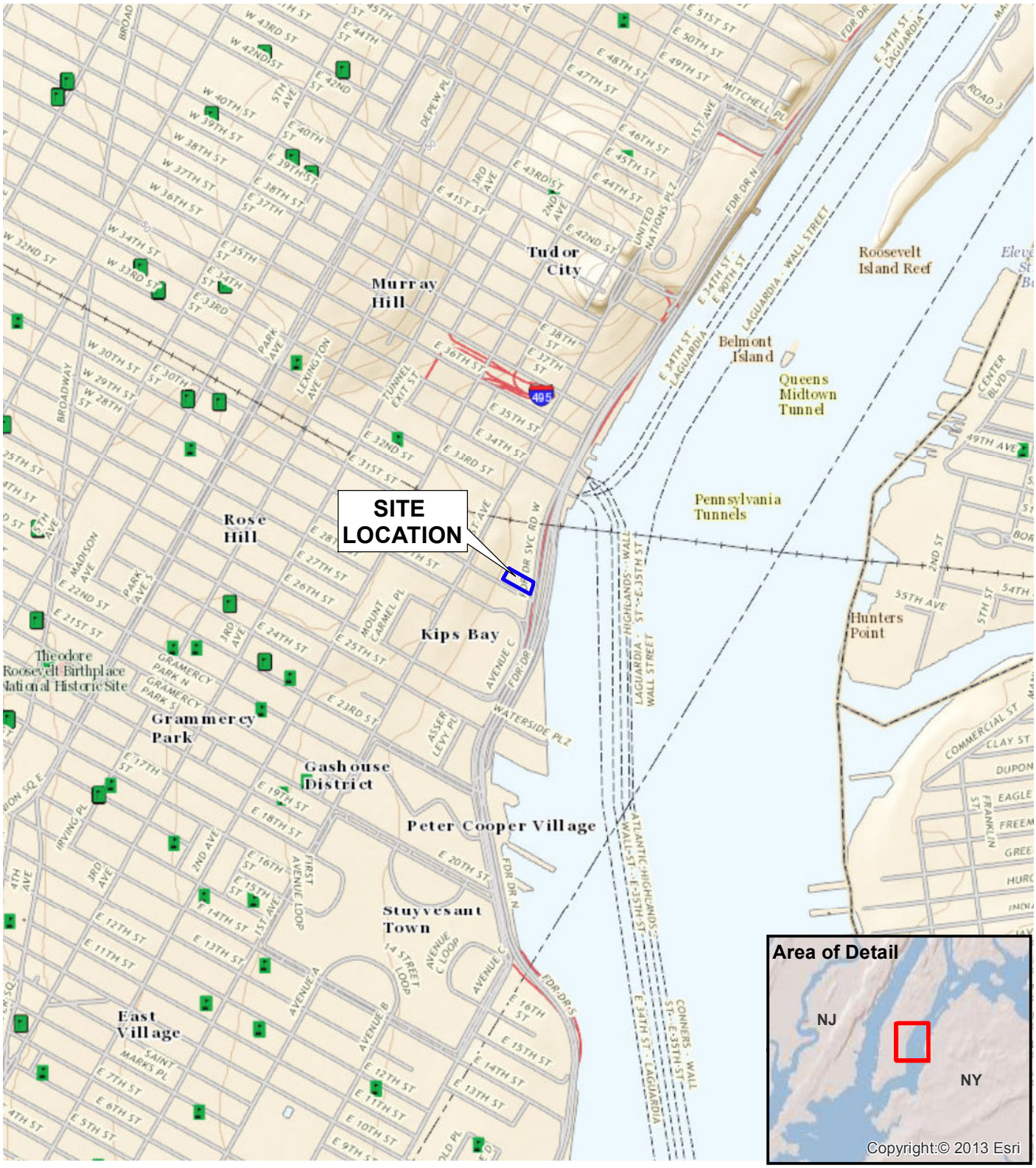
I certify that the OER-approved Remedial Action Work Plan dated January 2014 was implemented and that all requirements in this document have been substantively complied with. I certify that contaminated soil, fill, liquids or other material from the property were taken to facilities licensed to accept this material in full compliance with applicable laws and regulations.

7.0 SCHEDULE

The following table 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, an approximately 12-month remediation period is anticipated.

Schedule Milestone	Weeks from Remedial Action Start	Duration (weeks)
OER Approval of RAWP	0	-
Fact Sheet 2 announcing start of remedy	0	-
Mobilization	4	1
Remedial Excavation	5	52
Demobilization (following completion of remedial construction)	57	1
Submit Remedial Action Report	61	4

FIGURES



SOURCE
USGS 7.5 Minute Topographic Map
BROOKLYN Quad 2011

0 1,000 2,000 Feet

NYU Langone Medical Center
Science Building
New York, New York

SITE LOCATION MAP

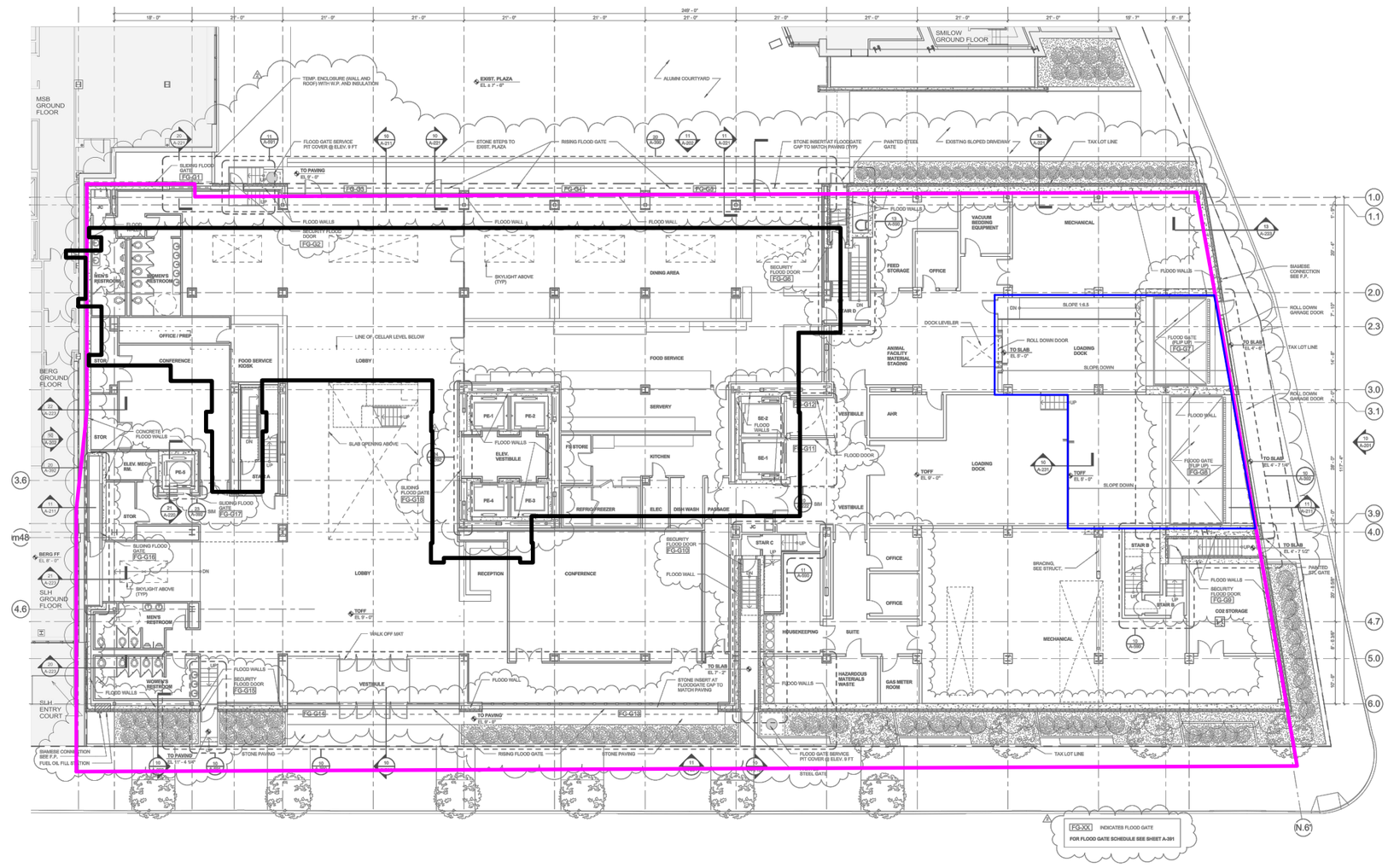
AKRF
Environmental Consultants
440 Park Avenue South, New York, N.Y. 10016

DATE
8/23/2013

PROJECT No.
11467

FIGURE
1

©2013 AKRF, Inc. Environmental Consultants O:\Projects\11467 - NYULMC SCIENCE BUILDING BSA EAS\hazmat\11467 Fig 1 loc map .mxd



LEGEND:

- PROJECT SITE BOUNDARY
- PROPOSED LOADING DOCK AREA
- CELLAR FOOTPRINT

0' 15' 30' 60'

SCALE IN FEET

SOURCE:
Based on A-102, *PLAN-GROUND FLOOR*,
NYU Medical Science Building
Prepared by Ennead Architects, LLP
320 West 13th Street New York, New York
Nov 2012

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

NYU LANGONE MEDICAL CENTER
SCIENCE BUILDING
NEW YORK, NEW YORK

DEVELOPMENT PLAN

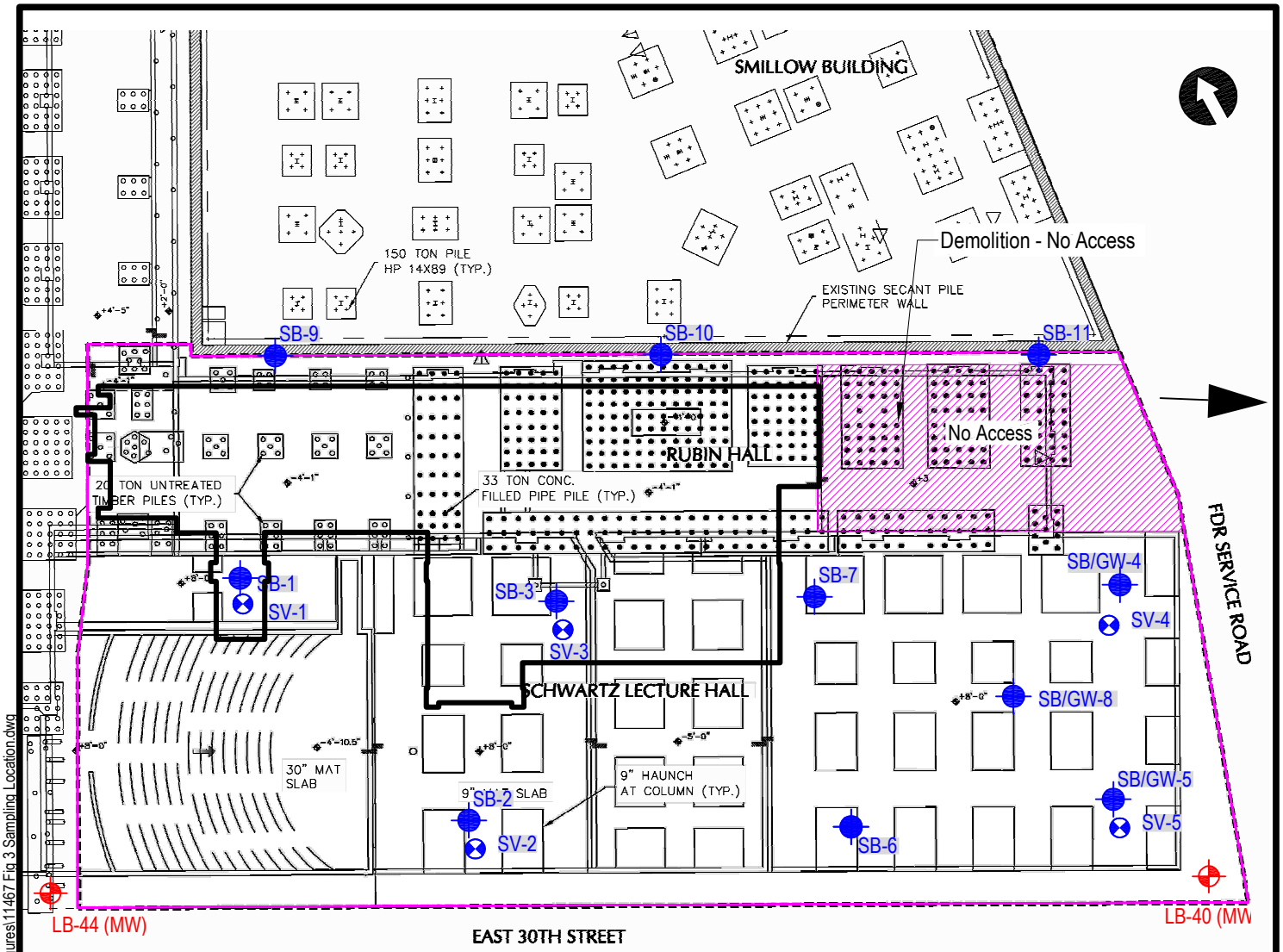
DATE
12.5.2013

PROJECT NO.
11467

SCALE
as shown

FIGURE
2

© 2013 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11467 - NYULMC Science Building Phase III\CP RAP\Figures\11467 Fig 2 Development NYULMC.dwg



LEGEND:

- CELLAR FOOTPRINT
- SV-4 SUB-SLAB SOIL VAPOR SAMPLE
- SB-1 SOIL BORING
- SB/GW-4 SOIL BORING/GROUNDWATER
- LB-44 (MW) EXISTING MONITORING WELL
- ANTICIPATED GROUNDWATER FLOW DIRECTION

0' 20' 40' 80'

SCALE IN FEET

NYU LANGONE MEDICAL CENTER
SCIENCE BUILDING
NEW YORK, NEW YORK

EXISTING CONDITIONS AND SAMPLING LOCATIONS

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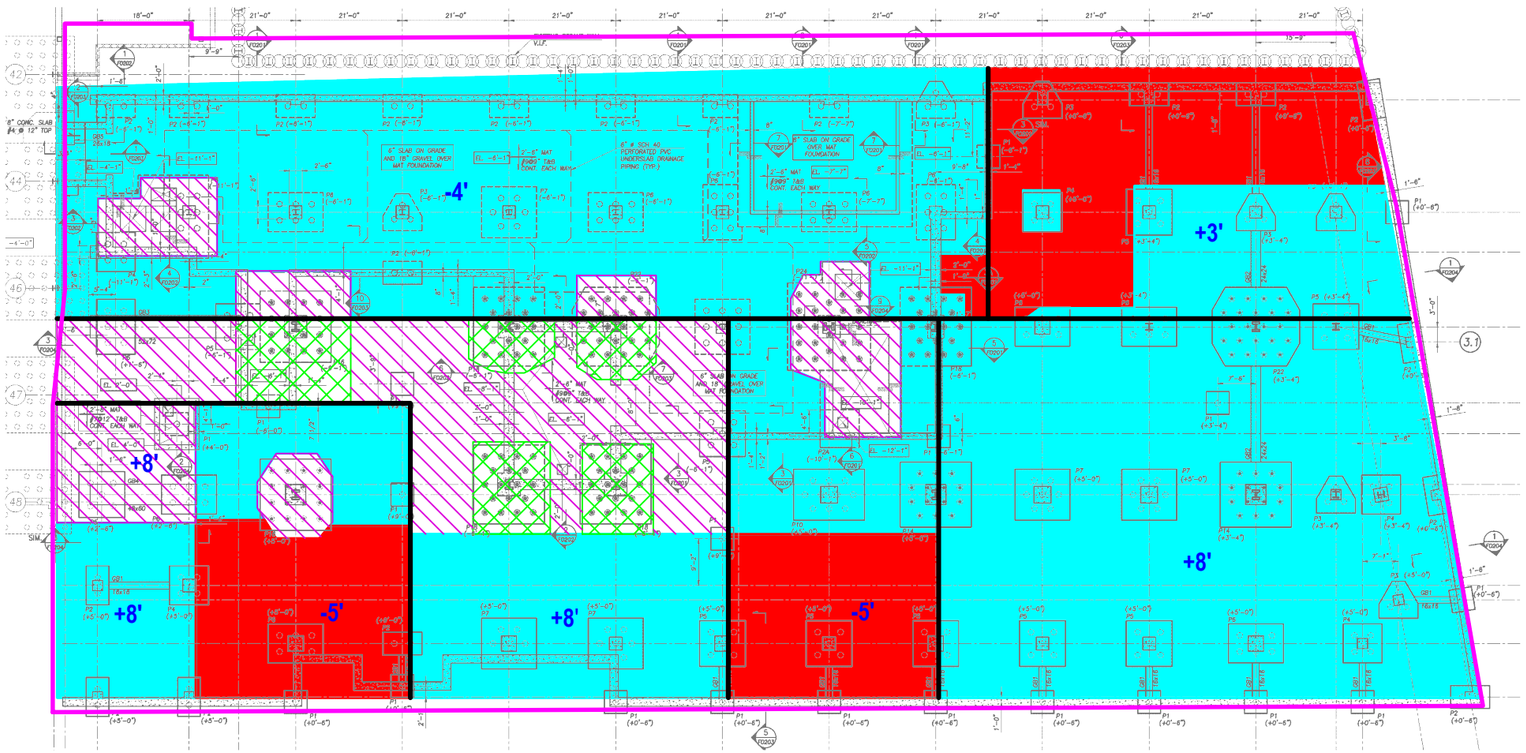
440 Park Avenue South, New York, N.Y. 10016

DATE	12.9.2013
PROJECT No.	11467
SCALE	as shown
FIGURE	3

© 2013 AKRF, Inc. Environmental Consultants M:\AKRF Project Files\11467 - NYULMC Science Building Phase II\VCP RAP\Figures\11467 Fig 3 Sampling Location.dwg



LEGEND:

PROJECT SITE BOUNDARY	
+8'	EXISTING TOP OF FOUNDATION SLAB
	EXISTING BUILDING WALLS
	CUT 0 - 10'
	CUT 10 - 20'
	CUT 20' - 25'
	FILL

SOURCE:
Based on FO-101, *FOUNDATION PLAN*,
NYU Medical Science Building
Prepared by Ennead Architects, LLP
320 West 13th Street New York, New York
Oct 2012

0' 15' 30' 60'
SCALE IN FEET

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

NYU LANGONE MEDICAL CENTER
SCIENCE BUILDING
NEW YORK, NEW YORK

EXCAVATION PLAN

DATE
12.9.2013

PROJECT NO.
11467

SCALE
as shown

FIGURE
4

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TABLES

Table 2
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Remedial Investigation Report Soil Analytical Results
Volatile Organic Compounds

Client ID Lab Sample ID Date Sampled mg/kg	NYSDEC Part 375 Unrestricted SCO mg/kg	NYSDEC Part 375 Commercial SCO mg/kg	SB-1 (0-2) L1315188-02 8/7/2013	SB-1 (7-9) L1315188-03 8/7/2013	SB-2 (0-2) L1315035-01 8/6/2013	SB-2 (5-7) L1315035-02 8/6/2013	SB-3 (0-2) L1315035-16 8/6/2013	SB-3 (6-8) L1315035-17 8/6/2013	SB-4 (0-2) L1315035-03 8/6/2013
1,1,1,2-Tetrachloroethane	NS	NS	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
1,1,1-Trichloroethane	0.68	500	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
1,1,2,2-Tetrachloroethane	NS	NS	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
1,1,2-Trichloroethane	NS	NS	0.0017 U	0.002 U	0.0023 U	0.0015 U	0.0018 U	0.0015 U	0.0017 U
1,1-Dichloroethane	0.27	240	0.0017 U	0.002 U	0.0023 U	0.0015 U	0.0018 U	0.0015 U	0.0017 U
1,1-Dichloroethene	0.33	500	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
1,1-Dichloropropene	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
1,2,3-Trichlorobenzene	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
1,2,3-Trichloropropane	NS	NS	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
1,2,4,5-Tetramethylbenzene	NS	NS	0.0045 U	0.0054 U	0.0062 U	0.004 U	0.0048 U	0.004 U	0.0045 U
1,2,4-Trichlorobenzene	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
1,2,4-Trimethylbenzene	3.6	190	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
1,2-Dibromo-3-chloropropane	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
1,2-Dibromoethane	NS	NS	0.0045 U	0.0054 U	0.0062 U	0.004 U	0.0048 U	0.004 U	0.0045 U
1,2-Dichlorobenzene	1.1	500	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
1,2-Dichloroethane	0.02	30	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
1,2-Dichloropropane	NS	NS	0.004 U	0.0048 U	0.0054 U	0.0035 U	0.0042 U	0.0035 U	0.0039 U
1,3,5-Trimethylbenzene	8.4	190	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
1,3-Dichlorobenzene	2.4	280	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
1,3-Dichloropropane	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
1,4-Dichlorobenzene	1.8	130	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
1,4-Diethylbenzene	NS	NS	0.0045 U	0.0054 U	0.0062 U	0.004 U	0.0048 U	0.004 U	0.0045 U
1,4-Dioxane	0.1	130	0.11 U	0.14 U	0.15 U	0.099 U	0.12 U	0.1 U	0.11 U
2,2-Dichloropropane	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
2-Butanone	0.12	500	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
2-Hexanone	NS	NS	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
4-Ethyltoluene	NS	NS	0.0045 U	0.0054 U	0.0062 U	0.004 U	0.0048 U	0.004 U	0.0045 U
4-Methyl-2-pentanone	NS	NS	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
Acetone	0.05	500	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
Acrylonitrile	NS	NS	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
Benzene	0.06	44	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Bromobenzene	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
Bromochloromethane	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
Bromodichloromethane	NS	NS	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Bromoform	NS	NS	0.0045 U	0.0054 U	0.0062 U	0.004 U	0.0048 U	0.004 U	0.0045 U
Bromomethane	NS	NS	0.0023 U	0.0027 U	0.0031 U	0.002 U	0.0024 U	0.002 U	0.0022 U
Carbon disulfide	NS	NS	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
Carbon tetrachloride	0.76	22	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Chlorobenzene	1.1	500	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Chloroethane	NS	NS	0.0023 U	0.0027 U	0.0031 U	0.002 U	0.0024 U	0.002 U	0.0022 U
Chloroform	0.37	350	0.0017 U	0.002 U	0.0023 U	0.0015 U	0.0018 U	0.0015 U	0.0017 U
Chloromethane	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
cis-1,2-Dichloroethene	0.25	500	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
cis-1,3-Dichloropropene	NS	NS	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Dibromochloromethane	NS	NS	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Dibromomethane	NS	NS	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
Dichlorodifluoromethane	NS	NS	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
Ethyl ether	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
Ethylbenzene	1	390	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Hexachlorobutadiene	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
Isopropylbenzene	NS	NS	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Methyl tert butyl ether	0.93	500	0.0023 U	0.0027 U	0.0031 U	0.002 U	0.0024 U	0.002 U	0.0022 U
Methylene chloride	0.05	500	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
Naphthalene	12	500	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
n-Butylbenzene	12	500	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
n-Propylbenzene	3.9	500	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
o-Chlorotoluene	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
o-Xylene	0.26	500	0.0023 U	0.0027 U	0.0031 U	0.002 U	0.0024 U	0.002 U	0.0022 U
p/m-Xylene	0.26	500	0.0023 U	0.0027 U	0.0031 U	0.002 U	0.0024 U	0.002 U	0.0022 U
p-Chlorotoluene	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
p-Isopropyltoluene	NS	NS	0.0011 U	0.028	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
sec-Butylbenzene	11	500	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Styrene	NS	NS	0.0023 U	0.0027 U	0.0031 U	0.002 U	0.0024 U	0.002 U	0.0022 U
tert-Butylbenzene	5.9	500	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
Tetrachloroethene	1.3	150	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Toluene	0.7	500	0.0017 U	0.002 U	0.0023 U	0.0015 U	0.0018 U	0.0015 U	0.0017 U
trans-1,2-Dichloroethene	0.19	500	0.0017 U	0.002 U	0.0023 U	0.0015 U	0.0018 U	0.0015 U	0.0017 U
trans-1,3-Dichloropropene	NS	NS	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
trans-1,4-Dichloro-2-butene	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
Trichloroethene	0.47	200	0.0011 U	0.0014 U	0.0015 U	0.00099 U	0.0012 U	0.001 U	0.0011 U
Trichlorofluoromethane	NS	NS	0.0057 U	0.0068 U	0.0077 U	0.005 U	0.0061 U	0.005 U	0.0056 U
Vinyl acetate	NS	NS	0.011 U	0.014 U	0.015 U	0.0099 U	0.012 U	0.01 U	0.011 U
Vinyl chloride	0.02	13	0.0023 U	0.0027 U	0.0031 U	0.002 U	0.0024 U	0.002 U	0.0022 U

Table 2
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Remedial Investigation Report Soil Analytical Results
Volatile Organic Compounds

Client ID Lab Sample ID Date Sampled mg/kg	NYSDEC Part 375 Unrestricted SCO mg/kg	NYSDEC Part 375 Commercial SCO mg/kg	SB-4 (8-10) L1315035-04 8/6/2013	SB-5 (0-2) L1315035-06 8/6/2013	SB-5 (5-7) L1315035-07 8/6/2013	SB-6 (0-2) L1315035-14 8/6/2013	SB-6 (5-7) L1315035-15 8/6/2013	SB-7 (0-2) L1315035-09 8/6/2013	SB-7 (8-10) L1315035-10 8/6/2013
1,1,1,2-Tetrachloroethane	NS	NS	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
1,1,1-Trichloroethane	0.68	500	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
1,1,2,2-Tetrachloroethane	NS	NS	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
1,1,2-Trichloroethane	NS	NS	0.0015 U	0.093 U	0.002 U	NA	0.0018 U	NA	NA
1,1-Dichloroethane	0.27	240	0.0015 U	0.093 U	0.002 U	NA	0.0018 U	NA	NA
1,1-Dichloroethene	0.33	500	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
1,1-Dichloropropene	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
1,2,3-Trichlorobenzene	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
1,2,3-Trichloropropane	NS	NS	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
1,2,4,5-Tetramethylbenzene	NS	NS	0.004 U	1.6	0.0052 U	NA	0.0047 U	NA	NA
1,2,4-Trichlorobenzene	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
1,2,4-Trimethylbenzene	3.6	190	0.005 U	0.82	0.0066 U	NA	0.0058 U	NA	NA
1,2-Dibromo-3-chloropropane	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
1,2-Dibromoethane	NS	NS	0.004 U	0.25 U	0.0052 U	NA	0.0047 U	NA	NA
1,2-Dichlorobenzene	1.1	500	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
1,2-Dichloroethane	0.02	30	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
1,2-Dichloropropane	NS	NS	0.0035 U	0.22 U	0.0046 U	NA	0.0041 U	NA	NA
1,3,5-Trimethylbenzene	8.4	190	0.005 U	0.24 J	0.0066 U	NA	0.0058 U	NA	NA
1,3-Dichlorobenzene	2.4	280	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
1,3-Dichloropropane	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
1,4-Dichlorobenzene	1.8	130	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
1,4-Diethylbenzene	NS	NS	0.004 U	0.21 J	0.0052 U	NA	0.0047 U	NA	NA
1,4-Dioxane	0.1	130	0.1 U	6.2 U	0.13 U	NA	0.12 U	NA	NA
2,2-Dichloropropane	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
2-Butanone	0.12	500	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
2-Hexanone	NS	NS	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
4-Ethyltoluene	NS	NS	0.004 U	0.69	0.0052 U	NA	0.0047 U	NA	NA
4-Methyl-2-pentanone	NS	NS	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
Acetone	0.05	500	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
Acrylonitrile	NS	NS	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
Benzene	0.06	44	0.001 U	**0.34**	0.0013 U	NA	0.0012 U	NA	NA
Bromobenzene	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
Bromochloromethane	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
Bromodichloromethane	NS	NS	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
Bromoform	NS	NS	0.004 U	0.25 U	0.0052 U	NA	0.0047 U	NA	NA
Bromomethane	NS	NS	0.002 U	0.12 U	0.0026 U	NA	0.0023 U	NA	NA
Carbon disulfide	NS	NS	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
Carbon tetrachloride	0.76	22	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
Chlorobenzene	1.1	500	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
Chloroethane	NS	NS	0.002 U	0.12 U	0.0026 U	NA	0.0023 U	NA	NA
Chloroform	0.37	350	0.0015 U	0.093 U	0.002 U	NA	0.0018 U	NA	NA
Chloromethane	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
cis-1,2-Dichloroethene	0.25	500	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
cis-1,3-Dichloropropene	NS	NS	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
Dibromochloromethane	NS	NS	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
Dibromomethane	NS	NS	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
Dichlorodifluoromethane	NS	NS	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
Ethyl ether	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
Ethylbenzene	1	390	0.001 U	0.64	0.0013 U	NA	0.0012 U	NA	NA
Hexachlorobutadiene	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
Isopropylbenzene	NS	NS	0.001 U	0.064	0.0013 U	NA	0.0012 U	NA	NA
Methyl tert butyl ether	0.93	500	0.002 U	0.12 U	0.0026 U	NA	0.0023 U	NA	NA
Methylene chloride	0.05	500	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
Naphthalene	12	500	0.005 U	0.73	0.0066 U	NA	0.0058 U	NA	NA
n-Butylbenzene	12	500	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
n-Propylbenzene	3.9	500	0.001 U	0.25	0.0013 U	NA	0.0012 U	NA	NA
o-Chlorotoluene	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
o-Xylene	0.26	500	0.002 U	**0.45**	0.0026 U	NA	0.0023 U	NA	NA
p/m-Xylene	0.26	500	0.002 U	**1.3**	0.0026 U	NA	0.0023 U	NA	NA
p-Chlorotoluene	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
p-Isopropyltoluene	NS	NS	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
sec-Butylbenzene	11	500	0.001 U	0.051 J	0.0013 U	NA	0.0012 U	NA	NA
Styrene	NS	NS	0.002 U	0.12 U	0.0026 U	NA	0.0023 U	NA	NA
tert-Butylbenzene	5.9	500	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
Tetrachloroethene	1.3	150	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
Toluene	0.7	500	0.0015 U	0.47	0.002 U	NA	0.0018 U	NA	NA
trans-1,2-Dichloroethene	0.19	500	0.0015 U	0.093 U	0.002 U	NA	0.0018 U	NA	NA
trans-1,3-Dichloropropene	NS	NS	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
trans-1,4-Dichloro-2-butene	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
Trichloroethene	0.47	200	0.001 U	0.062 U	0.0013 U	NA	0.0012 U	NA	NA
Trichlorofluoromethane	NS	NS	0.005 U	0.31 U	0.0066 U	NA	0.0058 U	NA	NA
Vinyl acetate	NS	NS	0.01 U	0.62 U	0.013 U	NA	0.012 U	NA	NA
Vinyl chloride	0.02	13	0.002 U	0.12 U	0.0026 U	NA	0.0023 U	NA	NA

Table 2
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Remedial Investigation Report Soil Analytical Results
Volatile Organic Compounds

Client ID Lab Sample ID Date Sampled mg/kg	NYSDEC Part 375 Unrestricted SCO mg/kg	NYSDEC Part 375 Commercial SCO mg/kg	SB-8 (0-2) L1315035-11 8/6/2013	SB-8 (5-7) L1315035-12 8/6/2013	SB-9 (5-5.5) L1321227-01 10/18/2013	SB-10 (5-5.5) L1321227-02 10/18/2013	SB-11 (8.0) L1321227-03 10/22/2013
1,1,1,2-Tetrachloroethane	NS	NS	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
1,1,1-Trichloroethane	0.68	500	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
1,1,2,2-Tetrachloroethane	NS	NS	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
1,1,2-Trichloroethane	NS	NS	0.11 U	0.0014 U	0.0024 U	0.0018 U	0.0019 U
1,1-Dichloroethane	0.27	240	0.11 U	0.0014 U	0.0024 U	0.0018 U	0.0019 U
1,1-Dichloroethene	0.33	500	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
1,1-Dichloropropene	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
1,2,3-Trichlorobenzene	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
1,2,3-Trichloropropane	NS	NS	0.72 U	0.0096 U	0.016 U	0.012 U	0.013 U
1,2,4,5-Tetramethylbenzene	NS	NS	0.71	0.0038 U	0.0063 U	0.0048 U	0.0052 U
1,2,4-Trichlorobenzene	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
1,2,4-Trimethylbenzene	3.6	190	0.58	0.0048 U	0.0079 U	0.006 U	0.0065 U
1,2-Dibromo-3-chloropropane	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
1,2-Dibromoethane	NS	NS	0.29 U	0.0038 U	0.0063 U	0.0048 U	0.0052 U
1,2-Dichlorobenzene	1.1	500	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
1,2-Dichloroethane	0.02	30	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
1,2-Dichloropropane	NS	NS	0.25 U	0.0033 U	0.0056 U	0.0042 U	0.0045 U
1,3,5-Trimethylbenzene	8.4	190	0.78	0.0048 U	0.0079 U	0.006 U	0.0065 U
1,3-Dichlorobenzene	2.4	280	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
1,3-Dichloropropane	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
1,4-Dichlorobenzene	1.8	130	0.36 U	0.0048 U	0.00039 J	0.006 U	0.0065 U
1,4-Diethylbenzene	NS	NS	2.4	0.0038 U	0.0063 U	0.0048 U	0.0052 U
1,4-Dioxane	0.1	130	7.2 U	0.096 U	0.16 U	0.12 U	0.13 U
2,2-Dichloropropane	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
2-Butanone	0.12	500	0.72 U	0.0096 U	0.016 U	0.012 U	0.013 U
2-Hexanone	NS	NS	0.72 U	0.0096 U	0.016 U	0.012 U	0.013 U
4-Ethyltoluene	NS	NS	0.61	0.0038 U	0.0063 U	0.0048 U	0.0052 U
4-Methyl-2-pentanone	NS	NS	0.72 U	0.0096 U	0.016 U	0.012 U	0.013 U
Acetone	0.05	500	0.72 U	0.0096 U	0.016 U	0.012 U	0.013 U
Acrylonitrile	NS	NS	0.72 U	0.0096 U	0.016 U	0.012 U	0.013 U
Benzene	0.06	44	**0.13**	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Bromobenzene	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
Bromochloromethane	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
Bromodichloromethane	NS	NS	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Bromoform	NS	NS	0.29 U	0.0038 U	0.0063 U	0.0048 U	0.0052 U
Bromomethane	NS	NS	0.14 U	0.0019 U	0.0032 U	0.0024 U	0.0026 U
Carbon disulfide	NS	NS	0.72 U	0.0096 U	0.016 U	0.012 U	0.013 U
Carbon tetrachloride	0.76	22	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Chlorobenzene	1.1	500	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Chloroethane	NS	NS	0.14 U	0.0019 U	0.0032 U	0.0024 U	0.0026 U
Chloroform	0.37	350	0.11 U	0.0014 U	0.0024 U	0.0018 U	0.0019 U
Chloromethane	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
cis-1,2-Dichloroethene	0.25	500	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
cis-1,3-Dichloropropene	NS	NS	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Dibromochloromethane	NS	NS	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Dibromomethane	NS	NS	0.72 U	0.0096 U	0.016 U	0.012 U	0.013 U
Dichlorodifluoromethane	NS	NS	0.72 U	0.0096 U	0.016 U	0.012 U	0.013 U
Ethyl ether	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
Ethylbenzene	1	390	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Hexachlorobutadiene	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
Isopropylbenzene	NS	NS	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Methyl tert butyl ether	0.93	500	0.14 U	0.0019 U	0.0032 U	0.0024 U	0.0026 U
Methylene chloride	0.05	500	0.72 U	0.0096 U	0.0048 J	0.0033 J	0.0044 J
Naphthalene	12	500	0.13 J	0.0048 U	0.0079 U	0.006 U	0.0065 U
n-Butylbenzene	12	500	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
n-Propylbenzene	3.9	500	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
o-Chlorotoluene	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
o-Xylene	0.26	500	0.17	0.0019 U	0.0032 U	0.0024 U	0.0026 U
p/m-Xylene	0.26	500	**0.72**	0.0019 U	0.0032 U	0.0024 U	0.0026 U
p-Chlorotoluene	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
p-Isopropyltoluene	NS	NS	0.22	0.00096 U	0.0016 U	0.0012 U	0.0013 U
sec-Butylbenzene	11	500	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Styrene	NS	NS	0.14 U	0.0019 U	0.0032 U	0.0024 U	0.0026 U
tert-Butylbenzene	5.9	500	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
Tetrachloroethene	1.3	150	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Toluene	0.7	500	0.46	0.0014 U	0.0024 U	0.0018 U	0.0019 U
trans-1,2-Dichloroethene	0.19	500	0.11 U	0.0014 U	0.0024 U	0.0018 U	0.0019 U
trans-1,3-Dichloropropene	NS	NS	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
trans-1,4-Dichloro-2-butene	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
Trichloroethene	0.47	200	0.072 U	0.00096 U	0.0016 U	0.0012 U	0.0013 U
Trichlorofluoromethane	NS	NS	0.36 U	0.0048 U	0.0079 U	0.006 U	0.0065 U
Vinyl acetate	NS	NS	0.72 U	0.0096 U	0.016 U	0.012 U	0.013 U
Vinyl chloride	0.02	13	0.14 U	0.0019 U	0.0032 U	0.0024 U	0.0026 U

Table 3
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Remedial Investigation Report Soil Analytical Results
Semivolatile Organic Compounds

Client ID	NYSDEC	NYSDEC	SB-1 (0-2)	SB-1 (7-9)	SB-2 (0-2)	SB-2 (5-7)	SB-3 (0-2)	SB-3 (6-8)	SB-4 (0-2)
Lab Sample ID	Part 375	Part 375	L1315188-02	L1315188-03	L1315035-01	L1315035-02	L1315035-16	L1315035-17	L1315035-03
Date Sampled	Unrestricted	Commercial	8/7/2013	8/7/2013	8/6/2013	8/6/2013	8/6/2013	8/6/2013	8/6/2013
Dilution	SCO	SCO	1	1	15	1	1	4	1
mg/kg	mg/kg	mg/kg							
1,2,4,5-Tetrachlorobenzene	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
1,2,4-Trichlorobenzene	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
1,2-Dichlorobenzene	1.1	500	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
1,3-Dichlorobenzene	2.4	280	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
1,4-Dichlorobenzene	1.8	130	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
2,4,5-Trichlorophenol	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
2,4,6-Trichlorophenol	NS	NS	0.12 U	0.12 U	1.6 U	0.12 U	0.1 U	0.44 U	0.1 U
2,4-Dichlorophenol	NS	NS	0.18 U	0.18 U	2.4 U	0.18 U	0.16 U	0.66 U	0.15 U
2,4-Dimethylphenol	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
2,4-Dinitrophenol	NS	NS	0.98 U	0.98 U	13 U	0.94 U	0.83 U	3.5 U	0.82 U
2,4-Dinitrotoluene	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
2,6-Dinitrotoluene	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
2-Chloronaphthalene	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
2-Chlorophenol	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
2-Methylnaphthalene	NS	NS	0.24 U	0.25 U	3.2 U	0.24 U	0.21 U	0.88 U	0.2 U
2-Methylphenol	0.33	500	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
2-Nitroaniline	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
2-Nitrophenol	NS	NS	0.44 U	0.44 U	5.8 U	0.42 U	0.37 U	1.6 U	0.37 U
3,3'-Dichlorobenzidine	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
3-Methylphenol/4-Methylphenol	0.33	500	0.3 U	0.3 U	3.8 U	0.28 U	0.25 U	1 U	0.24 U
3-Nitroaniline	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
4,6-Dinitro-o-cresol	NS	NS	0.53 U	0.53 U	7 U	0.51 U	0.45 U	1.9 U	0.44 U
4-Bromophenyl phenyl ether	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
4-Chloroaniline	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
4-Chlorophenyl phenyl ether	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
4-Nitroaniline	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
4-Nitrophenol	NS	NS	0.29 U	0.29 U	3.7 U	0.28 U	0.24 U	1 U	0.24 U
Acenaphthene	20	500	0.11 J	0.047 J	2.1 U	0.16 U	0.14 U	0.58 U	0.14 U
Acenaphthylene	100	500	0.31	0.073 J	2.1 U	0.16 U	0.064 J	0.58 U	0.14 U
Acetophenone	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Anthracene	100	500	0.69	0.13	1.6 U	0.038 J	0.053 J	0.2 J	0.028 J
Benzo(a)anthracene	1	5.6	**2.6**	0.42	0.63 J	0.19	0.54	0.65	0.16
Benzo(a)pyrene	1	1	**2.3**	0.38	2.1 U	0.2	0.51	0.6	0.16
Benzo(b)fluoranthene	1	5.6	**2.6**	0.42	0.72 J	0.22	0.74	0.7	0.19
Benzo(ghi)perylene	100	500	1.4	0.22	2.1 U	0.13 J	0.34	0.38 J	0.097 J
Benzo(k)fluoranthene	0.8	56	**1.1**	0.2	1.6 U	0.12	0.32	0.37 J	0.077 J
Benzoic Acid	NS	NS	0.66 U	0.66 U	8.7 U	0.64 U	0.56 U	2.4 U	0.55 U
Benzyl Alcohol	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Biphenyl	NS	NS	0.47 U	0.47 U	6.1 U	0.45 U	0.4 U	1.7 U	0.39 U
Bis(2-chloroethoxy)methane	NS	NS	0.22 U	0.22 U	2.9 U	0.21 U	0.19 U	0.79 U	0.18 U
Bis(2-chloroethyl)ether	NS	NS	0.18 U	0.18 U	2.4 U	0.18 U	0.16 U	0.66 U	0.15 U
Bis(2-chloroisopropyl)ether	NS	NS	0.24 U	0.25 U	3.2 U	0.24 U	0.21 U	0.88 U	0.2 U
Bis(2-Ethylhexyl)phthalate	NS	NS	0.094 J	0.18 J	2.7 U	0.2 U	0.066 J	0.73 U	0.17 U
Butyl benzyl phthalate	NS	NS	0.2 U	0.056 J	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Carbazole	NS	NS	0.08 J	0.056 J	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Chrysene	1	56	**2.5**	0.42	0.65 J	0.2	0.64	0.62	0.16
Dibenzo(a,h)anthracene	0.33	0.56	0.3	0.052 J	1.6 U	0.12 U	0.075 J	0.44 U	0.1 U
Dibenzofuran	7	350	0.088 J	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Diethyl phthalate	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Dimethyl phthalate	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Di-n-butylphthalate	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Di-n-octylphthalate	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Fluoranthene	100	500	4.4	0.8	1.3 J	0.36	0.92	1.3	0.29
Fluorene	30	500	0.16 J	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Hexachlorobenzene	0.33	6	0.12 U	0.12 U	1.6 U	0.12 U	0.1 U	0.44 U	0.1 U
Hexachlorobutadiene	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Hexachlorocyclopentadiene	NS	NS	0.59 U	0.59 U	7.7 U	0.56 U	0.5 U	2.1 U	0.49 U
Hexachloroethane	NS	NS	0.16 U	0.16 U	2.1 U	0.16 U	0.14 U	0.58 U	0.14 U
Indeno(1,2,3-cd)Pyrene	0.5	5.6	**1.5**	0.24	2.1 U	0.11 J	0.3	0.32 J	0.087 J
Isophorone	NS	NS	0.18 U	0.18 U	2.4 U	0.18 U	0.16 U	0.66 U	0.15 U
Naphthalene	12	500	0.13 J	0.2 U	2.7 U	0.073 J	0.17 U	0.73 U	0.17 U
Nitrobenzene	NS	NS	0.18 U	0.18 U	2.4 U	0.18 U	0.16 U	0.66 U	0.15 U
NitrosoDiPhenylAmine(NDPA)/DPA	NS	NS	0.16 U	0.16 U	2.1 U	0.16 U	0.14 U	0.58 U	0.14 U
n-Nitrosodi-n-propylamine	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
P-Chloro-M-Cresol	NS	NS	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Pentachlorophenol	0.8	6.7	0.16 U	0.16 U	2.1 U	0.16 U	0.14 U	0.58 U	0.14 U
Phenanthrene	100	500	2.6	0.44	0.53 J	0.19	0.23	0.53	0.11
Phenol	0.33	500	0.2 U	0.2 U	2.7 U	0.2 U	0.17 U	0.73 U	0.17 U
Pyrene	100	500	4.5	0.71	1.2 J	0.34	0.87	1.3	0.3

Table 3
NYULMC Science Building
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Remedial Investigation Report Soil Analytical Results
Semivolatile Organic Compounds

Client ID Lab Sample ID Date Sampled Dilution mg/kg	NYSDEC Part 375 Unrestricted SCO mg/kg	NYSDEC Part 375 Commercial SCO mg/kg	SB-4 (8-10) L1315035-04 8/6/2013 10	SB-5 (0-2) L1315035-06 8/6/2013 10	SB-5 (5-7) L1315035-07 8/6/2013 4	SB-6 (0-2) L1315035-14 8/6/2013 1	SB-6 (5-7) L1315035-15 8/6/2013 1	SB-7 (0-2) L1315035-09 8/6/2013 1
1,2,4,5-Tetrachlorobenzene	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
1,2,4-Trichlorobenzene	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
1,2-Dichlorobenzene	1.1	500	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
1,3-Dichlorobenzene	2.4	280	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
1,4-Dichlorobenzene	1.8	130	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
2,4,5-Trichlorophenol	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
2,4,6-Trichlorophenol	NS	NS	1.1 U	1.1 U	0.42 U	0.1 U	0.1 U	0.53 U
2,4-Dichlorophenol	NS	NS	1.7 U	1.6 U	0.63 U	0.15 U	0.15 U	0.8 U
2,4-Dimethylphenol	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
2,4-Dinitrophenol	NS	NS	8.9 U	8.7 U	3.4 U	0.82 U	0.82 U	4.2 U
2,4-Dinitrotoluene	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
2,6-Dinitrotoluene	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
2-Chloronaphthalene	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
2-Chlorophenol	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
2-Methylnaphthalene	NS	NS	2.2 U	2.2 U	0.84 U	0.21 U	0.2 U	1.1 U
2-Methylphenol	0.33	500	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
2-Nitroaniline	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
2-Nitrophenol	NS	NS	4 U	3.9 U	1.5 U	0.37 U	0.37 U	1.9 U
3,3'-Dichlorobenzidine	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
3-Methylphenol/4-Methylphenol	0.33	500	2.7 U	2.6 U	1 U	0.25 U	0.25 U	1.3 U
3-Nitroaniline	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
4,6-Dinitro-o-cresol	NS	NS	4.8 U	4.7 U	1.8 U	0.45 U	0.44 U	2.3 U
4-Bromophenyl phenyl ether	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
4-Chloroaniline	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
4-Chlorophenyl phenyl ether	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
4-Nitroaniline	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
4-Nitrophenol	NS	NS	2.6 U	2.5 U	0.98 U	0.24 U	0.24 U	1.2 U
Acenaphthene	20	500	1.5 U	1.4 U	0.56 U	0.14 U	0.14 U	0.71 U
Acenaphthylene	100	500	1.5 U	1.4 U	0.56 U	0.14 U	0.14 U	0.71 U
Acetophenone	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Anthracene	100	500	1.1 U	1.1 U	0.45	0.1 U	0.1 U	0.53 U
Benzo(a)anthracene	1	5.6	1.1 U	1.1 U	**1.1**	0.1 U	0.1 U	0.53 U
Benzo(a)pyrene	1	1	1.5 U	1.4 U	0.86	0.14 U	0.14 U	0.71 U
Benzo(b)fluoranthene	1	5.6	1.1 U	1.1 U	0.96	0.1 U	0.043 J	0.53 U
Benzo(ghi)perylene	100	500	1.5 U	1.4 U	0.6	0.14 U	0.042 J	0.71 U
Benzo(k)fluoranthene	0.8	56	1.1 U	1.1 U	0.44	0.1 U	0.1 U	0.53 U
Benzoic Acid	NS	NS	6 U	5.9 U	2.3 U	0.56 U	0.55 U	2.9 U
Benzyl Alcohol	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Biphenyl	NS	NS	4.2 U	4.1 U	1.6 U	0.39 U	0.39 U	2 U
Bis(2-chloroethoxy)methane	NS	NS	2 U	2 U	0.76 U	0.18 U	0.18 U	0.96 U
Bis(2-chloroethyl)ether	NS	NS	1.7 U	1.6 U	0.63 U	0.15 U	0.15 U	0.8 U
Bis(2-chloroisopropyl)ether	NS	NS	2.2 U	2.2 U	0.84 U	0.21 U	0.2 U	1.1 U
Bis(2-Ethylhexyl)phthalate	NS	NS	1.8 U	1.8 U	0.7 U	0.13 J	0.17 U	0.27 J
Butyl benzyl phthalate	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Carbazole	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Chrysene	1	56	1.1 U	1.1 U	1	0.1 U	0.037 J	0.53 U
Dibenzo(a,h)anthracene	0.33	0.56	1.1 U	1.1 U	0.14 J	0.1 U	0.1 U	0.53 U
Dibenzofuran	7	350	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Diethyl phthalate	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Dimethyl phthalate	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Di-n-butylphthalate	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Di-n-octylphthalate	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Fluoranthene	100	500	1.1 U	1.1 U	1.9	0.1 U	0.045 J	0.53 U
Fluorene	30	500	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Hexachlorobenzene	0.33	6	1.1 U	1.1 U	0.42 U	0.1 U	0.1 U	0.53 U
Hexachlorobutadiene	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Hexachlorocyclopentadiene	NS	NS	5.3 U	5.2 U	2 U	0.49 U	0.49 U	2.5 U
Hexachloroethane	NS	NS	1.5 U	1.4 U	0.56 U	0.14 U	0.14 U	0.71 U
Indeno(1,2,3-cd)Pyrene	0.5	5.6	1.5 U	1.4 U	**0.59**	0.14 U	0.14 U	0.71 U
Isophorone	NS	NS	1.7 U	1.6 U	0.63 U	0.15 U	0.15 U	0.8 U
Naphthalene	12	500	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Nitrobenzene	NS	NS	1.7 U	1.6 U	0.63 U	0.15 U	0.15 U	0.8 U
NitrosoDiPhenylAmine(NDPA)/DPA	NS	NS	1.5 U	1.4 U	0.56 U	0.14 U	0.14 U	0.71 U
n-Nitrosodi-n-propylamine	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
P-Chloro-M-Cresol	NS	NS	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Pentachlorophenol	0.8	6.7	1.5 U	1.4 U	0.56 U	0.14 U	0.14 U	0.71 U
Phenanthrene	100	500	1.1 U	1.1 U	1.7	0.1 U	0.1 U	0.53 U
Phenol	0.33	500	1.8 U	1.8 U	0.7 U	0.17 U	0.17 U	0.88 U
Pyrene	100	500	1.1 U	1.1 U	1.9	0.1 U	0.049 J	0.53 U

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Semivolatile Organic Compounds

Client ID Lab Sample ID Date Sampled Dilution mg/kg	NYSDEC Part 375 Unrestricted SCO mg/kg	NYSDEC Part 375 Commercial SCO mg/kg	SB-7 (8-10) L1315035-10 8/6/2013 1	SB-8 (0-2) L1315035-11 8/6/2013 4	SB-8 (5-7) L1315035-12 8/6/2013 2	SB-9 (5-5.5) L1321227-01 10/18/2013 1	SB-10 (5-5.5) L1321227-02 10/18/2013 1	SB-11 (8.0) L1321227-03 10/22/2013 1
1,2,4,5-Tetrachlorobenzene	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
1,2,4-Trichlorobenzene	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
1,2-Dichlorobenzene	1.1	500	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
1,3-Dichlorobenzene	2.4	280	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
1,4-Dichlorobenzene	1.8	130	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
2,4,5-Trichlorophenol	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
2,4,6-Trichlorophenol	NS	NS	0.52 U	0.46 U	0.22 U	0.16 U	0.12 U	0.13 U
2,4-Dichlorophenol	NS	NS	0.78 U	0.68 U	0.33 U	0.24 U	0.18 U	0.19 U
2,4-Dimethylphenol	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
2,4-Dinitrophenol	NS	NS	4.1 U	3.6 U	1.8 U	1.2 U	0.95 U	1 U
2,4-Dinitrotoluene	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
2,6-Dinitrotoluene	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
2-Chloronaphthalene	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
2-Chlorophenol	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
2-Methylnaphthalene	NS	NS	1 U	0.27 J	0.41 J	0.31 U	0.15 J	0.074 J
2-Methylphenol	0.33	500	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
2-Nitroaniline	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
2-Nitrophenol	NS	NS	1.9 U	1.6 U	0.79 U	0.56 U	0.43 U	0.46 U
3,3'-Dichlorobenzidine	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
3-Methylphenol/4-Methylphenol	0.33	500	1.2 U	1.1 U	0.53 U	0.38 U	0.28 U	0.31 U
3-Nitroaniline	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
4,6-Dinitro-o-cresol	NS	NS	2.2 U	2 U	0.95 U	0.68 U	0.51 U	0.56 U
4-Bromophenyl phenyl ether	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
4-Chloroaniline	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
4-Chlorophenyl phenyl ether	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
4-Nitroaniline	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
4-Nitrophenol	NS	NS	1.2 U	1.1 U	0.51 U	0.36 U	0.28 U	0.3 U
Acenaphthene	20	500	0.69 U	0.61 U	0.18 J	0.21 U	0.14 J	0.17 U
Acenaphthylene	100	500	0.69 U	0.61 U	1.4	0.21 U	0.16	0.057 J
Acetophenone	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
Anthracene	100	500	0.52 U	0.46 U	1.2	0.046 J	0.5	0.15
Benzo(a)anthracene	1	5.6	0.52 U	0.54	**4**	0.15 J	**1.2**	0.51
Benzo(a)pyrene	1	1	0.69 U	0.43 J	**4.4**	0.14 J	**1.2**	0.52
Benzo(b)fluoranthene	1	5.6	0.52 U	0.61	**5.3**	0.15 J	**1.2**	0.61
Benzo(ghi)perylene	100	500	0.69 U	0.32 J	3.7	0.083 J	0.74	0.33
Benzo(k)fluoranthene	0.8	56	0.52 U	0.24 J	**2.2**	0.08 J	0.44	0.22
Benzoic Acid	NS	NS	2.8 U	2.5 U	1.2 U	0.85 U	0.64 U	0.31 J
Benzyl Alcohol	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
Biphenyl	NS	NS	2 U	1.7 U	0.84 U	0.6 U	0.45 U	0.49 U
Bis(2-chloroethoxy)methane	NS	NS	0.93 U	0.82 U	0.4 U	0.28 U	0.21 U	0.23 U
Bis(2-chloroethyl)ether	NS	NS	0.78 U	0.68 U	0.33 U	0.24 U	0.18 U	0.19 U
Bis(2-chloroisopropyl)ether	NS	NS	1 U	0.91 U	0.44 U	0.31 U	0.24 U	0.26 U
Bis(2-Ethylhexyl)phthalate	NS	NS	0.76 J	0.76 U	0.37 U	0.26 U	0.2 U	0.072 J
Butyl benzyl phthalate	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
Carbazole	NS	NS	0.86 U	0.76 U	0.34 J	0.26 U	0.044 J	0.22 U
Chrysene	1	56	0.52 U	0.56	**4**	0.14 J	**1.2**	0.5
Dibenzo(a,h)anthracene	0.33	0.56	0.52 U	0.46 U	**1**	0.16 U	0.16	0.074 J
Dibenzofuran	7	350	0.86 U	0.76 U	0.15 J	0.26 U	0.2 U	0.22 U
Diethyl phthalate	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
Dimethyl phthalate	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
Di-n-butylphthalate	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
Di-n-octylphthalate	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
Fluoranthene	100	500	0.52 U	0.66	4.9	0.26	2	0.82
Fluorene	30	500	0.86 U	0.76 U	0.27 J	0.26 U	0.14 J	0.22 U
Hexachlorobenzene	0.33	6	0.52 U	0.46 U	0.22 U	0.16 U	0.12 U	0.13 U
Hexachlorobutadiene	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
Hexachlorocyclopentadiene	NS	NS	2.5 U	2.2 U	1 U	0.75 U	0.57 U	0.62 U
Hexachloroethane	NS	NS	0.69 U	0.61 U	0.29 U	0.21 U	0.16 U	0.17 U
Indeno(1,2,3-cd)Pyrene	0.5	5.6	0.69 U	0.31 J	**3.7**	0.085 J	**0.8**	0.36
Isophorone	NS	NS	0.78 U	0.68 U	0.33 U	0.24 U	0.18 U	0.19 U
Naphthalene	12	500	0.86 U	0.25 J	0.67	0.26 U	0.26	0.12 J
Nitrobenzene	NS	NS	0.78 U	0.68 U	0.33 U	0.24 U	0.18 U	0.19 U
NitrosoDiPhenylAmine(NDPA)/DPA	NS	NS	0.69 U	0.61 U	0.29 U	0.21 U	0.16 U	0.17 U
n-Nitrosodi-n-propylamine	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
P-Chloro-M-Cresol	NS	NS	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
Pentachlorophenol	0.8	6.7	0.69 U	0.61 U	0.29 U	0.21 U	0.16 U	0.17 U
Phenanthrene	100	500	0.52 U	0.36 J	3.6	0.17	1.5	0.41
Phenol	0.33	500	0.86 U	0.76 U	0.37 U	0.26 U	0.2 U	0.22 U
Pyrene	100	500	0.52 U	0.81	5.7	0.22	2.3	0.73

Table 4
NYULMC Science Building
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Metals

Client ID Lab Sample ID Date Sampled Dilution mg/kg	NYSDEC Part 375 Unrestricted SCO mg/kg	NYSDEC Part 375 Commercial SCO mg/kg	SB-1 (0-2) L1315188-02 8/7/2013 2/1 *	SB-1 (7-9) L1315188-03 8/7/2013 2/1 *	SB-2 (0-2) L1315035-01 8/6/2013 2/1 *	SB-2 (5-7) L1315035-02 8/6/2013 2/1 *	SB-3 (0-2) L1315035-16 8/6/2013 2/1 *	SB-3 (6-8) L1315035-17 8/6/2013 2/1 *	SB-4 (0-2) L1315035-03 8/6/2013 2/1 *
Aluminum	**NS**	**NS**	10,000	8,800	3,500	4,500	8,400	5,200	5,700
Antimony	**NS**	**NS**	4.8 U	0.76 J	1.2 J	2.3 J	2.5 J	4.3 U	4 U
Arsenic	**13**	**16**	3	3.6	6.1	3.7	5.4	2.9	2.6
Barium	**350**	**400**	100	96	130	60	77	70	79
Beryllium	**7.2**	**590**	0.53	0.45 J	0.5	0.37 J	0.29 J	0.22 J	0.29 J
Cadmium	**2.5**	**9.3**	0.52 J	0.55 J	0.49 J	0.7 J	0.87	0.32 J	0.29 J
Calcium	**NS**	**NS**	5,200	8,800	35,000	13,000	11,000	3,400	5,300
Chromium	**30**	**1,500**	30	21	8.5	8.6	18	11	12
Cobalt	**NS**	**NS**	14	9.1	4	5.1	12	4.2	4.5
Copper	**50**	**270**	46	44	40	32	**110**	20	16
Iron	**NS**	**NS**	24,000	21,000	8,200	13,000	29,000	12,000	9,900
Lead	**63**	**1,000**	**87**	**120**	**140**	**67**	**140**	**82**	48
Magnesium	**NS**	**NS**	4,000	3,300	17,000	1,400	2,800	1,700	1,900
Manganese	**1,600**	**10,000**	400	410	130	190	340	220	290
Mercury	**0.18**	**2.8**	**0.33**	**0.31**	0.16	0.05 J	**0.36**	**0.53**	0.05 J
Nickel	**30**	**310**	18	18	9.1	12	18	9.5	14
Potassium	**NS**	**NS**	2,200	1,900	610	570	1,500	750	640
Selenium	**3.9**	**1,500**	1.9 U	1.9 U	0.28 J	1.2 J	1.7 U	1.7 U	1.6 U
Silver	**2**	**1,500**	0.97 U	0.95 U	0.84 U	0.92 U	0.84 U	0.86 U	0.8 U
Sodium	**NS**	**NS**	280	450	440	740	170	800	180
Thallium	**NS**	**NS**	1.9 U	1.9 U	1.7 U	1.8 U	1.7 U	1.7 U	1.6 U
Vanadium	**NS**	**NS**	31	29	21	12	21	15	16
Zinc	**109**	**10,000**	73	95	98	**140**	95	49	41

Notes: *** =** Dilution rate for Mercury is 1.
† = Dilution rate for Calcium is 200.

Table 4
NYULMC Science Building
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Metals

Client ID	**NYSDEC**	**NYSDEC**	**SB-4 (8-10)**	**SB-5 (0-2)**	**SB-5 (5-7)**	**SB-6 (0-2)**	**SB-6 (5-7)**	**SB-7 (0-2)**	**SB-7 (8-10)**
Lab Sample ID	**Part 375**	**Part 375**	**L1315035-04**	**L1315035-06**	**L1315035-07**	**L1315035-14**	**L1315035-15**	**L1315035-09**	**L1315035-10**
Date Sampled	**Unrestricted**	**Commercial**	**8/6/2013**	**8/6/2013**	**8/6/2013**	**8/6/2013**	**8/6/2013**	**8/6/2013**	**8/6/2013**
Dilution	**SCO**	**SCO**	**2/1 ***	**2/1 ***	**2/1 ***	**2/1 ***	**2/1 ***	**1/200 †**	**1/200 †**
mg/kg	**mg/kg**	**mg/kg**							
Aluminum	**NS**	**NS**	5,300	8,900	3,800	4,300	2,600	3,300	1,800
Antimony	**NS**	**NS**	4.4 U	1.4 J	4.3 U	4.2 U	4 U	2 U	2 U
Arsenic	**13**	**16**	2.2	**38**	2.2	2	1.3	4.4	4
Barium	**350**	**400**	31	69	280	17	30	8.4	18
Beryllium	**7.2**	**590**	0.2 J	2.3	0.12 J	0.42 U	0.17 J	0.06 J	0.08 J
Cadmium	**2.5**	**9.3**	0.24 J	0.64 J	0.24 J	0.37 J	0.22 J	0.31 J	0.16 J
Calcium	**NS**	**NS**	13,000	43,000	9,200	45,000	950	56,000	250,000
Chromium	**30**	**1,500**	10	**39**	9.4	4	7.5	2.5	4.9
Cobalt	**NS**	**NS**	3.2	10	3.2	8.5	3.1	5.1	4.5
Copper	**50**	**270**	22	**67**	11	26	9.3	12	7.6
Iron	**NS**	**NS**	8,400	17,000	7,100	14,000	7,500	11,000	6,400
Lead	**63**	**1,000**	**75**	59	**110**	6.4	9	2.3	3.4
Magnesium	**NS**	**NS**	4,400	26,000	3,200	3,900	830	3,000	4,200
Manganese	**1,600**	**10,000**	150	120	130	240	180	110	250
Mercury	**0.18**	**2.8**	0.1	0.14	**0.32**	0.08 U	0.08 U	0.07 U	0.08 U
Nickel	**30**	**310**	8.3	28	9	5.1	6.8	4.7	4.6
Potassium	**NS**	**NS**	890	970	1,900	300	180 J	370	370
Selenium	**3.9**	**1,500**	1.8 U	2.2	1.7 U	1.7 U	1.6 U	0.79 U	0.79 U
Silver	**2**	**1,500**	0.88 U	0.87 U	0.85 U	0.83 U	0.81 U	0.4 U	0.39 U
Sodium	**NS**	**NS**	660	270	420	490	130 J	390	320
Thallium	**NS**	**NS**	1.8 U	0.52 J	1.7 U	1.7 U	1.6 U	0.79 U	0.79 U
Vanadium	**NS**	**NS**	16	37	16	39	10	17	7.9
Zinc	**109**	**10,000**	64	**160**	**110**	22	19	31	17

Notes: * = Dilution rate for Mercury is 1.
† = Dilution rate for Calcium is 200.

Table 4
NYULMC Science Building
East 30th Street and FDR Drive
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Remedial Investigation Report Soil Analytical Results
Metals

Client ID **Lab Sample ID** **Date Sampled** **Dilution** **mg/kg**	**NYSDEC Part 375 Unrestricted SCO** **mg/kg**	**NYSDEC Part 375 Commercial SCO** **mg/kg**	**SB-8 (0-2)** **L1315035-11** **8/6/2013** **2/1 ***	**SB-8 (5-7)** **L1315035-12** **8/6/2013** **2/1 ***	**SB-9 (5-5.5)** **L1321227-01** **10/18/2013** **1**	**SB-10 (5-5.5)** **L1321227-02** **10/18/2013** **1**	**SB-11 (8.0)** **L1321227-03** **10/22/2013** **1**
Aluminum	**NS**	**NS**	4,900	5,200	9,700	6,900	8,300
Antimony	**NS**	**NS**	1.3 J	0.71 J	1.2 J	0.92 J	1.6 J
Arsenic	**13**	**16**	11	5.3	4.2	4.4	12
Barium	**350**	**400**	160	120	66	92	130
Beryllium	**7.2**	**590**	0.34 J	0.21 J	0.45 J	0.31 J	0.64
Cadmium	**2.5**	**9.3**	0.54 J	0.43 J	0.56 J	0.46 J	0.66 J
Calcium	**NS**	**NS**	8,600	44,000	27,000	14,000	27,000
Chromium	**30**	**1,500**	13	8.1	20	15	27
Cobalt	**NS**	**NS**	5.6	2.7	9.2	5.4	6.8
Copper	**50**	**270**	34	29	36	31	42
Iron	**NS**	**NS**	9,500	8,300	20,000	12,000	15,000
Lead	**63**	**1,000**	**170**	**280**	**79**	**130**	**120**
Magnesium	**NS**	**NS**	2,300	2,500	7,000	4,700	5,600
Manganese	**1,600**	**10,000**	150	150	480	290	290
Mercury	**0.18**	**2.8**	**0.27**	**0.71**	0.08 J	**0.31**	0.54
Nickel	**30**	**310**	15	10	20	14	19
Potassium	**NS**	**NS**	1,600	610	1,900	1,400	1,600
Selenium	**3.9**	**1,500**	0.64 J	1.8 U	2.5 U	1.8 U	0.34 J
Silver	**2**	**1,500**	0.91 U	0.88 U	1.2 U	0.22 J	0.98 U
Sodium	**NS**	**NS**	310	650	570	210	840
Thallium	**NS**	**NS**	1.8 U	1.8 U	2.5 U	1.8 U	2 U
Vanadium	**NS**	**NS**	26	9.1	24	21	26
Zinc	**109**	**10,000**	**150**	**290**	84	**120**	**140**

Notes: *** =** Dilution rate for Mercury is 1.
† = Dilution rate for Calcium is 200.

Table 5
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Remedial Investigation Report Soil Analytical Results
Polychlorinated Biphenyls Pesticides

Client ID Lab Sample ID Date Sampled Dilution Polychlorinated Biphenyls - mg/kg	NYSDEC Part 375 Unrestricted SCO mg/kg	NYSDEC Part 375 Commercial SCO mg/kg	SB-1 (0-2) L1315188-02 8/7/2013 1	SB-1 (7-9) L1315188-03 8/7/2013 1	SB-2 (0-2) L1315035-01 8/6/2013 1	SB-2 (5-7) L1315035-02 8/6/2013 1	SB-3 (0-2) L1315035-16 8/6/2013 1	SB-3 (6-8) L1315035-17 8/6/2013 1	SB-4 (0-2) L1315035-03 8/6/2013 1
Aroclor 1016	**NS**	**NS**	0.0413 U	0.0408 U	0.035 U	0.0379 U	0.0346 U	0.0356 U	0.0332 U
Aroclor 1221	**NS**	**NS**	0.0413 U	0.0408 U	0.035 U	0.0379 U	0.0346 U	0.0356 U	0.0332 U
Aroclor 1232	**NS**	**NS**	0.0413 U	0.0408 U	0.035 U	0.0379 U	0.0346 U	0.0356 U	0.0332 U
Aroclor 1242	**NS**	**NS**	0.0413 U	0.0408 U	0.035 U	0.0379 U	0.0346 U	0.0356 U	0.0332 U
Aroclor 1248	**NS**	**NS**	0.0413 U	0.0408 U	0.035 U	0.0379 U	0.0346 U	0.0356 U	0.0332 U
Aroclor 1254	**NS**	**NS**	0.0413 U	0.0408 U	0.035 U	0.0379 U	0.0346 U	0.0356 U	0.0332 U
Aroclor 1260	**NS**	**NS**	0.0413 U	0.0408 U	0.035 U	0.0379 U	0.0346 U	0.0119 J	0.0332 U
Aroclor 1262	**NS**	**NS**	0.0413 U	0.0408 U	0.035 U	0.0379 U	0.0346 U	0.0356 U	0.0332 U
Aroclor 1268	**NS**	**NS**	0.0413 U	0.0408 U	0.035 U	0.0379 U	0.0346 U	0.0356 U	0.0332 U
Total PCBs	**0.1**	**1**	ND	ND	ND	ND	ND	0.0119	ND

Pesticides - mg/kg

Dilution			1	1	50	5	1	1	10
4,4'-DDD	**0.0033**	**92**	**0.00582**	0.00194 U	0.0842 U	0.0094 U	0.00163 U	0.00169 U	0.0162 U
4,4'-DDE	**0.0033**	**62**	**0.00376**	0.00212	0.0842 U	0.0094 U	0.00163 U	0.00179	**0.00539** J
4,4'-DDT	**0.0033**	**47**	**0.00852**	0.00364 U	0.158 U	0.0176 U	0.00305 U	0.00317 U	0.0303 U
Aldrin	**0.005**	**0.68**	0.00196 U	0.00194 U	0.0842 U	0.0094 U	0.00163 U	0.00169 U	0.0162 U
Alpha-BHC	**0.02**	**3.4**	0.000817 U	0.00081 U	0.0351 U	0.00392 U	0.000678 U	0.000705 U	0.00674 U
Beta-BHC	**0.036**	**3**	0.00196 U	0.00194 U	0.0842 U	0.0094 U	0.00163 U	0.00202	0.0162 U
Chlordane	**0.094**	**24**	0.0159 U	0.0158 U	0.684 U	0.0764 U	0.0433	0.0429	0.131 U
cis-Chlordane	**0.094**	**24**	0.00245 U	0.00243 U	0.105 U	0.0117 U	0.00798	0.0032	0.0202 U
Delta-BHC	**0.04**	**500**	0.00196 U	0.00194 U	0.0842 U	0.0094 U	0.00163 U	0.00169 U	0.0162 U
Dieldrin	**0.005**	**1.4**	0.00122 U	0.00122 U	0.0526 U	0.00587 U	0.00102 U	0.00106 U	0.0101 U
Endosulfan I	**2.4**	**200**	0.00196 U	0.00194 U	0.0842 U	0.0094 U	0.00163 U	0.00169 U	0.0162 U
Endosulfan II	**2.4**	**200**	0.00196 U	0.00194 U	0.0842 U	0.0094 U	0.00163 U	0.00169 U	0.0162 U
Endosulfan sulfate	**2.4**	**200**	0.000817 U	0.00081 U	0.0351 U	0.00392 U	0.000678 U	0.000705 U	0.00674 U
Endrin	**0.014**	**89**	0.000817 U	0.00081 U	0.0351 U	0.00392 U	0.000678 U	0.000705 U	0.00674 U
Endrin ketone	**NS**	**NS**	0.00196 U	0.00194 U	0.0842 U	0.0094 U	0.00163 U	0.00169 U	0.0162 U
Heptachlor	**0.042**	**15**	0.00098 U	0.000972 U	0.0421 U	0.0047 U	0.000814 U	0.000846 U	0.00809 U
Heptachlor epoxide	**NS**	**NS**	0.00368 U	0.00364 U	0.158 U	0.0176 U	0.00128 J	0.00317 U	0.0303 U
Lindane	**0.1**	**9.2**	0.000817 U	0.00081 U	0.0351 U	0.00392 U	0.000678 U	0.000705 U	0.00674 U
Methoxychlor	**NS**	**NS**	0.00368 U	0.00364 U	0.158 U	0.0176 U	0.00305 U	0.00317 U	0.0303 U
Toxaphene	**NS**	**NS**	0.0368 U	0.0364 U	1.58 U	0.176 U	0.0305 U	0.0317 U	0.303 U
trans-Chlordane	**NS**	**NS**	0.00245 U	0.00243 U	0.105 U	0.0117 U	0.0058	0.00649	0.0202 U

Table 5
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Polychlorinated Biphenyls Pesticides

Client ID	NYSDEC	NYSDEC	SB-4 (8-10)	SB-5 (0-2)	SB-5 (5-7)	SB-6 (0-2)	SB-6 (5-7)	SB-7 (0-2)	SB-7 (8-10)
Lab Sample ID	Part 375	Part 375	L1315035-04	L1315035-06	L1315035-07	L1315035-14	L1315035-15	L1315035-09	L1315035-10
Date Sampled	Unrestricted	Commercial	8/6/2013	8/6/2013	8/6/2013	8/6/2013	8/6/2013	8/6/2013	8/6/2013
Dilution	SCO	SCO	2	1	1	1	1	1	1
Polychlorinated Biphenyls - mg/kg	mg/kg	mg/kg							
Aroclor 1016	NS	NS	0.0719 U	0.0351 U	0.0345 U	0.0349 U	0.0334 U	0.0938 U	0.0913 U
Aroclor 1221	NS	NS	0.0719 U	0.0351 U	0.0345 U	0.0349 U	0.0334 U	0.0938 U	0.0913 U
Aroclor 1232	NS	NS	0.0719 U	0.0351 U	0.0345 U	0.0349 U	0.0334 U	0.0938 U	0.0913 U
Aroclor 1242	NS	NS	0.0719 U	0.0351 U	0.0345 U	0.0349 U	0.0334 U	0.0938 U	0.0913 U
Aroclor 1248	NS	NS	0.0719 U	0.0351 U	0.0345 U	0.0349 U	0.0334 U	0.0938 U	0.0913 U
Aroclor 1254	NS	NS	0.0719 U	0.0351 U	0.0345 U	0.0349 U	0.0334 U	0.0938 U	0.0913 U
Aroclor 1260	NS	NS	0.0719 U	0.0351 U	0.0345 U	0.0349 U	0.0334 U	0.0938 U	0.0913 U
Aroclor 1262	NS	NS	0.0719 U	0.0351 U	0.0345 U	0.0349 U	0.0334 U	0.0938 U	0.0913 U
Aroclor 1268	NS	NS	0.0719 U	0.0351 U	0.0345 U	0.0349 U	0.0334 U	0.0938 U	0.0913 U
Total PCBs	0.1	1	ND	ND	ND	ND	ND	ND	ND

Pesticides - mg/kg

Dilution			20	50	10	1	1	1	1
4,4'-DDD	0.0033	92	0.0359 U	0.083 U	0.0167 U	0.00161 U	0.00168 U	0.00433 U	0.00473 U
4,4'-DDE	0.0033	62	0.0359 U	0.083 U	0.0167 U	0.00161 U	0.00168 U	0.00433 U	0.00473 U
4,4'-DDT	0.0033	47	0.0674 U	0.156 U	0.0313 U	0.00302 U	0.00314 U	0.00813 U	0.00887 U
Aldrin	0.005	0.68	0.0359 U	0.083 U	0.0167 U	0.00161 U	0.00168 U	0.00433 U	0.00473 U
Alpha-BHC	0.02	3.4	0.015 U	0.0346 U	0.00696 U	0.00067 U	0.000698 U	0.00181 U	0.00197 U
Beta-BHC	0.036	3	0.0359 U	0.083 U	0.0167 U	0.00161 U	0.00168 U	0.00433 U	0.00473 U
Chlordane	0.094	24	0.292 U	0.674 U	0.136 U	0.0131 U	0.0136 U	0.0352 U	0.0384 U
cis-Chlordane	0.094	24	0.0449 U	0.104 U	0.0209 U	0.00201 U	0.00209 U	0.00542 U	0.00592 U
Delta-BHC	0.04	500	0.0359 U	0.083 U	0.0167 U	0.00161 U	0.00168 U	0.00433 U	0.00473 U
Dieldrin	0.005	1.4	0.0224 U	0.0519 U	0.0104 U	0.001 U	0.00105 U	0.00271 U	0.00296 U
Endosulfan I	2.4	200	0.0359 U	0.083 U	0.0167 U	0.00161 U	0.00168 U	0.00433 U	0.00473 U
Endosulfan II	2.4	200	0.0359 U	0.083 U	0.0167 U	0.00161 U	0.00168 U	0.00433 U	0.00473 U
Endosulfan sulfate	2.4	200	0.015 U	0.0346 U	0.00696 U	0.00067 U	0.000698 U	0.00181 U	0.00197 U
Endrin	0.014	89	0.015 U	0.0346 U	0.00696 U	0.00067 U	0.000698 U	0.00181 U	0.00197 U
Endrin ketone	NS	NS	0.0359 U	0.083 U	0.0167 U	0.00161 U	0.00168 U	0.00433 U	0.00473 U
Heptachlor	0.042	15	0.018 U	0.0415 U	0.00835 U	0.000804 U	0.000838 U	0.00217 U	0.00237 U
Heptachlor epoxide	NS	NS	0.0674 U	0.156 U	0.0313 U	0.00302 U	0.00314 U	0.00813 U	0.00887 U
Lindane	0.1	9.2	0.015 U	0.0346 U	0.00696 U	0.00067 U	0.000698 U	0.00181 U	0.00197 U
Methoxychlor	NS	NS	0.0674 U	0.156 U	0.0313 U	0.00302 U	0.00314 U	0.00813 U	0.00887 U
Toxaphene	NS	NS	0.674 U	1.56 U	0.313 U	0.0302 U	0.0314 U	0.0813 U	0.0887 U
trans-Chlordane	NS	NS	0.0449 U	0.104 U	0.0209 U	0.00201 U	0.00209 U	0.00542 U	0.00592 U

Table 5
NYULMC Science Building
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Polychlorinated Biphenyls Pesticides

Client ID Lab Sample ID Date Sampled Dilution Polychlorinated Biphenyls - mg/kg	NYSDEC Part 375 Unrestricted SCO mg/kg	NYSDEC Part 375 Commercial SCO mg/kg	SB-8 (0-2) L1315035-11 8/6/2013 1	SB-8 (5-7) L1315035-12 8/6/2013 1	SB-9 (5-5.5) L1321227-01 10/18/2013 1	SB-10 (5-5.5) L1321227-02 10/18/2013 1	SB-11 (8.0) L1321227-03 10/22/2013 1
Aroclor 1016	**NS**	**NS**	0.0371 U	0.037 U	0.052 U	0.0389 U	0.0414 U
Aroclor 1221	**NS**	**NS**	0.0371 U	0.037 U	0.052 U	0.0389 U	0.0414 U
Aroclor 1232	**NS**	**NS**	0.0371 U	0.037 U	0.052 U	0.0389 U	0.0414 U
Aroclor 1242	**NS**	**NS**	0.0371 U	0.037 U	0.052 U	0.0389 U	0.0414 U
Aroclor 1248	**NS**	**NS**	0.0371 U	0.037 U	0.052 U	0.0389 U	0.0414 U
Aroclor 1254	**NS**	**NS**	0.0371 U	0.037 U	0.052 U	0.0389 U	0.0414 U
Aroclor 1260	**NS**	**NS**	0.0251 J	0.037 U	0.052 U	0.02 J	0.0256 J
Aroclor 1262	**NS**	**NS**	0.0371 U	0.037 U	0.052 U	0.0389 U	0.0414 U
Aroclor 1268	**NS**	**NS**	0.0371 U	0.037 U	0.052 U	0.0389 U	0.0414 U
Total PCBs	**0.1**	**1**	0.0251	ND	ND	0.02	0.0256

Pesticides - mg/kg

Dilution			10	10	1	1	1
4,4'-DDD	**0.0033**	**92**	0.0182 U	0.0177 U	0.00246 U	0.0019 U	0.00201 U
4,4'-DDE	**0.0033**	**62**	**0.00455** J	0.0177 U	0.00246 U	0.0019 U	0.00201 U
4,4'-DDT	**0.0033**	**47**	**0.0218** J	0.0332 U	0.00461 U	0.00355 U	**0.016**
Aldrin	**0.005**	**0.68**	0.0182 U	0.0177 U	0.00246 U	0.0019 U	0.00201 U
Alpha-BHC	**0.02**	**3.4**	0.00758 U	0.00739 U	0.00102 U	0.00079 U	0.000838 U
Beta-BHC	**0.036**	**3**	0.0182 U	0.0177 U	0.00246 U	0.0019 U	0.00201 U
Chlordane	**0.094**	**24**	0.148 U	0.144 U	0.02 U	0.0154 U	0.0163 U
cis-Chlordane	**0.094**	**24**	0.0227 U	0.0222 U	0.00307 U	0.00153 J	0.00426
Delta-BHC	**0.04**	**500**	0.0182 U	0.0177 U	0.00246 U	0.0019 U	0.00201 U
Dieldrin	**0.005**	**1.4**	0.0114 U	0.0111 U	0.00154 U	0.00118 U	0.00126 U
Endosulfan I	**2.4**	**200**	0.0182 U	0.0177 U	0.00246 U	0.0019 U	0.00201 U
Endosulfan II	**2.4**	**200**	0.0182 U	0.0177 U	0.00246 U	0.00152 J	0.00137 J
Endosulfan sulfate	**2.4**	**200**	0.00758 U	0.00739 U	0.00102 U	0.00079 U	0.000838 U
Endrin	**0.014**	**89**	0.00758 U	0.00739 U	0.00102 U	0.00079 U	0.000838 U
Endrin ketone	**NS**	**NS**	0.0182 U	0.0177 U	0.00246 U	0.0019 U	0.00201 U
Heptachlor	**0.042**	**15**	0.0091 U	0.00886 U	0.00123 U	0.000948 U	0.00101 U
Heptachlor epoxide	**NS**	**NS**	0.0341 U	0.0332 U	0.00461 U	0.00121 J	0.00176 J
Lindane	**0.1**	**9.2**	0.00758 U	0.00739 U	0.00102 U	0.00079 U	0.000838 U
Methoxychlor	**NS**	**NS**	0.0341 U	0.0332 U	0.00461 U	0.00355 U	0.00377 U
Toxaphene	**NS**	**NS**	0.341 U	0.332 U	0.0461 U	0.0355 U	0.0377 U
trans-Chlordane	**NS**	**NS**	0.0227 U	0.0222 U	0.00307 U	0.00237 U	0.00252 U

Table 6
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Remedial Investigation Report Groundwater Analytical Results
Volatile Organic Compounds

Client ID Lab Sample ID Date Sampled µg/L	NYSDEC Class GA Ambient Standard µg/L	GW-SB-4 L1315035-05 8/6/2013	GW-SB-5 L1315035-08 8/6/2013	GW-SB-8 L1315035-13 8/6/2013	MW-40 L1315188-01 8/7/2013	TRIP BLANK L1315035-18 8/6/2013	TRIP BLANK L1315188-04 8/7/2013
1,1,1,2-Tetrachloroethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,1,1-Trichloroethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,1,2,2-Tetrachloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	1	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
1,1-Dichloroethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,1-Dichloroethene	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloropropene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2,3-Trichlorobenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2,3-Trichloropropane	0.04	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2,4,5-Tetramethylbenzene	5	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2,4-Trimethylbenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2-Dibromo-3-chloropropane	0.04	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2-Dibromoethane	0.0006	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichlorobenzene	3	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2-Dichloroethane	0.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,3-Dichlorobenzene	3	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,3-Dichloropropane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,4-Dichlorobenzene	3	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,4-Diethylbenzene	NS	2 U	2 U	2 U	2 U	2 U	2 U
1,4-Dioxane	NS	250 U	250 U	250 U	250 U	250 U	250 U
2,2-Dichloropropane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone	50	5 U	5 U	5 U	5 U	5 U	5 U
4-Ethyltoluene	NS	2 U	2 U	2 U	2 U	2 U	2 U
4-Methyl-2-pentanone	NS	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50	1.4 J	2.7 J	4.4 J	4.3 J	3 J	2.4 J
Acrylonitrile	5	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	0.31 J	0.5 U	0.5 U	0.25 J	0.5 U	0.5 U
Bromobenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Bromochloromethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Bromodichloromethane	50	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	50	2 U	2 U	2 U	2 U	2 U	2 U
Bromomethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Carbon disulfide	60	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chloroethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chloroform	7	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chloromethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
cis-1,2-Dichloroethene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
cis-1,3-Dichloropropene	NS	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	50	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromomethane	5	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	5	5 U	5 U	5 U	5 U	5 U	5 U
Ethyl ether	NS	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Ethylbenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Hexachlorobutadiene	0.5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Isopropylbenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Methyl tert butyl ether	10	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Methylene chloride	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Naphthalene	10	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
n-Butylbenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
n-Propylbenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
o-Chlorotoluene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
o-Xylene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
p/m-Xylene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
p-Chlorotoluene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
p-Isopropyltoluene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
sec-Butylbenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Styrene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
tert-Butylbenzene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Tetrachloroethene	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
trans-1,2-Dichloroethene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
trans-1,3-Dichloropropene	NS	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,4-Dichloro-2-butene	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Trichloroethene	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichlorofluoromethane	5	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Vinyl acetate	NS	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	2	1 U	1 U	1 U	1 U	1 U	1 U

Table 7
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Remedial Investigation Report Groundwater Analytical Results
Semivolatile Organic Compounds

Client ID Lab Sample ID Date Sampled µg/L	NYSDEC Class GA Ambient Standard µg/L	GW-SB-4 L1315035-05 8/6/2013	GW-SB-5 L1315035-08 8/6/2013	GW-SB-8 L1315035-13 8/6/2013	MW-40 L1315188-01 8/7/2013
1,2,4,5-Tetrachlorobenzene	5	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	5	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	3	2 U	2 U	2 U	2 U
1,3-Dichlorobenzene	3	2 U	2 U	2 U	2 U
1,4-Dichlorobenzene	3	2 U	2 U	2 U	2 U
2,4,5-Trichlorophenol	NS	5 U	5 U	5 U	5 U
2,4,6-Trichlorophenol	NS	5 U	5 U	5 U	5 U
2,4-Dichlorophenol	5	5 U	5 U	5 U	5 U
2,4-Dimethylphenol	50	5 U	5 U	5 U	5 U
2,4-Dinitrophenol	10	20 U	20 U	20 U	20 U
2,4-Dinitrotoluene	5	5 U	5 U	5 U	5 U
2,6-Dinitrotoluene	5	5 U	5 U	5 U	5 U
2-Chloronaphthalene	10	0.2 U	0.2 U	0.2 U	0.2 U
2-Chlorophenol	NS	2 U	2 U	2 U	2 U
2-Methylnaphthalene	NS	0.2 U	0.2 U	0.2 U	0.2 U
2-Methylphenol	NS	5 U	5 U	5 U	5 U
2-Nitroaniline	5	5 U	5 U	5 U	5 U
2-Nitrophenol	NS	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	5	5 U	5 U	5 U	5 U
3-Methylphenol/4-Methylphenol	NS	5 U	5 U	5 U	5 U
3-Nitroaniline	5	5 U	5 U	5 U	5 U
4,6-Dinitro-o-cresol	NS	10 U	10 U	10 U	10 U
4-Bromophenyl phenyl ether	NS	2 U	2 U	2 U	2 U
4-Chloroaniline	5	5 U	5 U	5 U	5 U
4-Chlorophenyl phenyl ether	NS	2 U	2 U	2 U	2 U
4-Nitroaniline	5	5 U	5 U	5 U	5 U
4-Nitrophenol	NS	10 U	10 U	10 U	10 U
Acenaphthene	20	0.2 U	0.2 U	0.2 U	0.2 U
Acenaphthylene	NS	0.2 U	0.2 U	0.1 J	0.2 U
Acetophenone	NS	5 U	5 U	5 U	5 U
Anthracene	50	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(a)anthracene	0.002	**0.08** J	**0.24**	**0.19** J	0.2 U
Benzo(a)pyrene	ND	**0.1** J	**0.21**	**0.2**	0.2 U
Benzo(b)fluoranthene	0.002	**0.13** J	**0.23**	**0.22**	0.2 U
Benzo(ghi)perylene	NS	0.09 J	0.13 J	0.22	0.2 U
Benzo(k)fluoranthene	0.002	0.2 U	**0.17** J	**0.12** J	0.2 U
Benzoic Acid	NS	50 U	50 U	50 U	50 U
Benzyl Alcohol	NS	2 U	2 U	2 U	2 U
Biphenyl	5	2 U	2 U	2 U	2 U
Bis(2-chloroethoxy)methane	5	5 U	5 U	5 U	5 U
Bis(2-chloroethyl)ether	1	2 U	2 U	2 U	2 U
Bis(2-chloroisopropyl)ether	NS	2 U	2 U	2 U	2 U
Bis(2-Ethylhexyl)phthalate	5	3 U	3 U	3 U	3 U
Butyl benzyl phthalate	50	5 U	5 U	5 U	5 U
Carbazole	NS	2 U	2 U	2 U	2 U
Chrysene	0.002	**0.1** J	**0.26**	**0.22**	0.2 U
Dibenzo(a,h)anthracene	NS	0.2 U	0.2 U	0.2 U	0.2 U
Dibenzofuran	NS	2 U	2 U	2 U	2 U
Diethyl phthalate	50	5 U	5 U	5 U	5 U
Dimethyl phthalate	50	5 U	5 U	5 U	5 U
Di-n-butylphthalate	50	5 U	5 U	5 U	5 U
Di-n-octylphthalate	50	5 U	5 U	5 U	5 U
Fluoranthene	50	0.17 J	0.5	0.29	0.2 U
Fluorene	50	0.2 U	0.2 U	0.2 U	0.2 U
Hexachlorobenzene	0.04	0.8 U	0.8 U	0.8 U	0.8 U
Hexachlorobutadiene	0.5	0.5 U	0.5 U	0.5 U	0.5 U
Hexachlorocyclopentadiene	5	20 U	20 U	20 U	20 U
Hexachloroethane	5	0.8 U	0.8 U	0.8 U	0.8 U
Indeno(1,2,3-cd)Pyrene	0.002	0.2 U	**0.12** J	**0.15** J	0.2 U
Isophorone	50	5 U	5 U	5 U	5 U
Naphthalene	10	0.09 J	0.06 J	0.2 U	0.2 U
Nitrobenzene	0.4	2 U	2 U	2 U	2 U
NitrosoDiPhenylAmine(NDPA)/DPA	50	2 U	2 U	2 U	2 U
n-Nitrosodi-n-propylamine	NS	5 U	5 U	5 U	5 U
P-Chloro-M-Cresol	NS	2 U	2 U	2 U	2 U
Pentachlorophenol	NS	0.8 U	0.8 U	0.8 U	0.8 U
Phenanthrene	50	0.11 J	0.09 J	0.12 J	0.2 U
Phenol	NS	5 U	5 U	5 U	5 U
Pyrene	50	0.18 J	0.47	0.35	0.2 U

Table 8
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Remedial Investigation Report Groundwater Analytical Results
Metals - Total Dissolved

Client ID Lab Sample ID Date Sampled Dilution µg/L	NYSDEC Class GA Ambient Standard µg/L	GW-SB-4 L1315035-05 8/6/2013 25/250/1 *	GW-SB-5 L1315035-08 8/6/2013 25/250/1 *	GW-SB-8 L1315035-13 8/6/2013 25/250/1 *	MW-40 L1315188-01 8/7/2013 10/200/1 *
Aluminum	**NS**	34,500	3,360	930	62 J
Antimony	**3**	**6.42** J	**3.02** J	2.79 J	10 U
Arsenic	**25**	**25.23**	14.46	13.86	9.78 J
Barium	**1,000**	308.2	161.4	117.7	612.6
Beryllium	**3**	2.96 J	12.5 U	12.5 U	5 U
Cadmium	**5**	1.53 J	5 U	5 U	5 U
Calcium	**NS**	404,000	285,000	273,000	1,630,000
Chromium	**50**	**110.5**	17.83 J	13.42 J	10 U
Cobalt	**NS**	34.55	3.5 J	12.5 U	6.14
Copper	**200**	195.8	33.5	23.98 J	3.02 J
Iron	**300+**	**55,000**	**6,580**	**3,870**	**94,700**
Lead	**25**	**832.2**	**200.9**	**275.8**	10 U
Magnesium	**35,000**	**755,000**	**738,000**	**756,000**	**172,000**
Manganese	**300+**	**1,096**	79.55	76.45	**46,080**
Mercury	**0.7**	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	**100**	80.18	15.05	9.63 J	4.55 J
Potassium	**NS**	238,000	240,000	242,000	9,550
Selenium	**10**	**48.2** J	**42.8** J	**46.1** J	50 U
Silver	**50**	10 U	10 U	10 U	5 U
Sodium	**20,000**	**6,580,000**	**6,520,000**	**6,620,000**	**405,000**
Thallium	**0.5**	12.5 U	12.5 U	12.5 U	10 U
Vanadium	**NS**	89.95 J	14.01 J	6.75 J	50 U
Zinc	**2,000**	458	167.6 J	205.7 J	100 U

Dissolved Metals - µg/L

Aluminum	**NS**	58.5 J	250 U	250 U	100 U
Antimony	**3**	**5.53** J	25 U	25 U	10 U
Arsenic	**25**	10.87 J	10.72 J	13.63	3.48 J
Barium	**1,000**	65.7	44.05	39.1	561.2
Beryllium	**3**	12.5 U	12.5 U	12.5 U	5 U
Cadmium	**5**	5 U	5 U	5 U	2 U
Calcium	**NS**	312,000	267,000	264,000	1,700,000
Chromium	**50**	25 U	5.02 J	25 U	10 U
Cobalt	**NS**	12.5 U	12.5 U	12.5 U	7.87
Copper	**200**	4.91 J	5.69 J	5.02 J	3.08 J
Iron	**300+**	**1,920**	**1,540**	**1,680**	**65,600**
Lead	**25**	25 U	25 U	25 U	10 U
Magnesium	**35,000**	**724,000**	**724,000**	**735,000**	**158,000**
Manganese	**300+**	85.2	14.91	30.5	**49,940**
Mercury	**0.7**	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	**100**	7.05 J	7.36 J	7.04 J	15.89 J
Potassium	**NS**	235,000	225,000	227,000	9,480
Selenium	**10**	**43.6** J	**45.2** J	**50.4** J	**11.6** J
Silver	**50**	10 U	10 U	10 U	4 U
Sodium	**20,000**	**6,410,000**	**6,280,000**	**6,280,000**	**363,000**
Thallium	**0.5**	12.5 U	12.5 U	12.5 U	**0.51** J
Vanadium	**NS**	3.66 J	2.97 J	125 U	50 U
Zinc	**2,000**	250 U	250 U	250 U	15.42 J

Note: * = Dilution Rates vary.

Table 9
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Remedial Investigation Report Groundwater Analytical Results
Polychlorinated Biphenyls Pesticides

Client ID Lab Sample ID Date Sampled Dilution Polychlorinated Biphenyls - µg/L	NYSDEC Class GA Ambient Standard µg/L	GW-SB-4 L1315035-05 8/6/2013	GW-SB-5 L1315035-08 8/6/2013	GW-SB-8 L1315035-13 8/6/2013	MW-40 L1315188-01 8/7/2013
Aroclor 1016	**NS**	0.083 U	0.083 U	0.083 U	0.083 U
Aroclor 1221	**NS**	0.083 U	0.083 U	0.083 U	0.083 U
Aroclor 1232	**NS**	0.083 U	0.083 U	0.083 U	0.083 U
Aroclor 1242	**NS**	0.083 U	0.083 U	0.083 U	0.083 U
Aroclor 1248	**NS**	0.083 U	0.083 U	0.083 U	0.083 U
Aroclor 1254	**NS**	0.083 U	0.083 U	0.083 U	0.083 U
Aroclor 1260	**NS**	0.083 U	0.083 U	0.083 U	0.083 U
Aroclor 1262	**NS**	0.083 U	0.083 U	0.083 U	0.083 U
Aroclor 1268	**NS**	0.083 U	0.083 U	0.083 U	0.083 U
Total PCBs	**0.09**	ND	ND	ND	ND

Pesticides - µg/L

4,4'-DDD	**0.3**	0.04 U	0.04 U	0.04 U	0.04 U
4,4'-DDE	**0.2**	0.04 U	0.04 U	0.04 U	0.04 U
4,4'-DDT	**0.2**	0.04 U	0.04 U	0.04 U	0.04 U
Aldrin	**ND**	0.02 U	0.02 U	0.02 U	0.02 U
Alpha-BHC	**0.01**	0.02 U	0.02 U	0.02 U	0.02 U
Beta-BHC	**0.04**	0.02 U	0.02 U	0.02 U	0.02 U
Chlordane	**0.05**	0.2 U	0.2 U	0.2 U	0.2 U
cis-Chlordane	**0.05**	0.02 U	0.02 U	0.02 U	0.02 U
Delta-BHC	**0.04**	0.02 U	0.02 U	0.02 U	0.02 U
Dieldrin	**0.004**	0.04 U	0.04 U	0.04 U	0.04 U
Endosulfan I	**NS**	0.02 U	0.02 U	0.02 U	0.02 U
Endosulfan II	**NS**	0.04 U	0.04 U	0.04 U	0.04 U
Endosulfan sulfate	**NS**	0.04 U	0.04 U	0.04 U	0.04 U
Endrin	**ND**	0.04 U	0.04 U	0.04 U	0.04 U
Endrin ketone	**5**	0.04 U	0.04 U	0.04 U	0.04 U
Heptachlor	**0.04**	0.02 U	0.02 U	0.02 U	0.02 U
Heptachlor epoxide	**0.03**	0.02 U	0.02 U	0.02 U	0.02 U
Lindane	**0.05**	0.02 U	0.02 U	0.02 U	0.02 U
Methoxychlor	**35**	0.2 U	0.2 U	0.2 U	0.2 U
Toxaphene	**0.06**	0.2 U	0.2 U	0.2 U	0.2 U
trans-Chlordane	**0.05**	0.02 U	0.02 U	0.02 U	0.02 U

Table 10
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Remedial Investigation Report Soil Vapor Analytical Results
Volatile Organic Compounds

Client ID Lab Sample ID Date Sampled Dilution µg/m3	NYSDOH 2006 Soil Vapor Intrusion Air Guideline Value µg/m³	NYSDOH 2005 HEI RIOPA 95th Percentile Indoor µg/m³	NYSDOH 2003 Soil Vapor Indoor Upper Fence µg/m³	EPA 2001 BASE 90th percentile Indoor µg/m³	SV-1 L1315132-03 8/7/2013 1	SV-2 L1315132-02 8/7/2013 1	SV-3 L1315132-01 8/7/2013 1	SV-4 L1315042-01 8/6/2013 2	SV-5 L1315042-02 8/6/2013 3.333
1,1,1-Trichloroethane	NS	NS	2.5	20.6	1.09 U	2.25	1.09 U	2.62	3.64 U
1,1,2,2-Tetrachloroethane	NS	NS	0.4	NS	1.37 U	1.37 U	1.37 U	2.75 U	4.58 U
1,1,2-Trichloroethane	NS	NS	0.4	<1.5	1.09 U	1.09 U	1.09 U	2.18 U	3.64 U
1,1-Dichloroethane	NS	NS	0.4	<0.7	0.809 U	0.809 U	0.809 U	1.62 U	2.7 U
1,1-Dichloroethene	NS	NS	0.4	<1.4	0.793 U	0.793 U	0.793 U	1.59 U	2.64 U
1,2,4-Trichlorobenzene	NS	NS	0.5	<6.8	1.48 U	1.48 U	1.48 U	2.97 U	4.95 U
1,2,4-Trimethylbenzene	NS	NS	9.8	9.5	21.1	35.1	25.1	164	203
1,2-Dibromoethane	NS	NS	0.4	<1.5	1.54 U	1.54 U	1.54 U	3.07 U	5.13 U
1,2-Dichlorobenzene	NS	NS	0.5	<1.2	1.2 U	1.2 U	1.2 U	2.4 U	4.01 U
1,2-Dichloroethane	NS	NS	0.4	<0.9	0.809 U	0.809 U	0.809 U	1.62 U	2.7 U
1,2-Dichloropropane	NS	NS	0.4	<1.6	0.924 U	0.924 U	0.924 U	1.85 U	3.08 U
1,3,5-Trimethylbenzene	NS	NS	3.9	3.7	7.18	10	8.26	39.5	51.1
1,3-Butadiene	NS	NS	0.5	<3.0	3.43	0.867	0.442 U	2.08	1.48 U
1,3-Dichlorobenzene	NS	NS	0.5	<2.4	1.2 U	1.2 U	1.2 U	2.4 U	4.01 U
1,4-Dichlorobenzene	NS	344	1.2	5.5	1.2 U	1.2 U	1.2 U	2.4 U	4.01 U
1,4-Dioxane	NS	NS	NS	NS	0.721 U	0.721 U	0.721 U	1.44 U	2.4 U
2,2,4-Trimethylpentane	NS	NS	5	NS	0.934 U	0.934 U	0.934 U	1.87 U	3.12 U
2-Butanone	NS	NS	16	12	29.4	19.1	6.72	28.5	45.4
2-Hexanone	NS	NS	NS	NS	17.9	10	1.41	3.16	6.27
3-Chloropropene	NS	NS	NS	NS	0.626 U	0.626 U	0.626 U	1.25 U	2.09 U
4-Ethyltoluene	NS	NS	NS	3.6	6.78	9.49	10.5	64.9	83.1
4-Methyl-2-pentanone	NS	NS	1.9	6	12.7	4.22	0.82 U	3.54	6.23
Acetone	NS	45.8	115	98.9	160	380	44.2	1040	1310
Benzene	NS	10	13	9.4	6.87	5.43	4.41	30.8	48.9
Benzyl chloride	NS	NS	NS	<6.8	1.04 U	1.04 U	1.04 U	2.07 U	3.45 U
Bromodichloromethane	NS	NS	NS	NS	1.35	1.34 U	1.82	2.68 U	4.47 U
Bromoform	NS	NS	NS	NS	2.07 U	2.07 U	2.07 U	4.14 U	6.9 U
Bromomethane	NS	NS	0.5	<1.7	0.777 U	0.777 U	0.777 U	1.55 U	2.59 U
Carbon disulfide	NS	NS	NS	4.2	9.12	12.3	4.17	26.6	26.8
Carbon tetrachloride	NS	1.1	1.3	<1.3	1.26 U	1.26 U	1.26 U	2.52 U	4.2 U
Chlorobenzene	NS	NS	0.4	<0.9	0.921 U	0.921 U	0.921 U	1.84 U	3.07 U
Chloroethane	NS	NS	0.4	<1.1	0.528 U	0.528 U	0.528 U	1.06 U	1.76 U
Chloroform	NS	6.34	1.2	1.1	7.52	155	17.1	39.2	68.4
Chloromethane	NS	NS	4.2	3.7	0.413 U	0.413 U	0.413 U	0.826 U	1.38 U
cis-1,2-Dichloroethene	NS	NS	0.4	<1.9	0.793 U	0.793 U	0.793 U	1.59 U	2.64 U
cis-1,3-Dichloropropene	NS	NS	0.4	<2.3	0.908 U	0.908 U	0.908 U	1.82 U	3.03 U
Cyclohexane	NS	NS	6.3	NS	1.91	1.95	1.45	9.29	15.9
Dibromochloromethane	NS	NS	NS	NS	1.7 U	1.7 U	1.7 U	3.41 U	5.68 U
Dichlorodifluoromethane	NS	NS	10	16.5	2.11	2.34	1.97	4.53	5.54
Ethanol	NS	NS	1300	210	11.6	19.4	19	69.9	83.7
Ethyl Acetate	NS	NS	NS	5.4	1.8 U	1.8 U	1.8 U	3.6 U	6.02 U
Ethylbenzene	NS	7.62	6.4	5.7	16.4	14.6	25.8	130	193
Freon-113	NS	NS	2.5	3.5	1.53 U	1.53 U	1.53 U	3.07 U	5.11 U
Freon-114	NS	NS	0.4	NS	1.4 U	1.4 U	1.4 U	2.8 U	4.66 U
Heptane	NS	NS	18	NS	23.6	21	16.5	64.3	98.8
Hexachlorobutadiene	NS	NS	0.5	<6.8	2.13 U	2.13 U	2.13 U	4.27 U	7.11 U
Isopropanol	NS	NS	NS	250	3.2	5.65	1.92	7.74	16.3
Methyl tert butyl ether	NS	36	14	11.5	0.721 U	0.721 U	0.721 U	1.44 U	2.4 U
Methylene chloride	60	7.5	16	10	3.47 U	4.62	3.47 U	**65.3**	29.5
n-Hexane	NS	NS	14	10.2	6.8	11.8	6.52	41.9	65.6
o-Xylene	NS	7.24	7.1	7.9	22.9	21.6	34.1	140	200
p/m-Xylene	NS	22.2	11	22.2	65.2	63.4	109	539	764
Propylene	NS	NS	NS	NS	28.6	5.59	0.861 U	22.9	19.8
Styrene	NS	5.13	1.4	1.9	0.992	0.852 U	4.04	1.7 U	2.84 U
Tetrachloroethene	30	6.01	2.5	15.9	6.69	**80.7**	7.05	**36.4**	**39.1**
Tetrahydrofuran	NS	NS	0.8	NS	8.49	2.76	5.66	1.81	1.97 U
Toluene	NS	39.8	57	43	60.7	56.9	81.4	430	659
trans-1,2-Dichloroethene	NS	NS	NS	NS	0.793 U	0.793 U	0.793 U	1.59 U	2.64 U
trans-1,3-Dichloropropene	NS	NS	NC	<1.3	0.908 U	0.908 U	0.908 U	1.82 U	3.03 U
Trichloroethene	5	1.36	0.5	4.2	1.07 U	1.76	1.07 U	2.15 U	3.58 U
Trichlorofluoromethane	NS	NS	12	18.1	2.74	2.98	1.14	6.24	16.5
Vinyl acetate	NS	NS	NS	NS	0.704 U	0.704 U	0.704 U	1.41 U	2.35 U
Vinyl bromide	NS	NS	NS	NS	0.874 U	0.874 U	0.874 U	1.75 U	2.92 U
Vinyl chloride	NS	NS	0.4	<1.9	0.511 U	0.511 U	0.511 U	1.02 U	1.71 U

Tables 2-10
NYULMC Science Building
East 30th Street and FDR Drive
New York, NY
Phase II ESA Analytical Results
Notes

GENERAL

NS : No soil cleanup objective listed.

ND : No Detect.

NA : Not analyzed.

U : The analyte was not detected at the indicated concentration.

J : The concentration given is an estimated value.

SOIL

Exceedences of Part 375 Unrestricted SCOs are highlighted in bold font.

Exceedences of Part 375 Commercial SCOs are highlighted in gray.

Part 375 Soil Cleanup Objectives : Soil Clean-up Objectives listed in NYSDEC (New York State Department of Environmental Conservation) "Part 375" Regulations (6 NYCRR Part 375).

mg/kg : milligrams per kilogram = parts per million (ppm)

GROUNDWATER

Exceedences are highlighted in bold font.

NYSDEC Class GA Ambient Standard : New York State Department of Environmental Conservation Technical and Operational Guidance Series (1.1.1): Class GA Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.

µg/L : micrograms per Liter = parts per billion (ppb)

SOIL VAPOR

Exceedences of NYSDOH Soil Vapor Intrusion Air Guidance Value are highlighted in bold font.

NYSDOH Soil Vapor Intrusion Air Guidance Value : NYSDOH Air Guideline Values (AGVs) presented in the Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006 ("NYSDOH Vapor Intrusion Guidance Document").

NYSDOH 2003 Soil Vapor Indoor Upper Fence : Upper fence indoor air values from "Table C1. NYSDOH 2003: Study of Volatile Organic Chemicals in Air of Fuel Oil Heated Homes", published in the NYSDOH Soil Vapor Intrusion Guidance Document, Appendix C" (October 2006).

EPA 2001 BASE 90th percentile : 90th Percentile indoor air values from "Table C-2. EPA 2001: Building Assessment and Survey Evaluation (BASE) Database, SUMMA canister method", published in the NYSDOH Soil Vapor Intrusion Guidance Document, Appendix C" (October 2006).

HEI RIOPA 2005 95th percentile : 95th Percentile Indoor Air Values from Table C-5, Health Effects Institute (HEI) 2005: Relationship of Indoor, Outdoor and Personal Air, published in the NYSDOH Soil Vapor Intrusion Guidance Document, Appendix C" (October 2006).

$\mu g/m^3$: micrograms per cubic meter of air

APPENDIX 1

CITIZEN PARTICIPATION PLAN

The NYC Office of Environmental Remediation and NYULMC have established this Citizen Participation Plan because the opportunity for citizen participation is an important component of the NYC Voluntary Cleanup Program. This Citizen Participation Plan describes how information about the project will be disseminated to the Community during the remedial process. As part of its obligations under the NYC VCP, NYULMC will maintain a repository for project documents and provide public notice at specified times throughout the remedial program. This Plan also takes into account potential environmental justice concerns in the community that surrounds the project Site. Under this Citizen Participation Plan, 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 the NYC Office of Environmental Remediation (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, Cavy Chu, who can be contacted about these issues or any others questions, comments or concerns that arise during the remedial process at (212) 788-8841.

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 NYC OER at (212) 788-8841 or by email at brownfields@cityhall.nyc.gov.

Repositories. A document repository is maintained in the nearest public library that maintains evening and weekend hours. This document repository is intended to house, for community review, all principal documents generated during the cleanup program including Remedial Investigation plans and reports, Remedial Action work plans and reports, and all public notices and fact sheets produced during the lifetime of the remedial project. NYULMC will inspect the repositories to ensure that they are fully populated with project information. The repository for this project is:

Kips Bay Library
446 Third Avenue at East 31st St.
New York, NY 10016

212-683-2520

Hours of operation:

Mon	11:00 AM - 6:00 PM
Tue	12:00 PM - 7:00 PM
Wed	11:00 AM - 6:00 PM
Thu	12:00 PM - 7:00 PM
Fri	10:00 AM - 5:00 PM
Sat	10:00 AM - 5:00 PM
Sun	closed

Digital Documentation. NYC 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.

Public Notice and Public Comment. Public notice to all members of the Project 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 NYULMC, reviewed and approved by OER prior to distribution and mailed by NYULMC. Public comment is solicited in public notices for all work plans developed under the NYC

Voluntary Cleanup Program. 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 NYC VCP project. See flow chart on the following page, which identifies when during the NYC 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.**

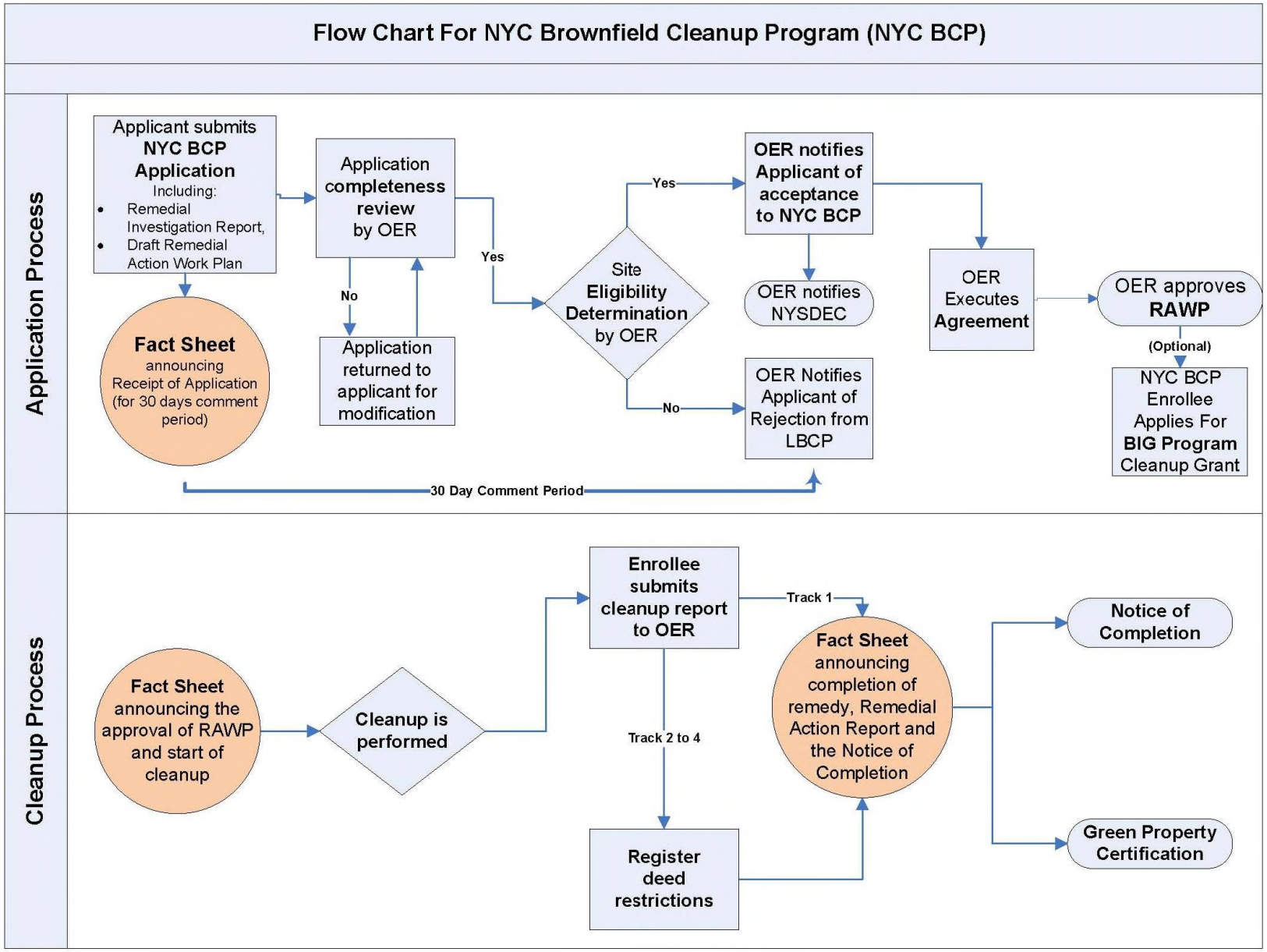
  Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the availability of the Remedial Investigation Report and Remedial Action Work Plan and the initiation of a 30-day public comment period on the Remedial Action Work Plan. The Fact Sheet summarizes 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 the Site, and announcing the issuance of the Notice of Completion.


Flow Chart For NYC Brownfield Cleanup Program (NYC BCP)
Application Process
Applicant submits NYC BCP Application Including: • Remedial Investigation Report, • Draft Remedial Action Work Plan
Fact Sheet announcing Receipt of Application (for 30 days comment period)
Application completeness review by OER
No
Application returned to applicant for modification
Yes
Site Eligibility Determination by OER
Yes
OER notifies Applicant of acceptance to NYC BCP
OER notifies NYSDEC
No
OER Notifies Applicant of Rejection from LBCP
30 Day Comment Period
OER Executes Agreement
OER approves RAWP
(Optional)
NYC BCP Enrollee Applies For BIG Program Cleanup Grant
Cleanup Process
Fact Sheet announcing the approval of RAWP and start of cleanup
Cleanup is performed
Enrollee submits cleanup report to OER
Track 1
Track 2 to 4
Register deed restrictions
Fact Sheet announcing completion of remedy, Remedial Action Report and the Notice of Completion
Notice of Completion
Green Property Certification

APPENDIX 2

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.

An estimate of the quantity (in tons) of clean, non-virgin materials (reported by type of material) reused under this plan 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.

An estimate of the quantity (in tons) of virgin and non-renewable resources, the use of which will be avoided under this plan, will be quantified and reported in the RAR.

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 Remedial Action Report (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.

An estimate of the volume of clean fuels used during remedial activities will be quantified and reported in the RAR.

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.

Measures to limit the potential for recontamination include capping of residual fill materials with building foundations, pavement or a soil cap, the use of demarcation above the residual fill layer, and the use of a vapor barrier to limit the migration of soil vapor contamination. 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 storm-water and sewer discharges to NYC's sewage treatment plants during periods of precipitation, and reduces the volume of untreated influent to local surface waters.

An estimate of the enhanced stormwater retention capability of the redevelopment project will be included in the RAR.

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. NYULMC 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. NYULMC 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.

An estimate of the land area that will be vegetated, including the number of trees planted or preserved, will be reported in square feet in the RAR.

APPENDIX 3

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 soil 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 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. Soil proposed for reuse on-site will be managed as defined in this plan. Waste characterization results will be provided to OER on an ongoing basis as the testing is conducted.

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; and
- 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 to minimize off-site disturbance. Off-site queuing will be minimized.

Outbound truck transport routes are as follows: east on East 30th Street, south on the FDR Drive service road, west on West 26th Street, north on First Avenue, west on East 34th Street, north on Tenth Avenue and west on West 41st Street for access to Lincoln Tunnel. 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 Manhattan, 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 affected 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 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 derived from the Site that does not exhibit evidence of contamination may be reused on-site beneath the building, pavement or soil cap. ‘Reuse on-site’ means material that is excavated during the remedy or development, does not leave the Site, is relocated within the same Site and on comparable soil/fill material, and addressed pursuant to the NYC VCP agreement subject to Engineering and Institutional Controls. 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.

Safe construction of elements of the new building’s foundations will require temporary relocation of soil to create excavations with sloping walls, with a portion of the relocated soil replaced around these structural elements following their construction. Unless it exhibits

evidence of contamination (e.g., odors, staining and/or elevated PID readings), soil relocated during foundation construction will be reused on-site without additional testing, and will be capped by the building's concrete foundations, paving or clean cover soil in areas to be landscaped or otherwise unpaved. Grossly contaminated soil will not be reused on-site. No soil exhibiting evidence of contamination will be reused on-site.

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 any 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 soil, pavement and associated sub-soil, 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. In Site areas that will be capped by new floor slabs, the new slabs will serve as the demarcation. Materials within this horizon require adherence to special conditions during future invasive activities as defined in the Site Management Plan.

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 soil will meet OER-approved backfill and cover soil quality objectives for this Site. The backfill and cover soil quality objectives will

be the lower of Restricted Commercial SCOs and Groundwater Protection Standard listed in 6 NYCRR Part 375-6.7(d) and table 375-6.8(b).

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; and
- Clean recycled concrete aggregate (RCA) from facilities permitted or registered by the regulations of NYS DEC.

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.

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 the entire amount of soil required 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;
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 500 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)

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 dewatering fluids, will be handled, transported and disposed in accordance with applicable laws and regulations. Discharge of water generated during remedial construction to surface waters (i.e., a stream or river) is prohibited without a SPDES permit issued by New York State Department of Environmental Conservation. Groundwater testing, and, if necessary, pre-treatment (depending upon the testing results) would be conducted to comply with SPDES requirements as determined by NYS DEC. If discharge to sewers connected to an NYCDEP wastewater treatment plant is contemplated, NYCDEP approval will be obtained.

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 NYS DEC 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. If nuisance odors are detected, 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 soil. If odors develop and cannot otherwise be controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soil 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 Remedial Action Report.

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 Remedial Action Report.

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.

APPENDIX 4

HEALTH AND SAFETY PLAN

NYU Langone Medical Center – Science Building

Block 962, part of Lot 7501

NEW YORK, NEW YORK

Construction Health and Safety Plan

OER Project Number 14RHAZ138M

AKRF Project Number 11467

Restrictive Declaration No. 2011000084677

Prepared for:

NYU Langone Medical Center– Project Planning and Design
323 East 29th Street
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Figure 1 - Hospital Location Map

APPENDICES

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 Plan (RAP) developed for the Site.

3.0 SITE DESCRIPTION

3.1 General Information

This CHASP has been prepared by AKRF, Inc. (AKRF) on behalf of NYU Langone Medical Center (NYULMC) for the Science Building project site (the "Site"), located in the southern portion of the NYULMC superblock in Manhattan. The Site is legally defined as Tax Block 962, portion of Lot 7501. The Site was assigned Restrictive Declaration No. 2011000084677 as part of the NYULMC Kimmel Program variance action in March 2011. The Site is currently occupied by three former NYULMC buildings: (a dormitory, a lecture hall and offices) which are in the process of being demolished. A Site location map is provided as Figure 1.

The proposed project will entail demolition of the existing buildings followed by the construction of a new multistory research building with a partial cellar in its northwestern portion. The new building's foundations would include pressure slabs (used as a foundation and flood-proofing measure). The bottom of the ground-floor pressure slab would be at approximately 3.5 feet Manhattan Borough Datum (MBD). The bottom of the cellar pressure slab would be at approximately -8.5 feet MBD. The pressure slabs would be underlain by three-inch thick mud slabs. Much of the proposed cellar area is existing cellar space, with existing tops of floor slabs ranging from approximately +8 to -5 feet MBD. Excavation for the new construction would generally extend less than 10 feet below the existing foundation slabs, with areas of deeper excavation (up to approximately 23 feet below the existing slabs) for footings and sumps. Portions of the Site where existing floor grades are below the proposed new pressure slab elevation would be backfilled. Dewatering will likely be required to accommodate the deeper excavations.

3.2 Hazard Potential

The hazard potential at the Site was evaluated based on findings of a *Phase I Environmental Site Assessment* (AKRF, February 2011) and a *Remedial Investigation (RI) Report* (AKRF, November 2013). Soil encountered during the RI included urban fill materials consisting of sand, gravel, silt,

brick and concrete with some timber and rubble (likely associated with a historical East River bulkhead). No indications of contamination [e.g., elevated photoionization detector (PID) readings, staining or odors] were detected in any of the recovered soil. Groundwater was encountered at elevations of approximately 0 to -3 feet MBD, and is likely tidally influenced. No sheen or odors were detected in the sampled groundwater.

Soil analytical results were compared to NYSDEC 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs) and Restricted - Commercial Use Soil Cleanup Objectives (CSCOs). The soil samples showed detections of low levels of volatile organic compounds (VOCs), some of which exceeded USCOs, but not CSCOs. The detected VOCs were likely attributable to historical use at the Site and/or urban fill materials, but were not indicative of a spill or release. The soil samples also contained semi-volatile organic compounds (SVOCs), metals, PCBs, and pesticides which appeared to be attributable to the urban fill. Concentrations of certain SVOCs, metals and pesticides exceeded their respective USCOs, with some SVOCs and metals also exceeding CSCOs. No visual, olfactory, or PID readings indicative of a spill or release were noted during field screening.

Groundwater sample analytical results were compared to NYSDEC Class GA Ambient Water Quality Standards, which are intended for current or potential potable water supplies, even though groundwater in Manhattan is not such a source. Groundwater samples showed detections of two VOCs (benzene and acetone) at concentrations below Class GA standards, which appeared to be attributable to some combination of historical use at the Site, off-site sources and/or urban fill, but were not indicative of a release or spill at the Site. The groundwater samples also contained SVOCs and metals in exceedance of Class GA standards, which appeared to be attributable to sediment entrained in the samples and (for some metals) natural sources such as brackish water. No pesticides or PCBs were detected in the groundwater samples. No visual, olfactory, or PID readings indicative of a spill or release were noted.

Laboratory analysis of sub-slab soil vapor samples showed concentrations of VOCs generally associated with petroleum and solvents, in exceedance of certain indoor air background levels published in the 2006 *New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (which were used for comparison). The solvent-related VOC methylene chloride was present at a concentration of 65.3 $\mu g/m^3$ in one soil vapor sample, slightly exceeding the NYSDOH Indoor Air Guideline Value (AGV) of 60 $\mu g/m^3$. The solvent-related VOC tetrachloroethylene was present at concentrations ranging from 6.69 to 80.7 $\mu g/m^3$, exceeding its AGV of 30 $\mu g/m^3$ in three of five soil vapor samples. As noted above, some petroleum-related VOCs were detected at low concentrations in soil and/or groundwater samples. Thus, the VOCs detected in soil vapor appeared to be attributable to some combination of historical use at the Site, off-site sources and urban fill materials, but did not appear to indicate an on-site spill or release.

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 investigations, 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		
(x) Organic Chemicals	(x) Inorganic Chemicals	( ) Radiological
( ) Biological	( ) Explosive/Flammable	( ) Oxygen Deficient Atm.
(x) Heat Stress	(x) Cold Stress	( ) Other
Comments: No personnel are permitted to enter permit confined spaces		

3.3.2 Physical Characteristics

Check all that apply		
(x) Liquid	(x) Solid	( ) Sludge
(x) Vapors	( ) Unknown	( ) Other

3.3.3 Hazardous Materials

Check all that apply					
Chemicals	**Solids**	**Sludges**	**Solvents**	**Oils**	**Other**
( ) Acids	( ) Ash	( ) Paints	(x) Halogens	( ) Transformer	( ) Lab
( ) Caustics	( ) Asbestos	( ) Metals	( ) Petroleum	( ) Other DF	( ) Pharm.
(x) Pesticides	( ) Tailings	( ) POTW	( ) Other	( ) Motor or Hydraulic Oil	(x) Hospital
(x) Petroleum	(x) Other: Fill Material	( ) Other		(x) Gasoline	( ) Rad.
( ) Inks				(x) Fuel Oil	( ) MGP
( ) PCBs					( ) Mold
(x) Metals					( ) Cyanide
(x) Other: VOCs & SVOCs					

3.3.4 Known and Suspect Chemicals of Concern

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
Acetone	REL = 250 ppm PEL = 1,000 ppm	Irritation eyes, nose, throat, lungs; headache, light-headedness, confusion, increased pulse rate; nausea, vomiting; long-term exposure – possible kidney, liver, nerve damage, reproductive effects
Arsenic	REL = 0.002 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
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
Chromium	REL = 0.5 mg/m^3 PEL = 1 mg/m^3	Irritation eyes, skin; lung fibrosis (histologic)
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
DDT/DDE (pesticides)	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.
Magnesium	PEL = 15 mg/m^3	Irritation eyes, nose; metal fume fever: cough, chest pain, flu-like fever
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
Methylene Chloride	PEL = 25 ppm STEL = 125 ppm	Dizziness, nausea, tingling or numbness (fingers/toes); skin irritation; carcinogen
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m^3	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; potential carcinogen
Sodium	REL = 2 mg/m^3 PEL = 2 mg/m^3	Irritation eyes, skin, mucous membrane; pneumonitis; eye, skin burns; temporary loss of hair
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; 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

Chemicals	REL/PEL/STEL (ppm)	Health Hazards
Zinc	REL = 10 mg/m^3 PEL = 15 mg/m^3	Irritation eyes, skin, upper respiratory system; cough
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 (up-dated 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 OER would 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 or 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	Other Earth Moving Activities
Level D (x) Steel Toe Shoes (x) Hard Hat **(within 25 ft of excavator)** (x) Work Gloves	(x) Safety Glasses ( ) Face Shield (x) Ear Plugs (within 25 ft of drill rig/excavator) (x) Latex Gloves	Yes	Yes
Level D – Modified ***(in addition to Level D)*** (x) Tyvek Coveralls	(x) Nitrile Gloves ( ) Overboots ( ) Saranex Coveralls	As necessary	As Necessary
Level C ***(in addition to Level D – Modified)*** ( ) Half-Face Respirator (x) Full Face Respirator ( ) Full-Face PAPR	( ) Particulate Cartridge ( ) Organic Cartridge (x) Dual Organic/ Particulate Cartridge	If PID > 10 ppm (breathing zone)	If PID > 10 ppm (breathing zone)
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breathe or any odors detected).			

7.2 Work Zone Air Monitoring and Community Air Monitoring

As outlined in the RAP, 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 September 2013 RAP prepared for the Site.

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 of 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. Wash water will be collected for treatment and/or disposal.

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 are provided in Appendix B. Information on emergency hand signals is provided in 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, eye-wash, and blood-borne pathogens 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; and
- 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;
- 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 (sorbent 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 **NYU Langone Medical Center Emergency Department** is located on the project superblock, as shown on Figure 1.

Hospital Information and Directions

Hospital Name:	NYU Langone Medical Center
Phone Number:	(212) 263-7300
Address/Location:	550 First Avenue – New York, New York (First Avenue and East 33rd Street)
Directions:	The entrance to the Emergency Department is located at 560 First Avenue at East 33rd Street.

If driving, the nearest hospital is **Bellevue Hospital Center**, located at 462 First Avenue, also shown on Figure 1.

Hospital Information and Directions

Hospital Name:	Bellevue Hospital Center
Phone Number:	(212) 562-4141
Address/Location:	462 First Avenue – New York, New York (East 28th Street extension between First Avenue and FDR Drive Service Road)
Directions:	1. Drive EAST on *East 30th Street*. 2. Turn RIGHT onto *FDR Drive Service Road*. Do not take DFR Drive on-ramp. 3. Turn RIGHT at *Bellevue Hospital Center* sign / *East 28th Street extension*. The entrance to the Emergency Department is located on the left.

9.3 CHASP Contact Information

AKRF Project Director – Michelle Lapin……..... .(646) 388-9520 (office)
AKRF Project Manager – Axel Schwendt..... (646) 388-9529 (office)
Site Safety Officer (SSO) – Erik Nimlos.....(917) 613-5977 (cell)
NYULMC Representative – Claudia Gorun..... (212) 263-2458 (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
Consolidated Edison Representative - Chris Hughes ..... (718) 204-4295

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 (CHASP) for the NYU Langone Medical Center – Science Building site in New York, 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 HASP could lead to my removal from the site.

Signed: _____ Company: _____ Date: _____
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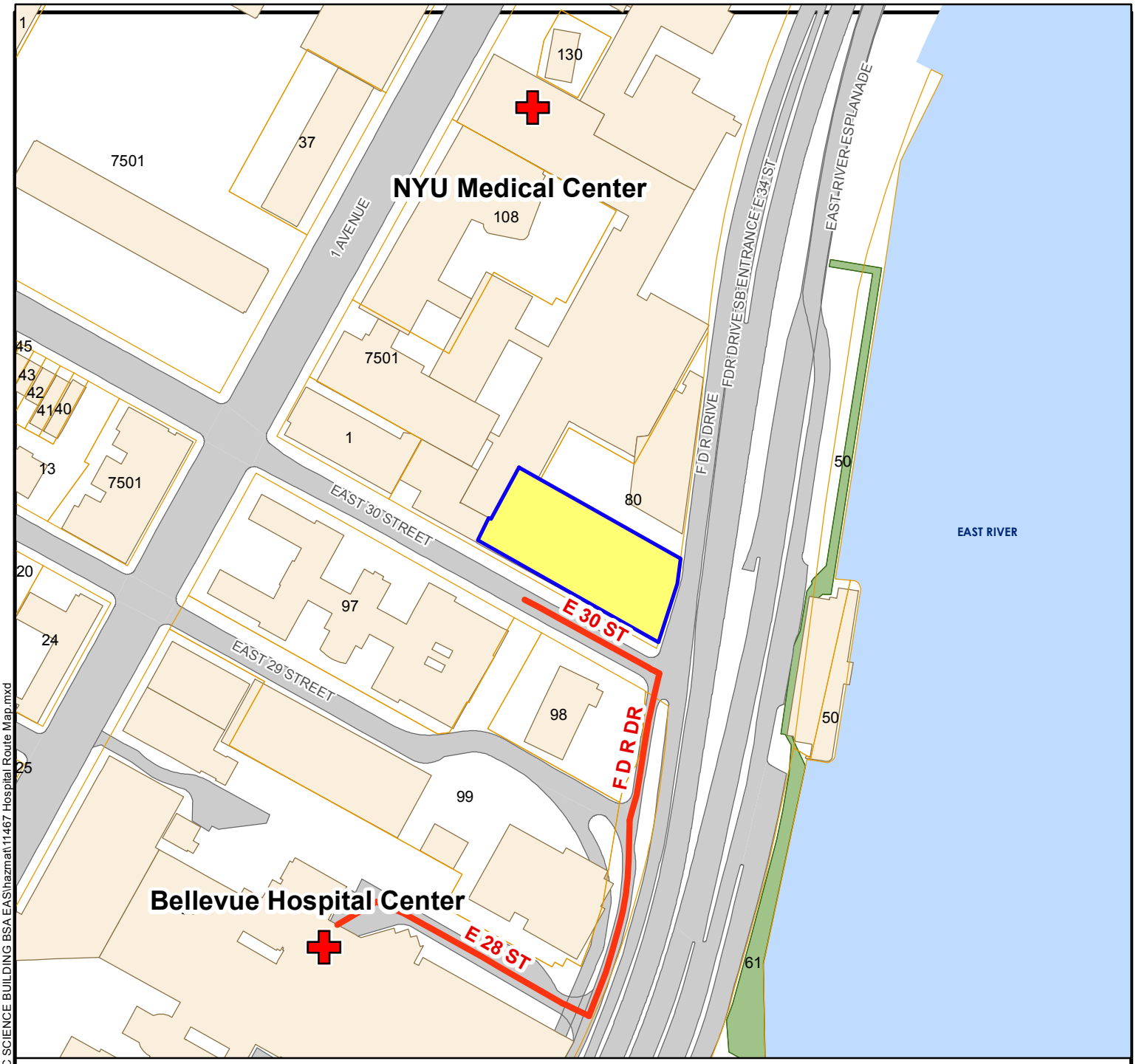
FIGURES



Legend

- Route to Hospital
- Project Site Location
- Hospital Location

0 250 500 Feet

Bellevue Hospital Center
462 1st Avenue
New York, NY 10016

NYU Langone Medical Center Science Building New York, New York	AKRF	DATE **9/18/2013**
		PROJECT No. **11467**
HOSPITAL LOCATION MAP	Environmental Consultants 440 Park Avenue South, New York, N.Y. 10016	FIGURE **1**

© 2013 AKRF, Inc. Environmental Consultants O:\Projects\11467 - NYULMC SCIENCE BUILDING BSA EAS\hazmat\11467 Hospital Route Map.mxd

APPENDIX A

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ACETONE
CAS # 67-64-1

Agency for Toxic Substances and Disease Registry ToxFAQs September 1995

This fact sheet answers the most frequently asked health questions (FAQs) about acetone. 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 acetone results mostly from breathing air, drinking water, or coming in contact with products or soil that contain acetone. Exposure to moderate-to-high amounts of acetone can irritate your eyes and respiratory system, and make you dizzy. Very high exposure may cause you to lose consciousness. This chemical has been found in at least 572 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is acetone?

(Pronounced ăs′ĭ-tōn′)

Acetone is a manufactured chemical that is also found naturally in the environment. It is a colorless liquid with a distinct smell and taste. It evaporates easily, is flammable, and dissolves in water. It is also called dimethyl ketone, 2-propanone, and beta-ketopropane.

Acetone is used to make plastic, fibers, drugs, and other chemicals. It is also used to dissolve other substances.

It occurs naturally in plants, trees, volcanic gases, forest fires, and as a product of the breakdown of body fat. It is present in vehicle exhaust, tobacco smoke, and landfill sites. Industrial processes contribute more acetone to the environment than natural processes.

What happens to acetone when it enters the environment?

- A large percentage (97%) of the acetone released during its manufacture or use goes into the air.
- In air, about one-half of the total amount breaks down from sunlight or other chemicals every 22 days.
- It moves from the atmosphere into the water and soil by rain and snow. It also moves quickly from soil and water back to air.
- Acetone doesn't bind to soil or build up in animals.
- It's broken down by microorganisms in soil and water.
- It can move into groundwater from spills or landfills.
- Acetone is broken down in water and soil, but the time required for this to happen varies.

How might I be exposed to acetone?

- Breathing low background levels in the environment.
- Breathing higher levels of contaminated air in the workplace or from using products that contain acetone (for example, household chemicals, nail polish, and paint).
- Drinking water or eating food containing acetone.
- Touching products containing acetone.
- For children, eating soil at landfills or hazardous waste sites that contain acetone.
- Smoking or breathing secondhand smoke.

How can acetone affect my health?

If you are exposed to acetone, it goes into your blood which then carries it to all the organs in your body. If it is a small amount, the liver breaks it down to chemicals that are not harmful and uses these chemicals to make energy for normal body functions. Breathing moderate- to-high levels

of acetone for short periods of time, however, can cause nose, throat, lung, and eye irritation; headaches; light-headedness; confusion; increased pulse rate; effects on blood; nausea; vomiting; unconsciousness and possibly coma; and shortening of the menstrual cycle in women.

Swallowing very high levels of acetone can result in unconsciousness and damage to the skin in your mouth. Skin contact can result in irritation and damage to your skin.

The smell and respiratory irritation or burning eyes that occur from moderate levels are excellent warning signs that can help you avoid breathing damaging levels of acetone.

Health effects from long-term exposures are known mostly from animal studies. Kidney, liver, and nerve damage, increased birth defects, and lowered ability to reproduce (males only) occurred in animals exposed long-term. It is not known if people would have these same effects.

How likely is acetone 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 acetone for carcinogenicity.

Acetone does not cause skin cancer in animals when applied to the skin. We don't know if breathing or swallowing acetone for long periods will cause cancer. Studies of workers exposed to it found no significant risk of death from cancer.

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

Methods are available to measure the amount of acetone in your breath, blood, and urine. The test can tell you how much acetone you were exposed to, although the amount that people have naturally in their bodies varies with each person. The tests can't tell you if you will experience any health effects from the exposure.

The test must be performed within 2-3 days after exposure because acetone leaves your body within a few days. These tests are not routinely performed at your doctor's office, but your doctor can take blood or urine samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA requires that spills of 5,000 pounds or more of acetone be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum concentration limit in workplace air of 1,000 parts of acetone per million parts of air (1,000 ppm) for an 8-hour workday over a 40-hour week to protect workers. The National Institute for Occupational Safety and Health (NIOSH) recommends an exposure limit of 250 ppm in workplace air for up to a 10-hour workday over a 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.
Evaporate: To change into a vapor or a gas.
Ingesting: Taking food or drink into your body.
Long-term: Lasting one year or longer.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. Toxicological profile for acetone. 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ARSENIC
CAS # 7440-38-2

Division of Toxicology ToxFAQs™ December 2003

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

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 or 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 $\mu g/m^3$) 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BENZENE
CAS # 71-43-2

Agency for Toxic Substances and Disease Registry ToxFAQs September 1997

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′zēn′)

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.

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 mgL). 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

CHROMIUM

CAS # 7440-47-3

Division of Toxicology and Environmental Medicine ToxFAQs™ September 2008

This fact sheet answers the most frequently asked health questions (FAQs) about chromium. 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 chromium occurs from ingesting contaminated food or drinking water or breathing contaminated workplace air. Chromium(VI) at high levels can damage the nose and cause cancer. Ingesting high levels of chromium(VI) may result in anemia or damage to the stomach or intestines. Chromium(III) is an essential nutrient. Chromium has been found in at least 1,127 of the 1,669 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is chromium?

Chromium is a naturally occurring element found in rocks, animals, plants, and soil. It can exist in several different forms. Depending on the form it takes, it can be a liquid, solid, or gas. The most common forms are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds.

The metal chromium, which is the chromium(0) form, is used for making steel. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

What happens to chromium when it enters the environment?

❑ Chromium can be found in air, soil, and water after release from the manufacture, use, and disposal of chromium-based products, and during the manufacturing process.
❑ Chromium does not usually remain in the atmosphere, but is deposited into the soil and water .
❑ Chromium can easily change from one form to another in water and soil, depending on the conditions present.
❑ Fish do not accumulate much chromium in their bodies from water.

How might I be exposed to chromium?

❑ Eating food containing chromium(III).
❑ Breathing contaminated workplace air or skin contact during use in the workplace.
❑ Drinking contaminated well water.
❑ Living near uncontrolled hazardous waste sites containing chromium or industries that use chromium.

How can chromium affect my health?

Chromium(III) is an essential nutrient that helps the body use sugar, protein, and fat.

Breathing high levels of chromium(VI) can cause irritation to the lining of the nose, nose ulcers, runny nose, and breathing problems, such as asthma, cough, shortness of breath, or wheezing. The concentrations of chromium in air that can cause these effects may be different for different types of chromium compounds, with effects occurring at much lower concentrations for chromium(VI) compared to chromium(III).

The main health problems seen in animals following ingestion of chromium(VI) compounds are irritation and ulcers in the stomach and small intestine and anemia. Chromium(III) compounds are much less toxic and do not appear to cause these problems.

Sperm damage and damage to the male reproductive system have also been seen in laboratory animals exposed to chromium(VI).

Skin contact with certain chromium(VI) compounds can cause skin ulcers. Some people are extremely sensitive to chromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted.

How likely is chromium to cause cancer?

The Department of Health and Human Services (DHHS), the International Agency for Reseach on Cancer (IARC), and the EPA have determined that chromium(VI) compounds are known human carcinogens. In workers, inhalation of chromium(VI) has been shown to cause lung cancer. Chromium(VI) also causes lung cancer in animals. An increase in stomach tumors was observed in humans and animals exposed to chromium(VI) in drinking water.

How can chromium affect children?

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

We do not know if exposure to chromium will result in birth defects or other developmental effects in people. Some developmental effects have been observed in animals exposed to chromium(VI).

How can families reduce the risks of exposure to chromium?

❏ Children should avoid playing in soils near uncontrolled hazardous waste sites where chromium may have been discarded.

❏ Chromium is a component of tobacco smoke. Avoid smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.

❏ Although chromium(III) is an essential nutrient, you should avoid excessive use of dietary supplements containing chromium.

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

Since chromium(III) is an essential element and naturally occurs in food, there will always be some level of chromium in your body. Chromium can be measured in hair, urine, and blood.

Higher than normal levels of chromium in blood or urine may indicate that a person has been exposed to chromium. However, increases in blood and urine chromium levels cannot be used to predict the kind of health effects that might develop from that exposure.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to chromium in drinking water at concentrations of 1 mg/L for up to 10 days is not expected to cause any adverse effects in a child.

The FDA has determined that the chromium concentration in bottled drinking water should not exceed 1 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 0.0005 mg/m^3 chromium(VI), 0.5 mg/m^3 chromium(III), and 1.0 mg/m^3 chromium(0) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Chromium (Draft for Public Comment). 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

COPPER

CAS # 7440-50-8

Division of Toxicology ToxFAQs™ September 2002

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 crumps, 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

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/m^3) of copper fumes (vapor generated from heating copper) and 1 mg/m^3 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

DDT, DDE, AND DDD

CAS # 50-29-3, 72-55-9, 72-54-8

Division of Toxicology ToxFAQs™ September 2002

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

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 reasonable 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/m^3) 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.

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ETHYLBENZENE

CAS # 100-41-4

Agency for Toxic Substances and Disease Registry ToxFAQs June 1999

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′ zēn′)

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.

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.

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FUEL OILS

CAS # 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

Agency for Toxic Substances and Disease Registry ToxFAQs September 1996

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 fyōō′əl 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

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/m^3) 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.

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LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ August 2007

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

(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 or 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 (μg/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 μg/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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

MERCURY
CAS # 7439-97-6

Agency for Toxic Substances and Disease Registry ToxFAQs April 1999

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,

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 can 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/m^3) and 0.05 mg/m^3 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.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

METHYLENE CHLORIDE

CAS # 75-09-2

Division of Toxicology ToxFAQs™ February 2001

This fact sheet answers the most frequently asked health questions (FAQs) about methylene chloride. 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 methylene chloride occurs mostly from breathing contaminated air, but may also occur through skin contact or by drinking contaminated water. Breathing in large amounts of methylene chloride can damage the central nervous system. Contact of eyes or skin with methylene chloride can result in burns. Methylene chloride has been found in at least 882 of 1,569 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is methylene chloride?

Methylene chloride is a colorless liquid with a mild, sweet odor. Another name for it is dichloromethane. Methylene chloride does not occur naturally in the environment.

Methylene chloride is used as an industrial solvent and as a paint stripper. It may also be found in some aerosol and pesticide products and is used in the manufacture of photographic film.

What happens to methylene chloride when it enters the environment?

❑ Methylene chloride is mainly released to the environment in air. About half of the methylene chloride in air disappears in 53 to 127 days.

❑ Methylene chloride does not easily dissolve in water, but small amounts may be found in drinking water.

❑ We do not expect methylene chloride to build up in plants or animals.

How might I be exposed to methylene chloride?

❑ The most likely way to be exposed to methylene chloride is by breathing contaminated air.

❑ Breathing the vapors given off by products containing methylene chloride. Exposure to high levels of methylene chloride is likely if methylene chloride or a product containing it is used in a room with inadequate ventilation.

How can methylene chloride affect my health?

If you breathe in large amounts of methylene chloride you may feel unsteady, dizzy, and have nausea and a tingling or numbness of your finger and toes. A person breathing smaller amounts of methylene chloride may become less attentive and less accurate in tasks requiring hand-eye coordination. Skin contact with methylene chloride causes burning and redness of the skin.

How likely is methylene chloride to cause cancer?

We do not know if methylene chloride can cause cancer in humans. An increased cancer risk was seen in mice

breathing large amounts of methylene chloride for a long time.

The World Health Organization (WHO) has determined that methylene chloride may cause cancer in humans.

The Department of Health and Human Services (DHHS) has determined that methylene chloride can be reasonably anticipated to be a cancer-causing chemical.

The EPA has determined that methylene chloride is a probable cancer-causing agent in humans.

How can methylene chloride affect children?

It is likely that health effects seen in children exposed to high amounts of methylene chloride will be similar to the effects seen in adults. We do not know if methylene chloride can affect the ability of people to have children or if it causes birth defects. Some birth defects have been seen in animals inhaling very high levels of methylene chloride.

How can families reduce the risk of exposure to methylene chloride?

❏ Families may be exposed to methylene chloride while using products such as paint removers. Such products should always be used in well-ventilated areas and skin contact should be avoided.
❏ Children should not be allowed to remain near indoor paint removal activities.

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

❏ Several tests can measure exposure to methylene chloride. These tests are not routinely available in your doctor's office.
❏ Methylene chloride can be detected in the air you breathe out and in your blood. These tests are only useful for detecting exposures that have occurred within a few days.
❏ It is also possible to measure carboxyhemoglobin (a chemical formed in the blood as methylene chloride breaks down in the body) in the blood or formic acid (a breakdown product of methylene chloride) in the urine. These tests are not specific for methylene chloride.

Has the federal government made recommendations to protect human health?

❏ The EPA requires that releases of methylene chloride of 1,000 pounds or more be reported to the federal government.
❏ The EPA recommends that exposure of children to methylene chloride be limited to less than 10 milligrams per liter of drinking water (10 mg/L) for 1 day or 2 mg/L for 10 days.
❏ The Food and Drug Administration (FDA) has established limits on the amounts of methylene chloride that can remain after processing of spices, hops extract, and decaffeinated coffee.
❏ The Occupational Safety and Health Administration (OSHA) has set limits of 25 parts methylene chloride per million parts of workplace air (25 ppm) for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for methylene chloride. 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.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs September 1996

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′ĭ-sī′klĭk ăr′ə-măt′ĭk 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; smokehouses; 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.

- 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ July 2003

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.

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.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TETRACHLOROETHYLENE
CAS # 127-18-4

Agency for Toxic Substances and Disease Registry ToxFAQs September 1997

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 tĕt′rə-klôr′ ō-ĕth′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-

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 performed 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ February 2001

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 petrolieum products as well as from leasking 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 levles can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and

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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

XYLENE
CAS # 1330-20-7

Agency for Toxic Substances and Disease Registry ToxFAQs September 1996

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

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.

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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ZINC
CAS # 7440-66-6

Agency for Toxic Substances and Disease Registry ToxFAQs September 1995

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 zĭngk)

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

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/m^3) for an 8-hour workday over a 40-hour work week and 5 mg/m^3 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.

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: _____

INCIDENT REPORT FORM

Date of Report: _____

Injured: _____

Employer: _____

Site: _____ Site Location: _____

Report Prepared By: _____ _____
Signature Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

___Injury	___ Illness	___ Near Miss
__ Property Damage	___ Fire	___ Chemical Exposure
__ On-site Equipment	___ Motor Vehicle	___ Electrical
__ Mechanical	___ Spill	___ Other

DATE AND TIME OF ACCIDENT/INCIDENT: Narrative report of Accident/Incident: Identify: 1) actions leading to or contributing to the accident/incident; 2) the accident/incident occurrence; and 3) actions following the accident/incident.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

WITNESS TO ACCIDENT/INCIDENT:

Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____
Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____

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!

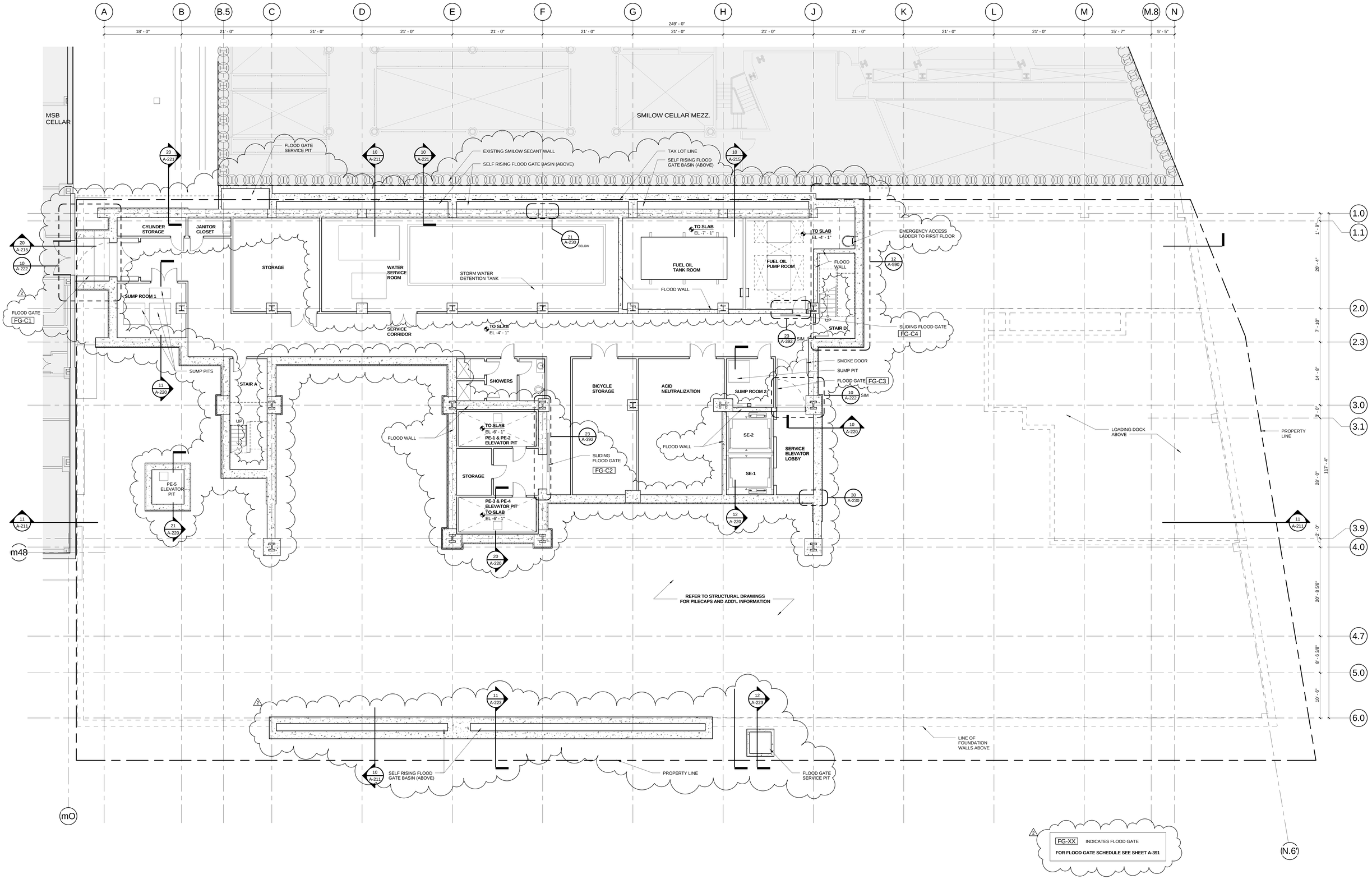
Thumbs up

NO! - NEGATIVE!

Thumbs down

APPENDIX 5

PROPOSED DEVELOPMENT PLANS



Project Title

NYU Langone Medical Center Science Building

435 East 30th Street, FDR Drive, New York, NY 10016

Owner	Architect	Structural Engineer	MEP Engineer	Laboratory Consultant	Civil Engineer
NYULMC Real Estate Development 339 East 28th Street New York, NY, 10018 USA 212.263.2450 tel	ENNEAD ARCHITECTS, LLP 320 West 13th Street New York, NY 10014-1278 212.807.7171 tel 212.807.5917 fax www.ennead.com	Severud Associates 469 Seventh Avenue, Suite 900 New York, NY, 10018 212.986.3700 tel 212.687.6467 fax	Jaros Baum & Bolles 80 Pine Street New York, NY, 10005 212.530.9300 tel 212.289.5894 fax	Jacobs Consultancy/GPR 303 South Broadway, Suite G20 Tarrytown, NY, 10591 914.333.1110 tel 914.333.1109 fax	Langan Engineering & Environmental Services Inc. 21 Penn Plaza 360 West 31st Street, 8th Floor New York, NY 10001-2727 212.479.5400 tel 212.479.5444 fax

Seal

Key Plan

No.	Issue Name	Date
3	DD Flood Proofing Pricing	10/24/2013
2	ASI #1 Foundation Hardening	10/24/2013
1	Foundation CD's	11/21/2012

Sheet Title

PLAN - CELLAR

Date 11/16/12

Project Number 1101

Sheet No. A-101.00

Scale 1/8" = 1'-0"

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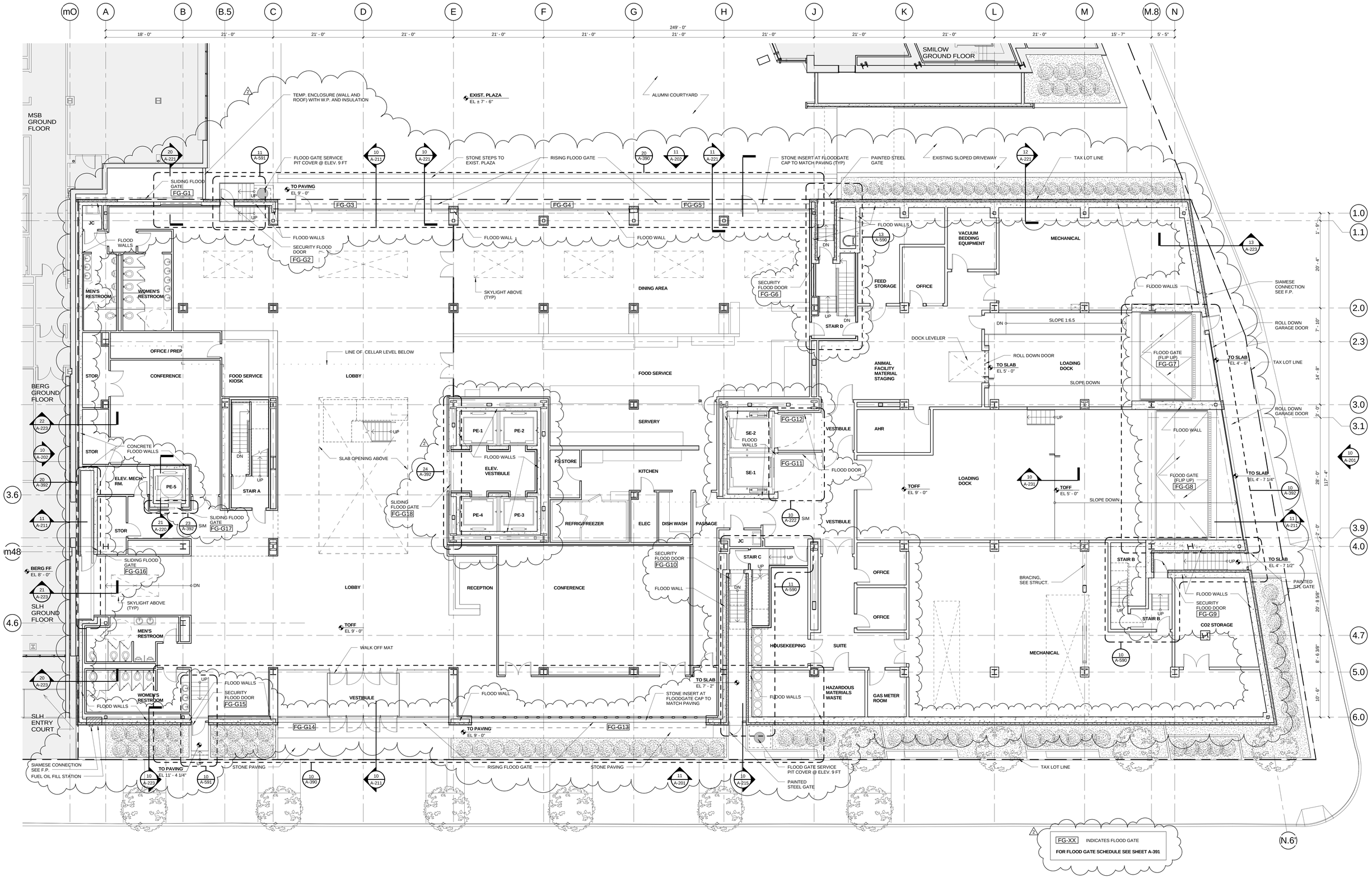

Project Title

NYU Langone Medical Center Science Building

435 East 30th Street, FDR Drive, New York, NY 10016

Owner
NYULMC Real Estate Development
339 East 28th Street
New York, NY, 10018
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212.479.5400 tel
212.479.5444 fax

Seal

Key Plan

No.	Issue Name	Date
3	DD Flood Proofing Pricing	10/24/2013
2	ASI #1 Foundation Hardening	10/24/2013
1	Foundation CD's	11/21/2012

Sheet Title

PLAN - GROUND FLOOR

Date 11/16/12

Project Number 1101

Scale 1/8" = 1'-0"

Sheet No. A-102.00

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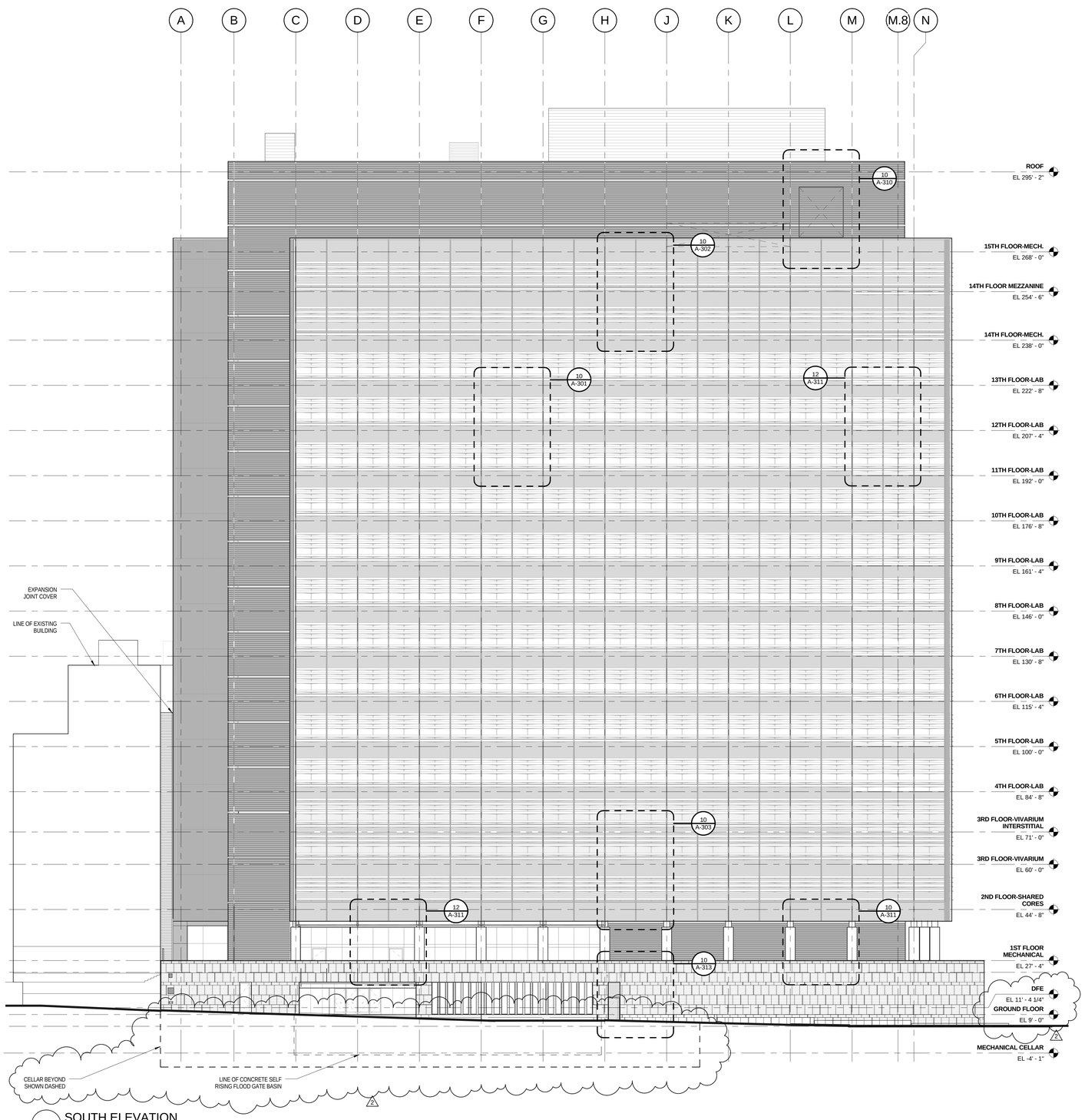
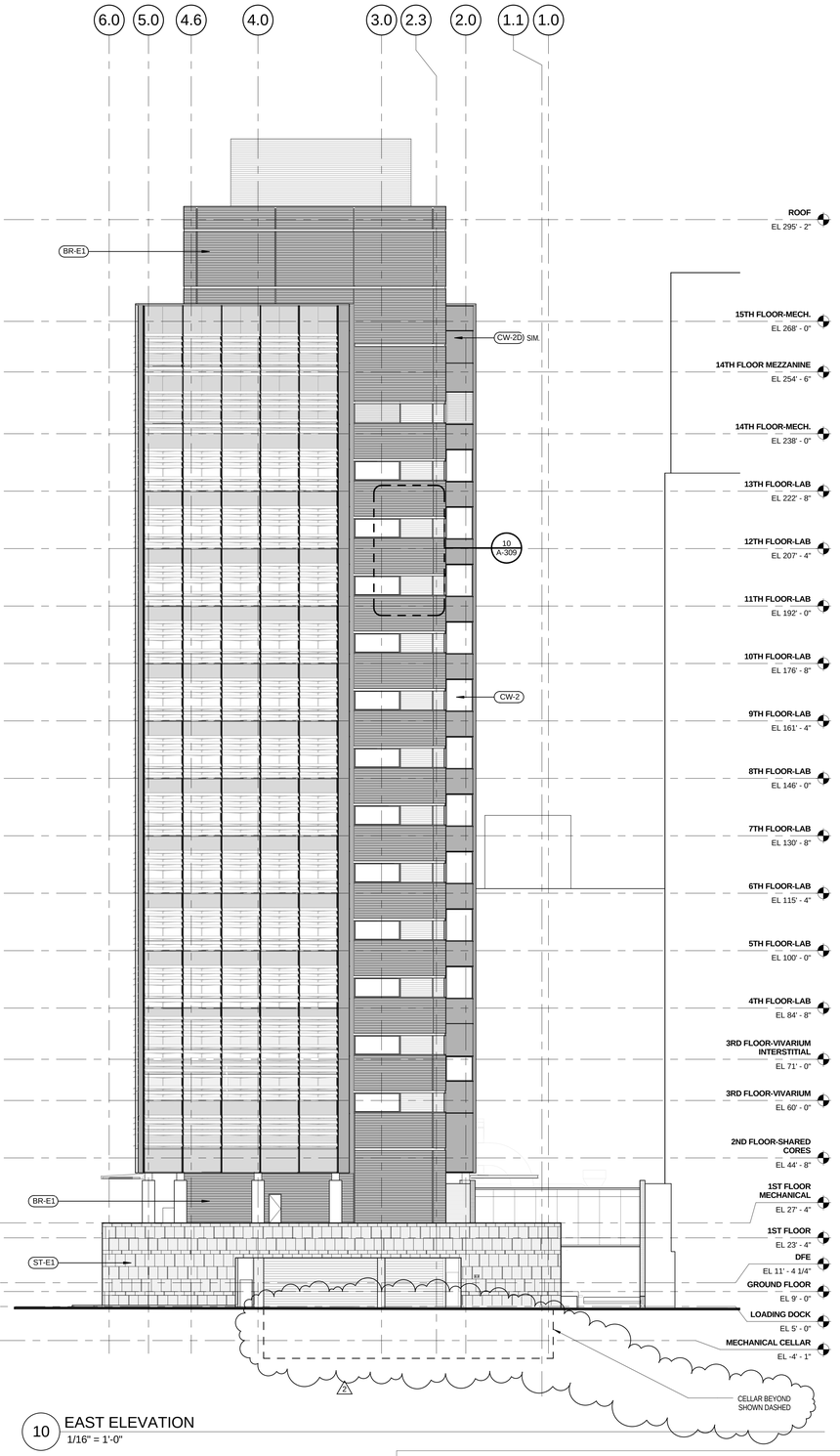


11 SOUTH ELEVATION
1/16" = 1'-0"



10 EAST ELEVATION
1/16" = 1'-0"

NOT FOR CONSTRUCTION - FOR INFORMATION ONLY

Project Title

NYU Langone Medical Center Science Building

Street Address, City, State, ZIP

Owner
NYULMC Real Estate Development
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USA
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Architect
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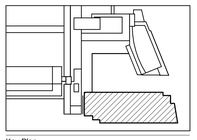
Seal



Key Plan

No.	Issue Name	Date
3	DD Flood Proofing Pricing	10/24/2013
2	ASI #1 Foundation Hardening	10/24/2013
1	Foundation CD's	11/21/2012

Sheet Title

BUILDING ELEVATIONS - SOUTH & EAST

Date
11/21/12

Project Number
1101

Sheet No.
A-201.00

Scale
1/16" = 1'-0"

Page

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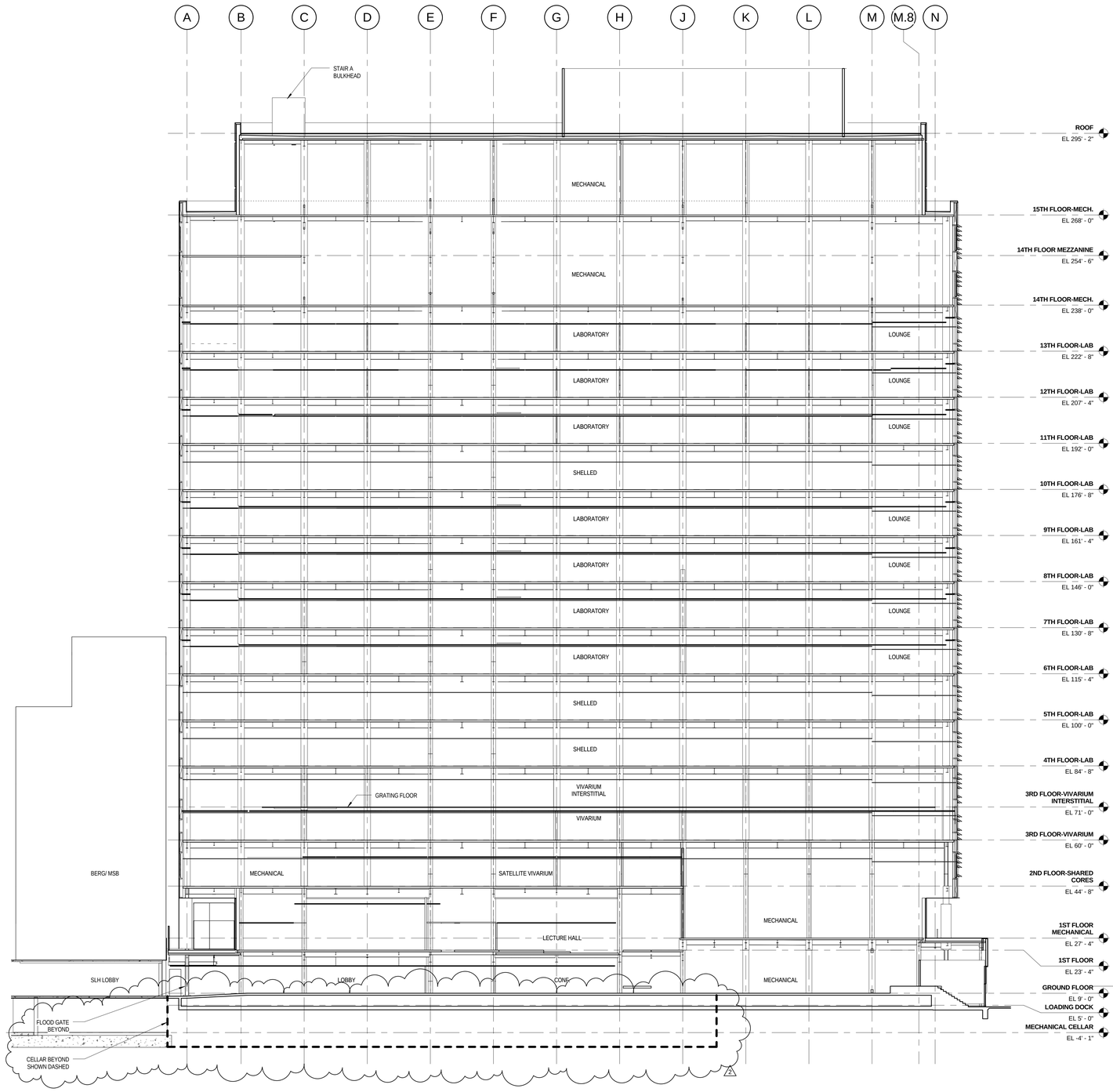

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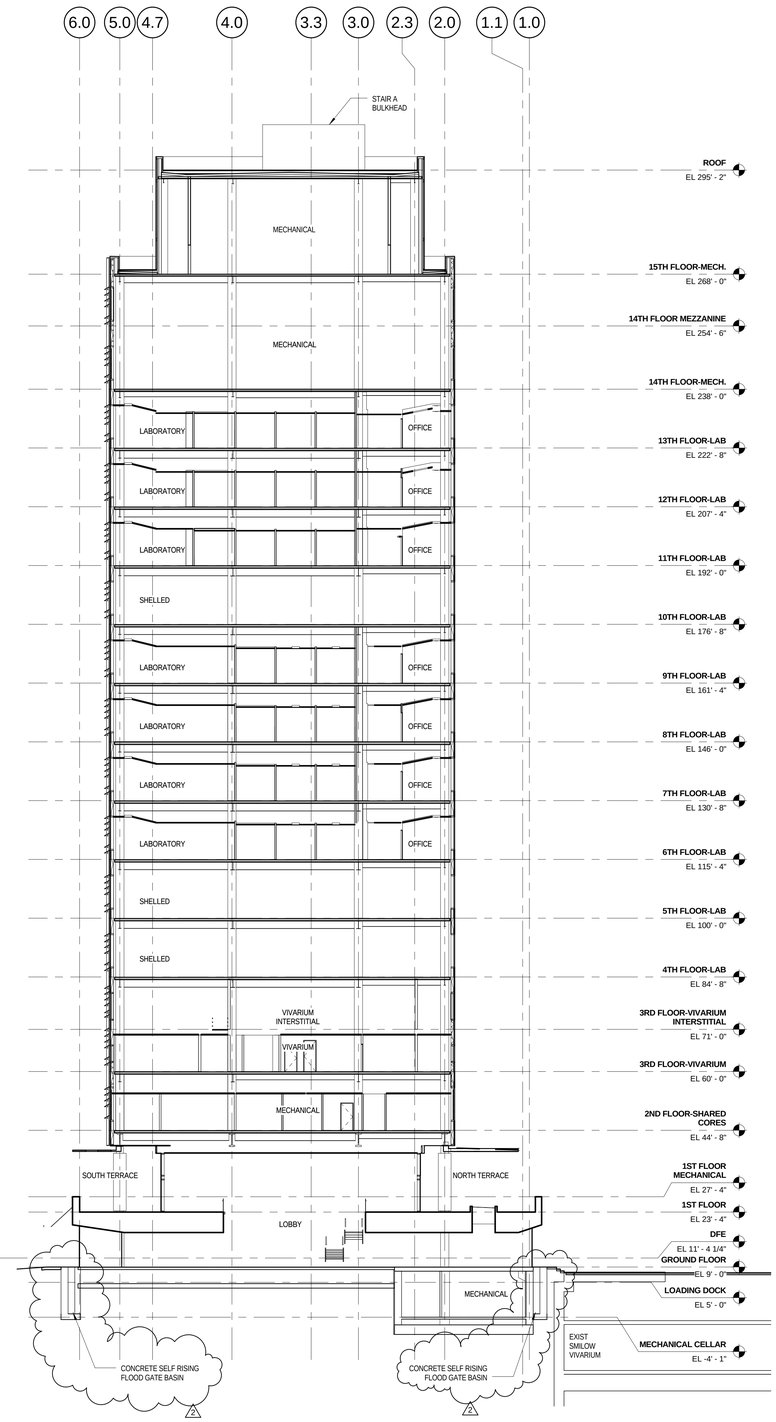

10 CROSS SECTION
1/16" = 1'-0"

NOT FOR CONSTRUCTION - FOR INFORMATION ONLY

Project Title

NYU Langone Medical Center Science Building

Street Address, City, State, ZIP

Owner
NYULMC Real Estate Development
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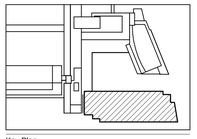

Key Plan

No.	Issue Name	Date
3	DD Flood Proofing Pricing	10/24/2013
2	ASI #1 Foundation Hardening	10/24/2013
1	Foundation CD's	11/21/2012

Sheet Title
BUILDING SECTIONS

Date
11/21/12

Project Number
1101

Sheet No.
A-211.00

Scale
1/16" = 1'-0"

Page

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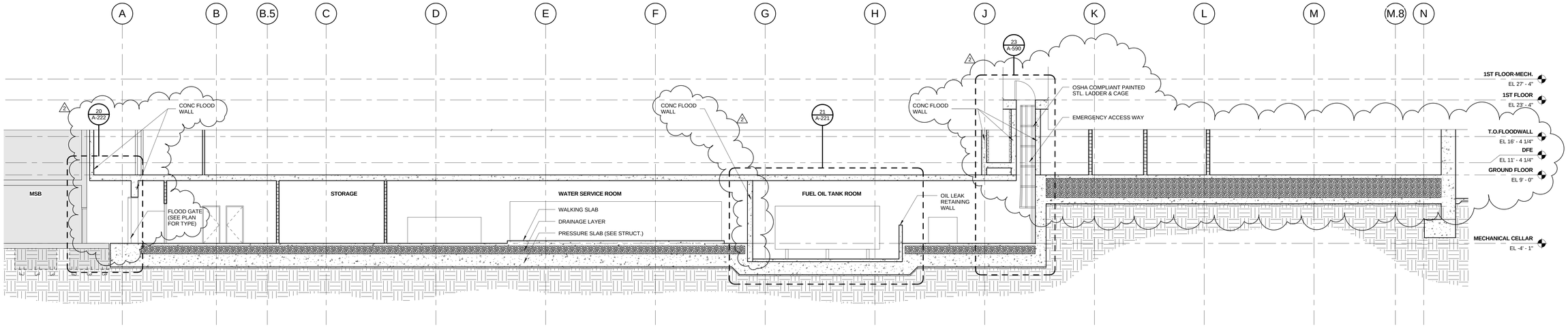

20 E/W PARTIAL BUILDING SECTION
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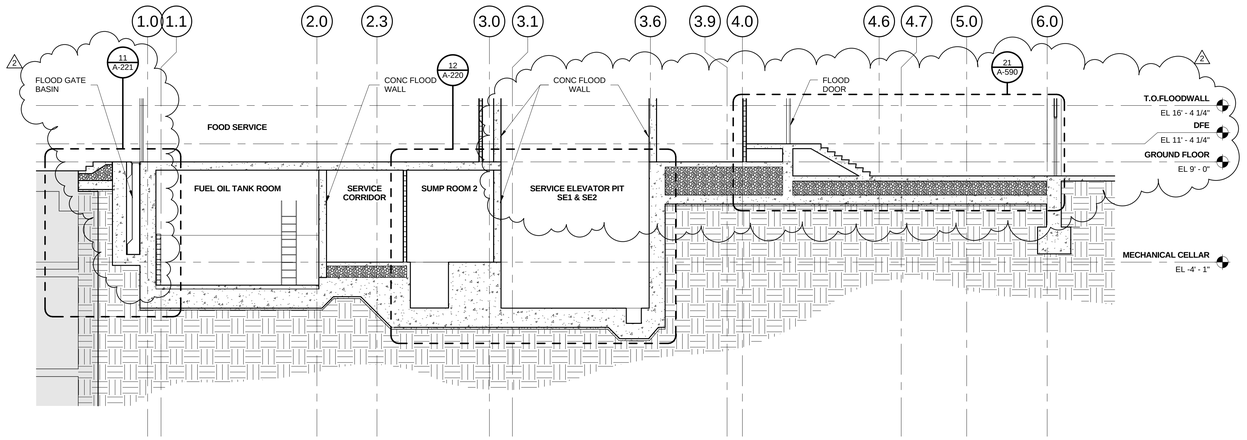

10 N/S PARTIAL BUILDING SECTION
1/8" = 1'-0"

Project Title

NYU Langone Medical Center Science Building

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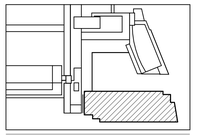
Seal

Key Plan



No.	Issue Name	Date
3	DD Flood Proofing Pricing	10/24/2013
2	ASI #1 Foundation Hardening	10/24/2013
1	Foundation CD's	11/21/2012

Sheet Title

ENLARGED BUILDING SECTIONS AT MECHANICAL CELLAR LEVEL

Date
11/29/12

Project Number
1101

Sheet No.
A-215.00

Scale
1/8" = 1'-0"

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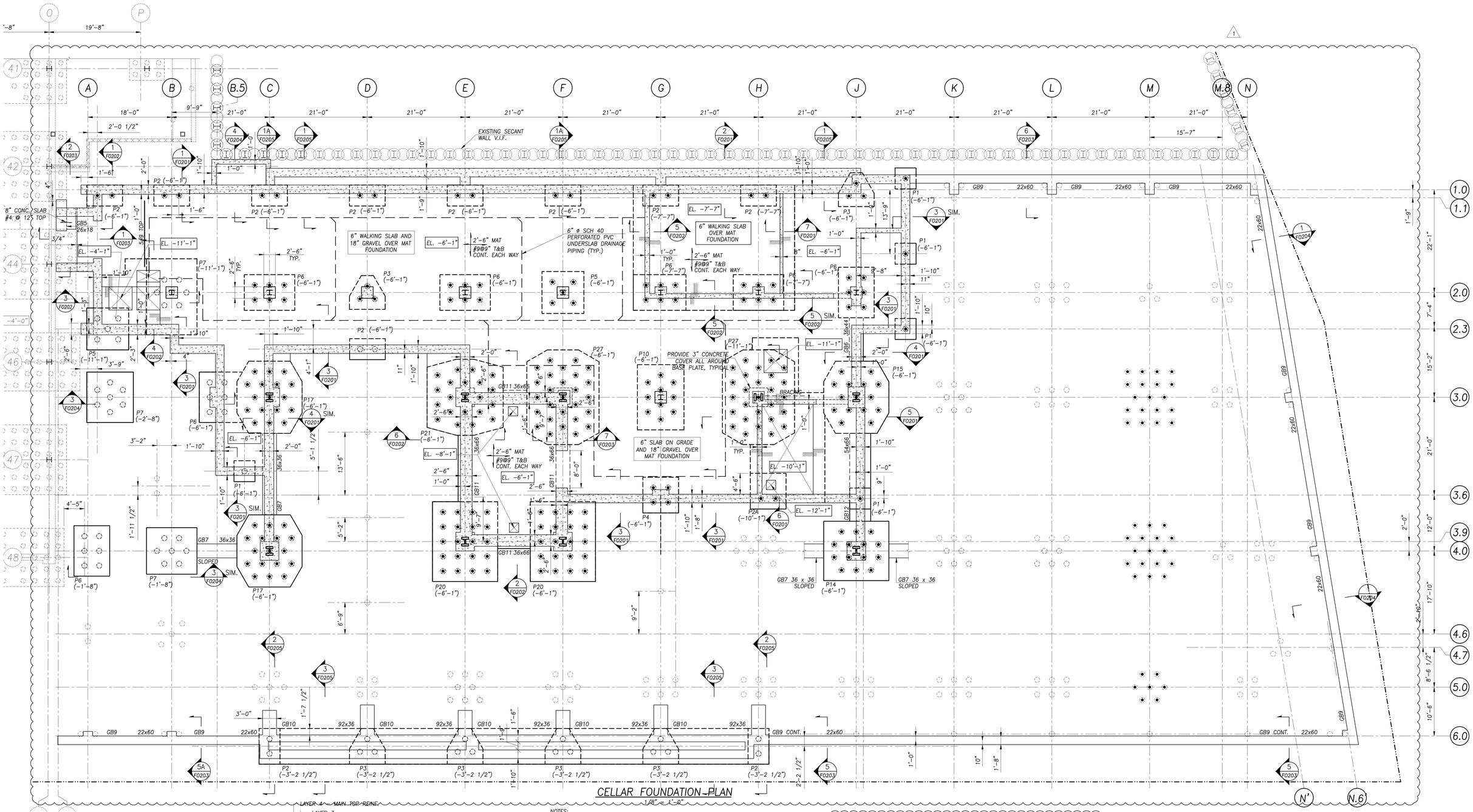
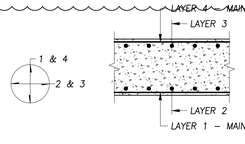


CELLAR FOUNDATION PLAN

1/8" = 1'-0"



MAT FOUNDATION BAR PLACING ORDER

NOTES:

1. ALL ELEVATIONS ON THIS PLAN ARE ACTUAL ELEVATIONS. REFER TO THE ARCHITECTURAL DRAWINGS FOR THE DEFINITION OF PROJECT DATUM.
2. TOP OF MAT FOUNDATION SHALL BE SHOWN EL. ..... ON PLAN.
3. ALL TOP OF PILE CAP ELEVATIONS ARE ACTUAL ELEVATIONS NOTED THUS (±. . .).
4. PILE CAP SHALL BE CONCENTRIC WITH COLUMN ABOVE UNLESS OTHERWISE NOTED.
5. ALL CONCRETE WALLS, COLUMNS, PILE CAPS, SLAB SHALL BE NORMAL WEIGHT (STONE) CONCRETE HAVING A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS. UNLESS NOTICED OTHERWISE.
6. FOR LOCATIONS OF DEPRESSIONS AND WALLS, SEE S701.
7. ⊙ INDICATE TENSION PILE ON PLAN, SEE DETAIL ON F0302.
8. MAT FOUNDATION AND PILE CAPS HAVE BEEN DESIGNED FOR A STATIC UPLIFT PRESSURE TO EL. 16.35'.
9. FOR GRADE BEAM SCHEDULE WITH BEAMS DESIGNATED GB_, SEE F0304.
10. FOR ALL SLAB DIMENSIONS AND LOCATIONS, SEE S701 AND S701A.

1

LEGEND:

2T8 / 2B8	INDICATES ADDITIONAL TOP OR BOTTOM BARS EXTENDING FULL LENGTH OF SPAN, C.L. TO C.L. OF SUPPORTS.
2T8 / 2B8	INDICATES ADDITIONAL TOP OR BOTTOM BARS EXTENDING 1/3 OF CLEAR SPAN EACH SIDE.

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Project Title
NYU Langone Medical Center Science Building

435 East 30th Street/ FDR Drive, New York, NY 10016

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Seal

Key Plan

No.	Issue Name	Date

No.	Issue Name	Date
	D.D. Flood Proof Pricing	10/24/2013
1	ASI#1 Foundation Hardening	10/24/2013
	Foundation CDs	11/21/2012

Sheet Title
CELLAR FOUNDATION PLAN

Date	Project Number	Sheet No.
10/21/12	14140	FO-101.00

Scale 1/8" = 1'-0"

Page 2 of 23

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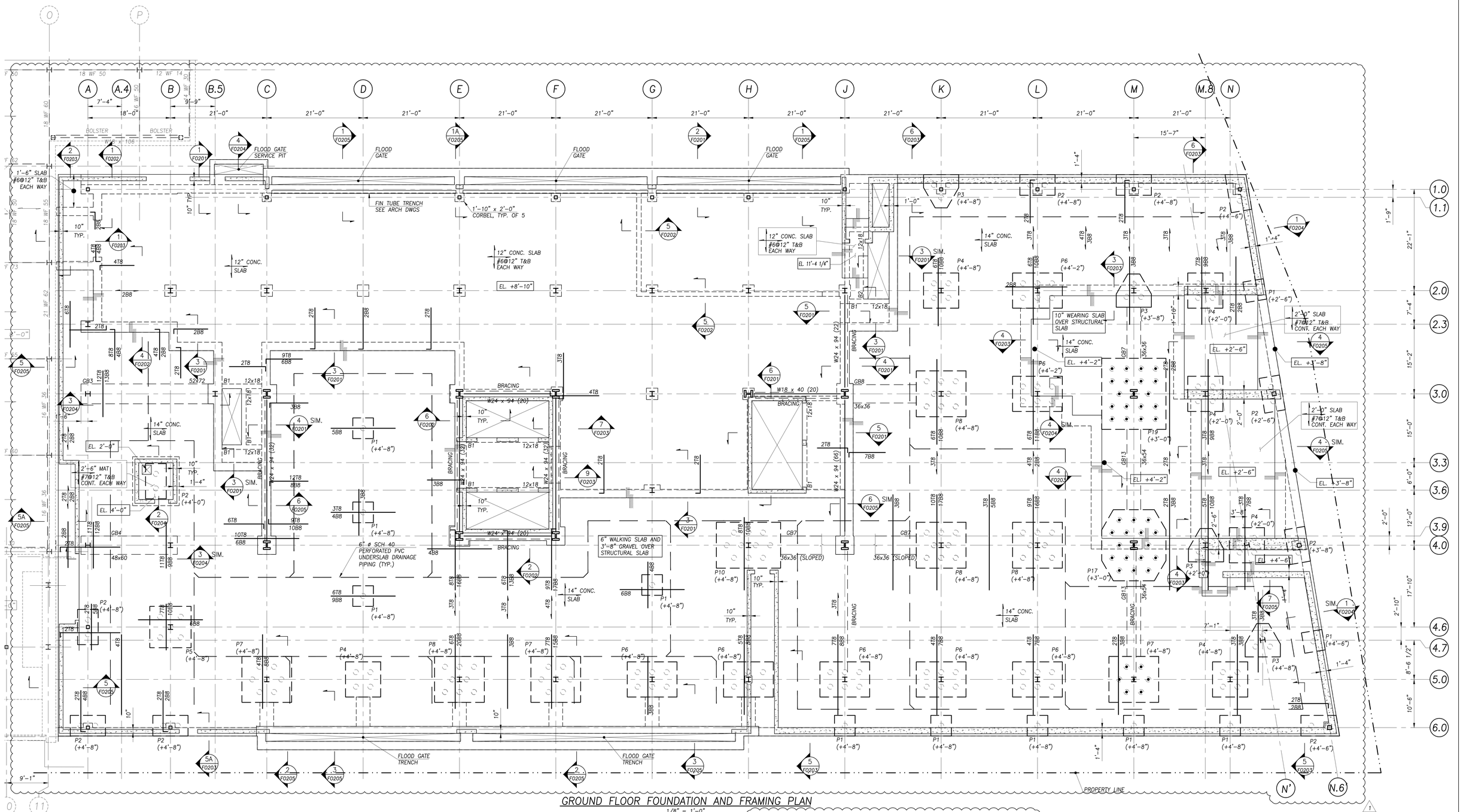
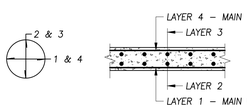


GROUND FLOOR FOUNDATION AND FRAMING PLAN

1/8" = 1'-0"



FLAT SLAB BAR PLACING ORDER

LEGEND:

2T8 / 2B8 — INDICATES ADDITIONAL TOP OR BOTTOM BARS EXTENDING FULL LENGTH OF SPAN, C.L. TO C.L. OF SUPPORTS.

2T8 / 2B8 — INDICATES ADDITIONAL TOP OR BOTTOM BARS EXTENDING 1/3 OF CLEAR SPAN EACH SIDE.

NOTES:

1. TOP OF STRUCTURAL SLAB SHALL BE AT EL. 4'-8" UNLESS OTHERWISE NOTED THUS EL. ...'-...." ON PLAN.
2. FOR GENERAL NOTES, SEE S-001.
3. FOR TYPICAL DETAILS, SEE S-500 AND S-600 SERIES.
4. SLAB SHALL BE REINFORCED WITH #8 @ 12" T.&B. N/S AND #7@12" E/W, U.O.N. SEE S500 FOR TYPICAL DETAIL.
5. GROUND FLOOR STRUCTURAL SLAB AND PILE CAPS HAVE BEEN DESIGNED FOR A STATIC UPLIFT PRESSURE TO EL. 16.35'.
6. FOR GRADE BEAM SCHEDULE WITH BEAMS DESIGNATED GB_, SEE F0304.
7. FOR CONCRETE BEAM SCHEDULE WITH BEAMS DESIGNATED B_. SEE S500.
8. ALL EXTERIOR AND INTERIOR FLOOD WALLS FROM THE GROUND FLOOR UP SHALL EXTEND TO THE UNDERSIDE OF THE FIRST FLOOR.
9. FOR ALL SLAB DIMENSIONS AND LOCATIONS, SEE S702 AND S702A.
10. TOP OF STEEL FRAMING SHALL BE EL. 7'-10".

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Project Title

NYU Langone Medical Center Science Building

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Seal

Key Plan

No.	Issue Name	Date
	D.D. Flood Proof Pricing	10/24/2013
1	ASI#1 Foundation Hardening	10/24/2013
	Foundation CDs	11/21/2012

Sheet Title

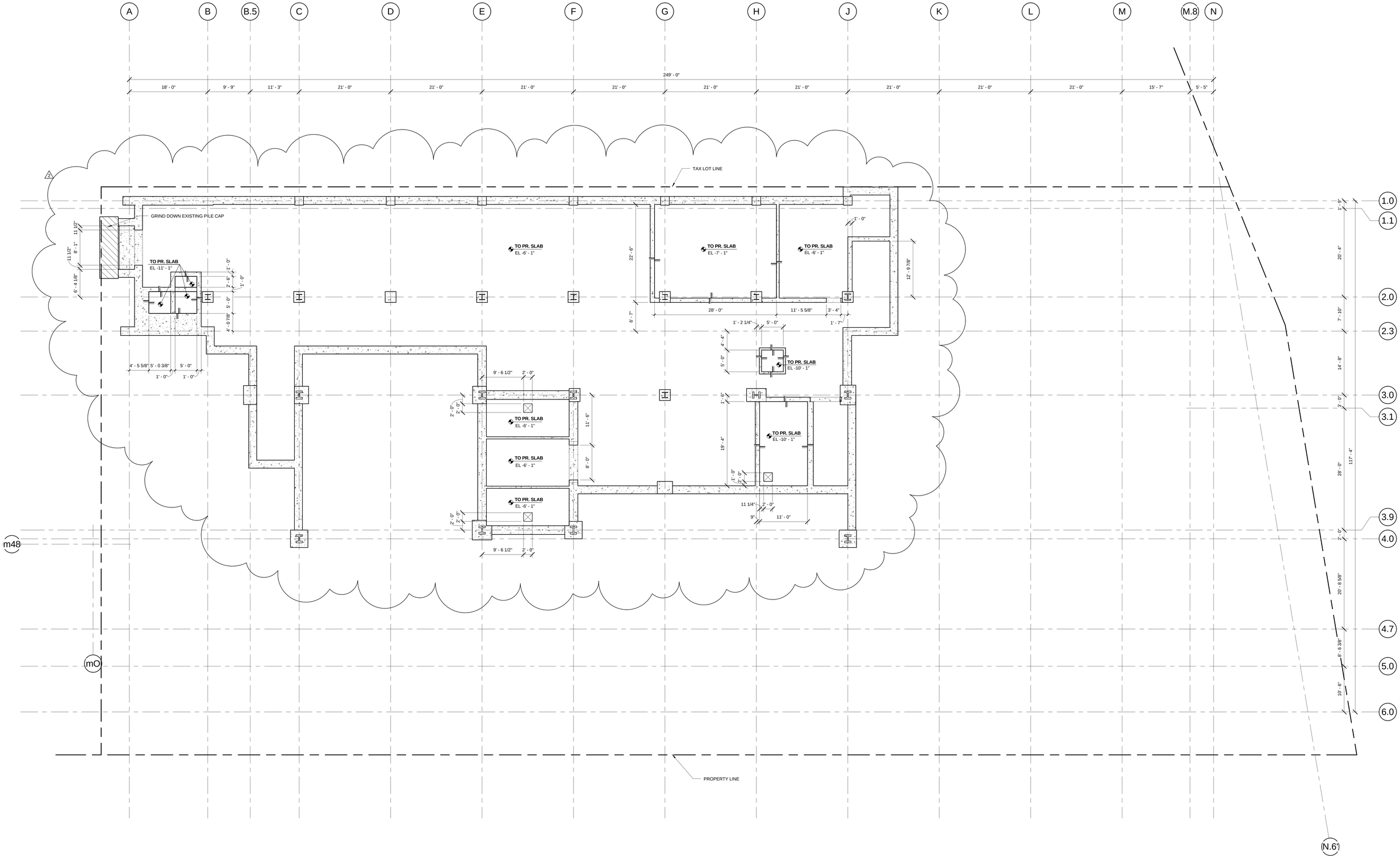
GROUND FLOOR FOUNDATION AND FRAMING PLAN

Date 10/21/12

Project Number 14140

Sheet No. FO-102.00

Scale 1/8" = 1'-0"



Project Title

NYU Langone Medical Center Science Building

435 East 30th Street, FDR Drive, New York, NY 10016

Owner	Architect	Structural Engineer	MEP Engineer	Laboratory Consultant	Civil Engineer
NYULMC Real Estate Development	ENNEAD ARCHITECTS, LLP	Severud Associates	Jaros Baum & Bolles	Jacobs Consultancy/GPR	Langan Engineering & Environmental Services Inc.
339 East 28th Street	320 West 13th Street	469 Seventh Avenue, Suite 900	80 Pine Street	303 South Broadway, Suite G20	21 Penn Plaza
New York, NY, 10018	New York, NY 10014-1278	New York, NY, 10018	New York, NY, 10005	Tarrytown, NY, 10591	360 West 31st Street, 8th Floor
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					212.479.5444 fax

Seal

Key Plan

No.	Issue Name	Date
3	DD Flood Proofing Pricing	10/24/2013
2	ASI #1 Foundation Hardening	10/24/2013
1	Foundation CD's	11/21/2012

Sheet Title

SLAB EDGE PLAN - CELLAR PRESSURE SLAB

Date 12/03/12

Project Number 1101

Sheet No. S-701.00

Scale 1/8" = 1'-0"

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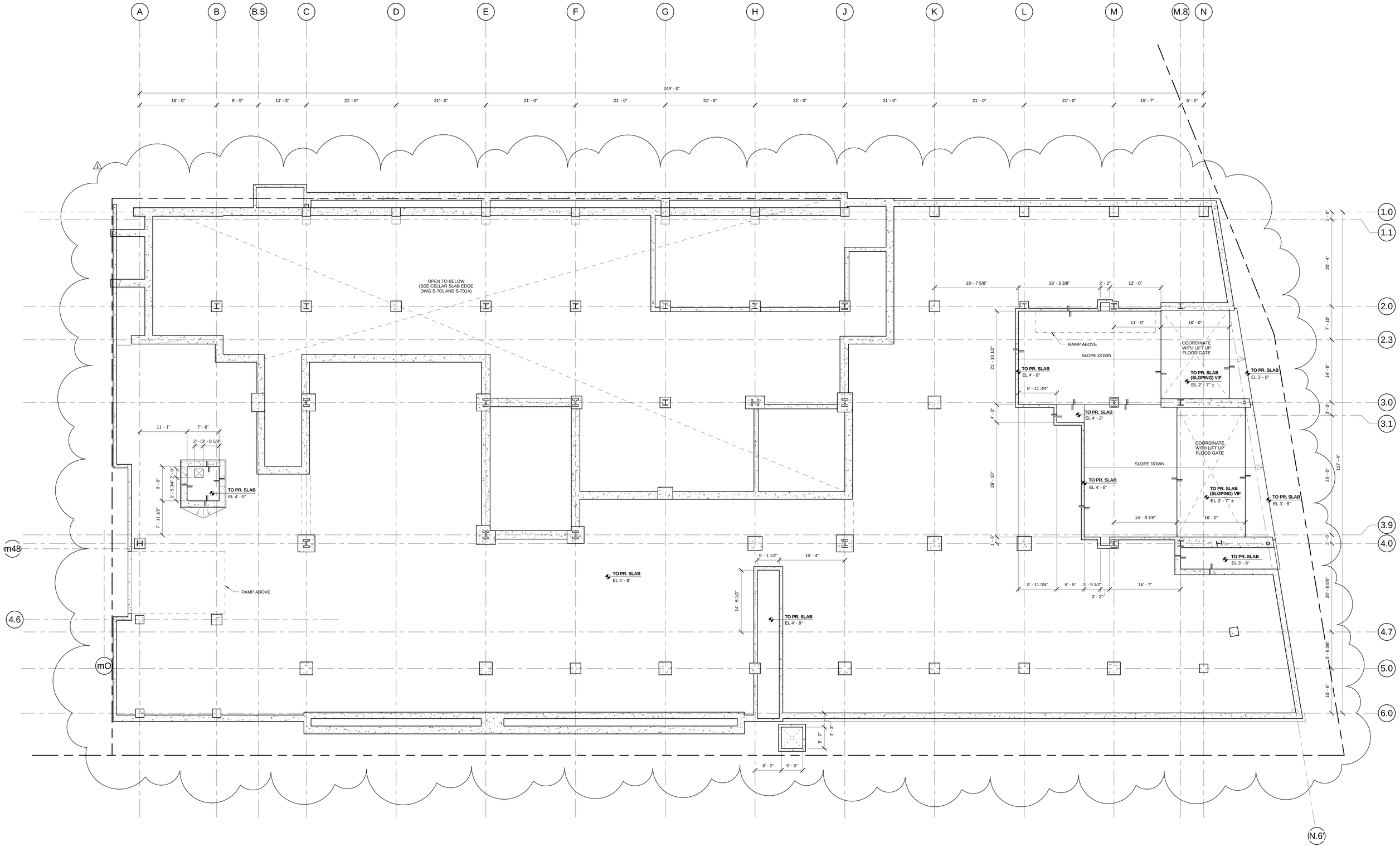

Project Title

NYU Langone Medical Center Science Building

435 East 30th Street, FDR Drive, New York, NY 10016

Owner	Architect	Structural Engineer	MEP Engineer	Laboratory Consultant	Civil Engineer
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Seal

Key Plan

No.	Issue Name	Date
1	ASI #1 Foundation Hardening	10/24/2013

Sheet Title

SLAB EDGE PLAN - GROUND FLOOR PRESSURE SLAB

Date 10/24/13

Project Number 1101

Sheet No. S-702.00

Scale 1/8" = 1'-0"

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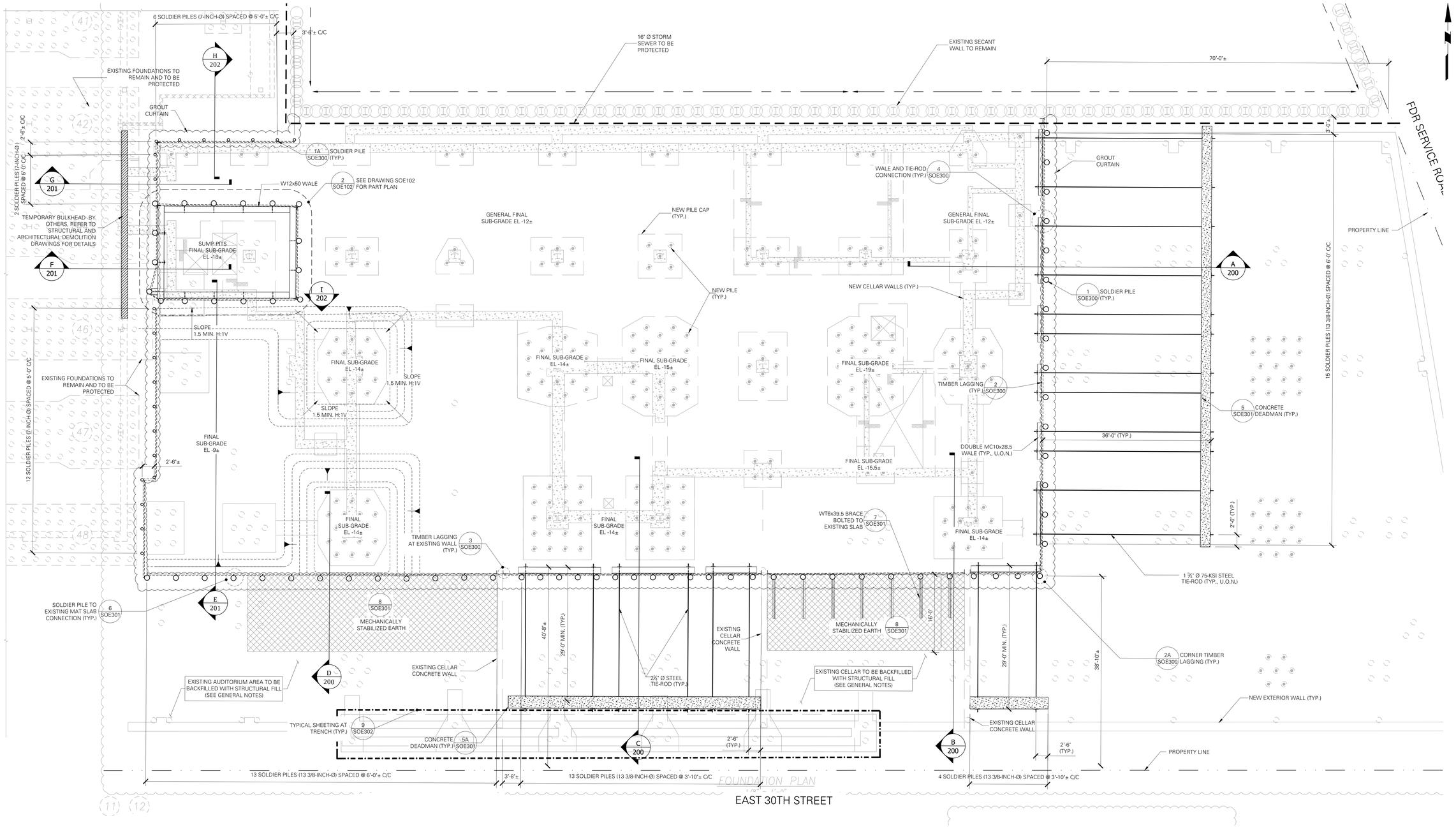

NOTES

1. REFER TO SOE-001 FOR GENERAL NOTES.
2. REFER TO SOE-400 FOR MONITORING PLAN AND NOTES.

LEGEND

ELEV — APPROXIMATE LOWEST SLAB OR WORKING GRADE ELEVATION

PLAN

SCALE: 1/8" = 1'-0"

0 4' 8' 16' 24'

GRAPHIC SCALE

Project Title

NYU Langone Medical Center Science Building

435 East 30th Street/ FDR Drive, New York, NY 10016

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Key Plan

No.	Issue Name	Date
2	D.D. Flood Proof Pricing	10/24/2013
2	ASI #1 Foundation Hardening	10/24/2013
1	Foundation C.D.	11/21/2012

Sheet Title

SUPPORT OF EXCAVATION PLAN WITH NEW FOUNDATIONS

Date: 6 NOVEMBER 2013
Project Number: 1101
Sheet No.: SOE-101.00
Scale: AS SHOWN
Page

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APPENDIX 6

PLANS AND SPECIFICATIONS FOR VAPOR BARRIER/WATERPROOFING MEMBRANE

GRACE

PREPRUFE® 300R & 160R

Pre-applied waterproofing membranes that bond integrally to poured concrete for use below slabs or behind basement walls on confined sites

Description

Preprufe® 300R & 160R membranes are unique composite sheets comprising a thick HDPE film, an aggressive pressure sensitive adhesive and a weather resistant protective coating.

Unlike conventional non-adhering membranes, which are vulnerable to water ingress tracking between the unbonded membrane and structure, the unique Preprufe bond to concrete prevents ingress or migration of water around the structure.

The Preprufe R System includes:

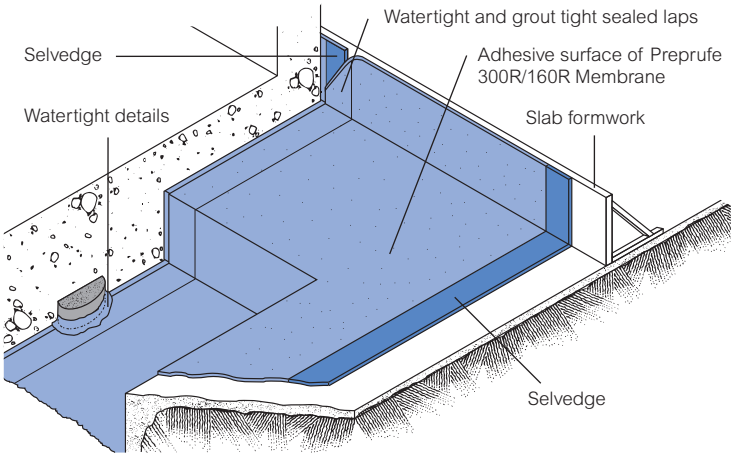
- **Preprufe 300R**—heavy-duty grade for use below slabs and on rafts (i.e. mud slabs). Designed to accept the placing of heavy reinforcement using conventional concrete spacers.
- **Preprufe 160R**—thinner grade for blindside, zero property line applications against soil retention systems.
- **Preprufe Tape LT**—for covering cut edges, roll ends, penetrations and detailing (temperatures between 25°F (-4°C) and 86°F (+30°C)).
- **Preprufe Tape HC**—as above for use in Hot Climates (minimum 50°F (10°C)).
- **Bituthene® Liquid Membrane**—for sealing around penetrations, etc.
- **Adcor™ ES**—waterstop for joints in concrete walls and floors
- **Preprufe Tieback Covers**—preformed cover for soil retention wall tieback heads
- **Preprufe Preformed Corners**—preformed inside and outside corners

Preprufe 300R & 160R membranes are applied either horizontally to smooth prepared concrete, carton forms or well rolled and compacted earth or crushed stone substrate; or vertically to permanent formwork or adjoining structures. Concrete is then cast directly against the adhesive side of the membranes. The specially developed Preprufe adhesive layers work together to form a continuous and integral seal to the structure.

Preprufe can be returned up the inside face of slab formwork but is not recommended for conventional twin-sided formwork on walls, etc. Use Bituthene self-adhesive membrane or Procor® fluid applied membrane to walls after removal of formwork for a fully bonded system to all structural surfaces.

Advantages

- **Forms a unique continuous adhesive bond to concrete poured against it**—prevents water migration and makes it unaffected by ground settlement beneath slabs
- **Fully-adhered watertight laps** and detailing
- **Provides a barrier to water, moisture and gas**—physically isolates the structure from the surrounding ground
- **BBA Certified** for basement Grades 2, 3, & 4 to BS 8102:1990
- **Zero permeance** to moisture
- **Solar reflective**—reduced temperature gain
- **Simple and quick to install**—requiring no priming or fillets
- **Can be applied to permanent formwork**—allows maximum use of confined sites
- **Self protecting**—can be trafficked immediately after application and ready for immediate placing of reinforcement
- **Unaffected by wet conditions**—cannot activate prematurely
- **Inherently waterproof, non-reactive system:**
  - not reliant on confining pressures or hydration
  - unaffected by freeze/thaw, wet/dry cycling
- **Chemical resistant**—effective in most types of soils and waters, protects structure from salt or sulphate attack



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

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 97/3325

Installation

The most current application instructions, detail drawings and technical letters can be viewed at graceconstruction.com. For other technical information contact your local Grace representative.

Preprufe 300R & 160R membranes are supplied in rolls 4 ft (1.2 m) wide, with a selvedge on one side to provide self-adhered laps for continuity between rolls. The rolls of Preprufe Membrane and Preprufe Tape are interwound with a disposable plastic release liner which must be removed before placing reinforcement and concrete.

Substrate Preparation

All surfaces—It is essential to create a sound and solid substrate to eliminate movement during the concrete pour. Substrates must be regular and smooth with no gaps or voids greater than 0.5 in. (12 mm). Grout around all penetrations such as utility conduits, etc. for stability (see Figure 1).

Horizontal—The substrate must be free of loose aggregate and sharp protrusions. Avoid curved or rounded substrates. When installing over earth or crushed stone, ensure substrate is well compacted to avoid displacement of substrate due to traffic or concrete pour. The surface does not need to be dry, but standing water must be removed.

Vertical—Use concrete, plywood, insulation or other approved facing to sheet piling to provide support to the membrane. Board systems such as timber lagging must be close butted to provide support and not more than 0.5 in. (12 mm) out of alignment.

Membrane Installation

Preprufe can be applied at temperatures of 25°F (-4°C) or above. When installing Preprufe in cold or marginal weather conditions 55°F (<13°C) the use of Preprufe Tape LT is recommended at all laps and detailing. Preprufe Tape LT should be applied to clean, dry surfaces and the release liner must be removed immediately after application. Alternatively, Preprufe Low Temperature (LT) is available for low temperature condition applications. Refer to Preprufe LT data sheet for more information.

Horizontal substrates—Place the membrane HDPE film side to the substrate with the clear plastic release liner facing towards the concrete pour. End laps should be staggered to avoid a build up of layers. Leave plastic release liner in position until overlap procedure is completed (see Figure 2).

Accurately position succeeding sheets to overlap the previous sheet 3 in. (75 mm) along the marked selvedge. Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap. Peel back the plastic release liner from between the overlaps as the two layers are bonded together. Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller. Completely remove the plastic liner to expose the protective coating. Any initial tack will quickly disappear.

Refer to Grace Tech Letter 15 for information on suitable rebar chairs for Preprufe.

Vertical substrates—Mechanically fasten the membrane vertically using fasteners appropriate to the substrate with the the clear plastic release liner facing towards the concrete pour. The membrane may be installed in any convenient length. Fastening can be made through the selvedge using a small and low profile head fastener so that the membrane lays flat and allows firmly rolled overlaps. Immediately remove the plastic release liner.

Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap. Roll firmly to ensure a watertight seal.

Roll ends and cut edges—Overlap all roll ends and cut edges by a minimum 3 in. (75 mm) and ensure the area is clean and free from contamination, wiping with a damp cloth if necessary. Allow to dry and apply Preprufe Tape LT (or HC in hot climates) centered over the lap edges and roll firmly (see Figure 3). Immediately remove printed plastic release liner from the tape.

Details

Refer to Preprufe Field Application Manual, Section V Application Instructions or visit graceconstruction.com. This manual gives comprehensive guidance and standard details.

Membrane Repair

Inspect the membrane before installation of reinforcement steel, formwork and final placement of concrete. The membrane can be easily cleaned by power washing if required. Repair damage by wiping the area with a damp cloth to ensure the area is clean and free from dust, and allow to dry. Repair small punctures (0.5 in. (12 mm) or less) and slices by applying Preprufe Tape centered over the damaged area and roll firmly. Remove the release liner from the tape. Repair holes and large punctures by applying a patch of Preprufe membrane, which extends 6 in. (150 mm) beyond the damaged area. Seal all edges of the patch with Preprufe Tape, remove the release liner from the tape and roll firmly. Any areas of damaged adhesive should be covered with Preprufe Tape. Remove printed plastic release liner from tape. Where exposed selvedge has lost adhesion or laps have not been sealed, ensure the area is clean and dry and cover with fresh Preprufe Tape, rolling firmly. Alternatively, use a hot air gun or similar to activate adhesive and firmly roll lap to achieve continuity.

Pouring of Concrete

Ensure the plastic release liner is removed from all areas of Preprufe membrane and tape.

It is recommended that concrete be poured within 56 days (42 days in hot climates) of application of the membrane. Following proper ACI guidelines, concrete must be placed carefully and consolidated properly to avoid damage to the membrane. Never use a sharp object to consolidate the concrete.

Removal of Formwork

Preprufe membranes can be applied to removable formwork, such as slab perimeters, elevator and lift pits, etc. Once the concrete is poured the formwork must remain in place until the concrete has gained sufficient compressive strength to develop the surface bond. Preprufe membranes are not recommended for conventional twin-sided wall forming systems.

A minimum concrete compressive strength of 1500 psi (10 N/mm^2) is recommended prior to stripping formwork supporting Preprufe membranes. Premature stripping may result in displacement of the membrane and/or spalling of the concrete.

Refer to Grace Tech Letter 17 for information on removal of formwork for Preprufe.

Figure 1

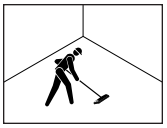


Figure 2

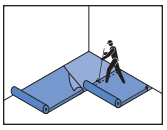
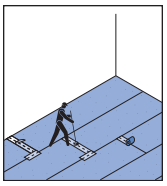
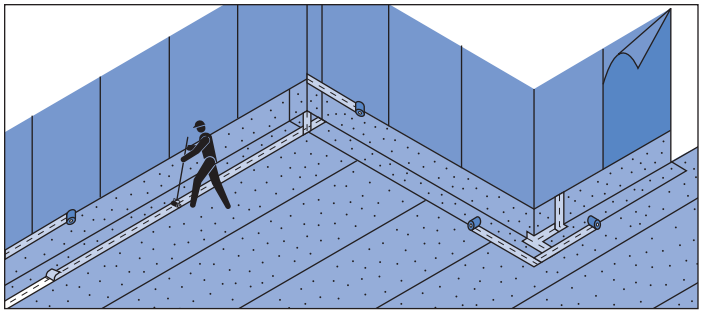


Figure 3

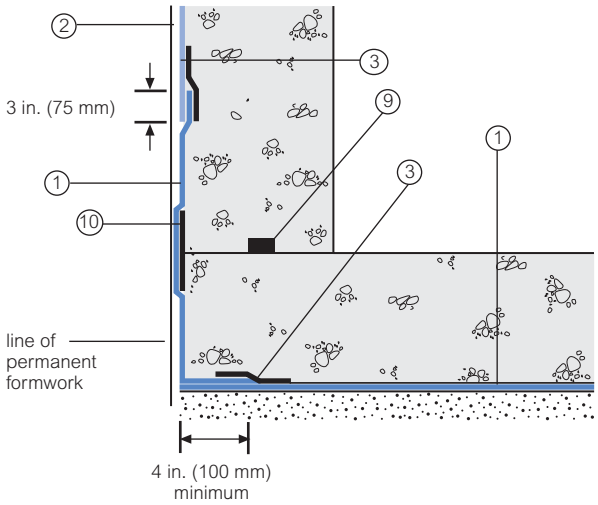




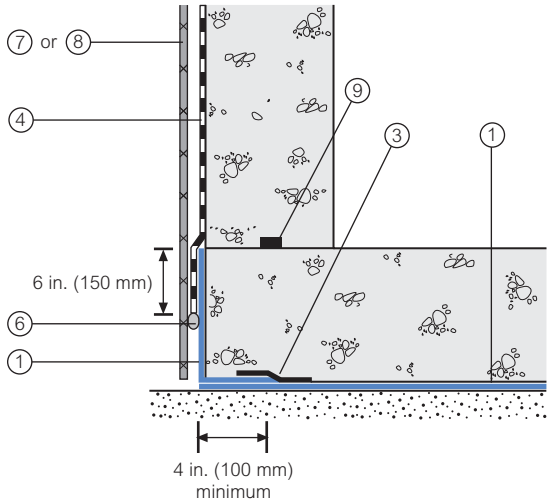
Detail Drawings

Details shown are typical illustrations and not working details. For a list of the most current details, visit us at graceconstruction.com. For technical assistance with detailing and problem solving please call toll free at 866-333-3SBM (3726).

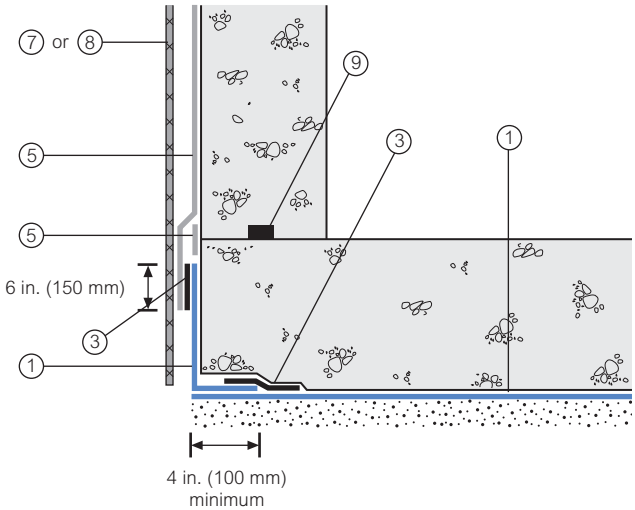
Wall base detail against permanent shutter



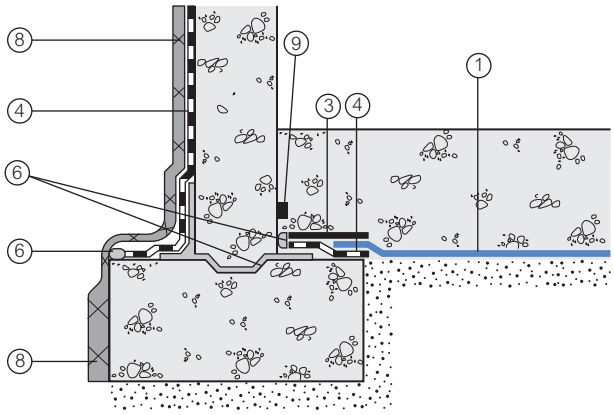
Bituthene wall base detail (Option 1)



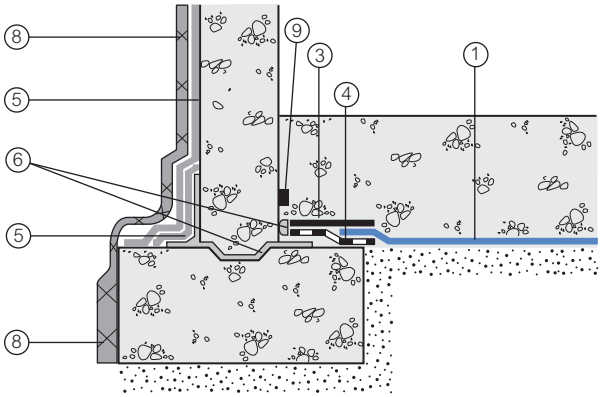
Procor wall base detail (Option 1)



Bituthene wall base detail (Option 2)



Procor wall base detail (Option 2)



1 **Preprufe 300R**
2 **Preprufe 160R**
3 **Preprufe Tape**
4 **Bituthene**
5 **Procor**
6 **Bituthene Liquid Membrane**
7 **Protection**
8 **Hydroduct®**
9 **Adcor ES**
10 **Preprufe CJ Tape**

Supply

Dimensions (Nominal)	Preprufe 300R Membrane	Preprufe 160R Membrane	Preprufe Tape (LT or HC*)
Thickness	0.046 in. (1.2 mm)	0.032 in. (0.8 mm)	
Roll size	4 ft x 98 ft (1.2 m x 30 m)	4 ft x 115 ft (1.2 m x 35 m)	4 in. x 49 ft (100 mm x 15 m)
Roll area	392 ft^2 (36 m^2)	460 ft^2 (42 m^2)	
Roll weight	108 lbs (50 kg)	92 lbs (42 kg)	4.3 lbs (2 kg)
Minimum side/end laps	3 in. (75 mm)	3 in. (75 mm)	3 in. (75 mm)
* LT denotes Low Temperature (between 25°F (-4°C) and 86°F (+30°C)) HC denotes Hot Climate (50°F (>+10°C))			
Ancillary Products			
Bituthene Liquid Membrane—1.5 US gal (5.7 liter) or 4 US gal (15.1 liter)			

Physical Properties

Property	Typical Value 300R	Typical Value 160R	Test Method
Color	white	white	
Thickness	0.046 in. (1.2 mm)	0.032 in. (0.8 mm)	ASTM D3767
Lateral Water Migration Resistance	Pass at 231 ft (71 m) of hydrostatic head pressure	Pass at 231 ft (71 m) of hydrostatic head pressure	ASTM D5385, modified[1]
Low temperature flexibility	Unaffected at -20°F (-29°C)	Unaffected at -20°F (-29°C)	ASTM D1970
Resistance to hydrostatic head	231 ft (71 m)	231 ft (71 m)	ASTM D5385, modified[2]
Elongation	660%	580%	ASTM D412, modified[3]
Tensile strength	4000 psi (27.6 MPa)	4000 psi (27.6 MPa)	ASTM D412
Crack cycling at -9.4°F (-23°C), 100 cycles	Unaffected, Pass	Unaffected, Pass	ASTM C836
Puncture resistance	221 lbs (990 N)	100 lbs (445 N)	ASTM E154
Peel adhesion to concrete	5 lbs/in. (880 N/m)	5 lbs/in. (880 N/m)	ASTM D903, modified[4]
Lap peel adhesion	5 lbs/in. (880 N/m)	5 lbs/in. (880 N/m)	ASTM D1876, modified[5]
Permeance to water vapor transmission	0.01 perms (0.6 ng/(Pa x s x m^2))	0.01 perms (0.6 ng/(Pa x s x m^2))	ASTM E96, method B
Water absorption	0.5%	0.5%	ASTM D570

Footnotes:

1. Lateral water migration resistance is tested by casting concrete against membrane with a hole and subjecting the membrane to hydrostatic head pressure with water. The test measures the resistance of lateral water migration between the concrete and the membrane.
2. Hydrostatic head tests of Preprufe Membranes are performed by casting concrete against the membrane with a lap. Before the concrete cures, a 0.125 in. (3 mm) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where water is introduced to the membrane surface up to the head indicated.
3. Elongation of membrane is run at a rate of 2 in. (50 mm) per minute.
4. Concrete is cast against the protective coating surface of the membrane and allowed to properly dry (7 days minimum). Peel adhesion of membrane to concrete is measured at a rate of 2 in. (50 mm) per minute at room temperature.
5. The test is conducted 15 minutes after the lap is formed (per Grace published recommendations) and run at a rate of 2 in. (50 mm) per minute.

Specification Clauses

Preprufe 300R or 160R shall be applied with its adhesive face presented to receive fresh concrete to which it will integrally bond. Only Grace Construction Products approved membranes shall be bonded to Preprufe 300R/160R. All Preprufe 300R/160R system materials shall be supplied by Grace Construction Products, and applied strictly in accordance with their instructions. Specimen performance and formatted clauses are also available.

NOTE: Use Preprufe Tape to tie-in Procor with Preprufe.

Health and Safety

Refer to relevant Material Safety data sheet. Complete rolls should be handled by a minimum of two persons.

www.graceconstruction.com

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

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Procor is a U.S. registered trademark of W. R. Grace & Co.–Conn., and is used in Canada under license from PROCOR LIMITED.

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FLORPRUFE® 120

Integrally bonded vapor protection for slabs on grade

Description

Florprufe® 120 is a high perfor-mance 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

Product Advantages

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

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 sub-base, 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.

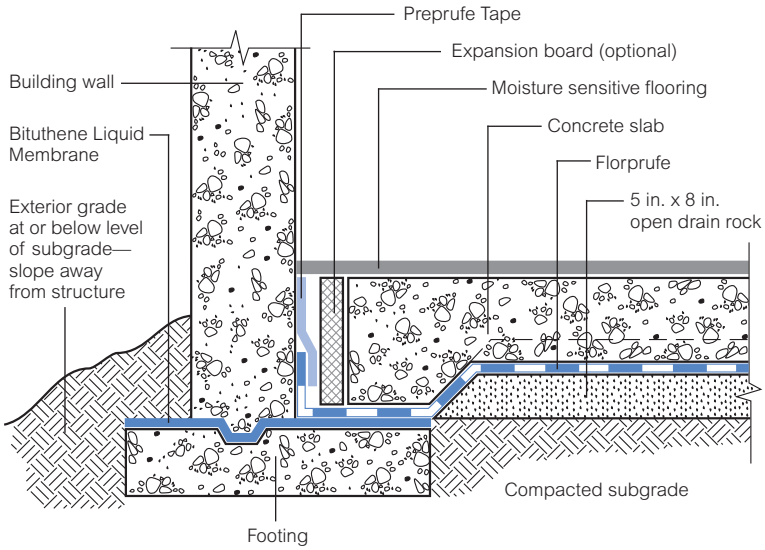
Slab reinforcement and concrete can be placed immediately. Once the concrete is poured, an integral bond develops between the concrete and membrane.

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 25ºF (-4ºC) 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.

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.

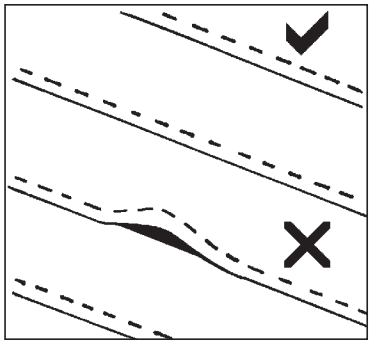


Figure 1

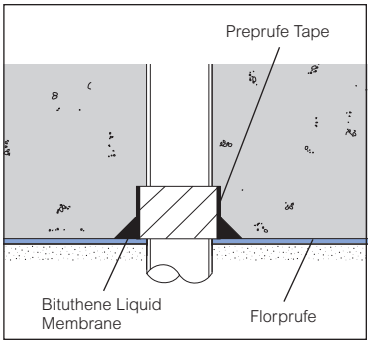


Figure 2

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)

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Preprufe® Tape

DESCRIPTION

Preprufe® Tape is a specially formulated two sided, reinforced pressure sensitive tape. The bottom side of the tape has a highly aggressive pressure sensitive adhesive which is designed to adhere to penetrations, protrusions and Bituthene® membranes. The top side has another layer of adhesive and a protective coating. The protective coating protects the tape from the weather and UV light for up to 30 days after application. A thin flexible film is sandwiched between the two layers of pressure sensitive adhesive. The tape develops a continuous mechanical bond with the concrete that is cast against it.

Preprufe Tape is supplied in rolls and is interwound with a silicone coated release liner.

USE

Preprufe Tape is used in detail areas including end laps, penetrations and various tie-ins. It is also used to patch damaged areas in the Preprufe membranes. The tape is a critical component of the Preprufe system since it is designed to develop a continuous mechanical bond to concrete that is cast against it.

APPLICATION

Apply Preprufe Tape when ambient temperatures are -4°C (25°F) or above.

Wipe Preprufe membranes clean to remove any dirt, dust or moisture. Clean the surface of penetrations or protrusions with a wire brush to remove dirt, dust, rust and loose particles.

Unroll the tape and adhere the exposed pressure sensitive adhesive surface to the membrane or penetration. The protective coating surface of the tape should face toward the concrete to be cast.

Use heavy hand pressure or a hand roller to maximize adhesion. Remove the release liner during application. Cast concrete or apply shotcrete within 30 days of application of the tape.

For Technical Assistance call us at 800-444-6459 (Option 3).

Visit our web site at: www.graceconstruction.com **printed on recycled paper**

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Technical Service Engineer - Americas

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W. R. Grace & Co.-Conn.
62 Whittemore Avenue
Cambridge, MA 02140

November 20th, 2013

Asya Bychkov
Environmental Engineer
AKRF, INC.
440 Park Ave South, 7th Floor
New York, NY 10016
646.388.9533

Project: NYU Langone Medical Center – Science Building East 30th Street, Manhattan, NY

Dear Ms. Bychkov,

I have reviewed the following reports for the above referenced project:

- Tables 1-9 Analytical Date provided by AKRF, INC.
- Figure 2 – Sampling Locations Plan prepared by AKRF, INC., dated 8/29/13

The identified contaminants at the levels reported will not have an adverse effect on the waterproofing or vapor barrier properties of Preprufe® 300R, Preprufe® 160R or Florprufe® 120 systems and all system accessories, provided standard design and application procedures are followed.

Standard installation instructions and details can be found on our website at www.graceconstruction.com.

If you have any questions, please feel free to call me at the number above.

Sincerely,

Mark Franciosi

Mark Franciosi

Technical Services Engineer

cc: J. Ridgeway

GRACE

Chemical Resistance
Technical Letter 4

Several series of tests have been conducted to define the chemical resistance of Preprufe® and Bituthene® waterproofing membranes. Both Preprufe and Bituthene membranes are highly resistant to normal ground water conditions which range from alkaline to acidic. In addition, Preprufe and Bituthene waterproofing membranes are unaffected by exposure to salt water.

Occasionally Preprufe and Bituthene may be used in applications which will be subjected to intermittent or even continuous exposure to chemicals. The following guidelines can be used to evaluate the applicability of the Preprufe and Bituthene membrane system.

NOTE: Most solvents and fuels will not significantly affect polyethylene film but may soften or dissolve the adhesive compounds exposed at the edge laps. Detailed information on the type of exposure is necessary to make recommendations.

For below slab and blind side applications, a concrete mud-slab or continuous soil retention system will reduce the exposure of the Preprufe membrane laps. For Bituthene wall applications, the use of Bituthene Edgeguard®, or a solvent resistant tape, should be used over the membrane edges to protect the rubberized asphalt from prolonged exposure.

Exposure Conditions	Preprufe and Bituthene Membrane Resistance Rating
Sea water, de-icing salt	Excellent
Acids in solution e.g. sulfuric, acetic, hydrochloric and nitric acid	Excellent
Alkalis e.g. Sodium hydroxide, ammonium hydroxide	Excellent
Alcohols	Very Good
Organic or fuel oils, solvents	Variable (See note.)

www.graceconstruction.com

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

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High Density Polyethylene Long-Term Durability

Technical Letter 29

High Density Polyethylene (HDPE) sheet is a major component of the Bituthene® and Preprufe® membranes. The functions of the HDPE are to 1) provide a portion of the waterproofing protection for the structure and 2) provide increased resistance of the waterproofing adhesive from environmental exposure and backfill.

HDPE was chosen for this purpose because it has excellent mechanical properties required for this application including high puncture, tear, and tensile strengths as well as good elongation for bridging any post-formed cracks in the structure. The other advantage of HDPE is that it is extremely resistant to attack and degradation from most chemicals. Consequently, it is typically a leading candidate for use in geomembranes including landfills containment systems, pond liners, and holding tanks for waste liquids.

Below grade waterproofing membranes, such as Preprufe, are often exposed to a variety of soil contaminants in addition to water. These could include alkaline and acidic environments, petroleum-based hydrocarbons, and chlorinated hydrocarbons. A number of studies have been conducted on various materials on the long-term durability of HDPE after exposure to contaminants. The general conclusion of various studies is that HDPE is one of the more inert materials used in geomembrane systems. A 1990 publication by the American Society of Testing and Materials [1] based on an extensive survey of case study testing concluded that the service life of base polymers, such as HDPE, in flexible membrane liners (FML) used in geotextiles should last hundreds of years without premature failure. However, the study also stated that inappropriate applications or installations, such as excessive exposure to UV, heat, and ozone, could lead to degradation and shorter life expectancy. In summary, the major component of Preprufe, HDPE, provides the necessary mechanical properties for waterproofing and excellent chemical resistance provided the HDPE is protected from excessive exposure to UV, heat, and ozone.

Reference:

1. Landreth, R. E., Service Life of Geosynthetics in Hazardous Waste Management Facilities, in Geosynthetics: Microstructure and Performance, ASTM ATP 1076, I. D. Peggs, editor, American Society for Testing and Materials, Philadelphia (1990) p. 26.

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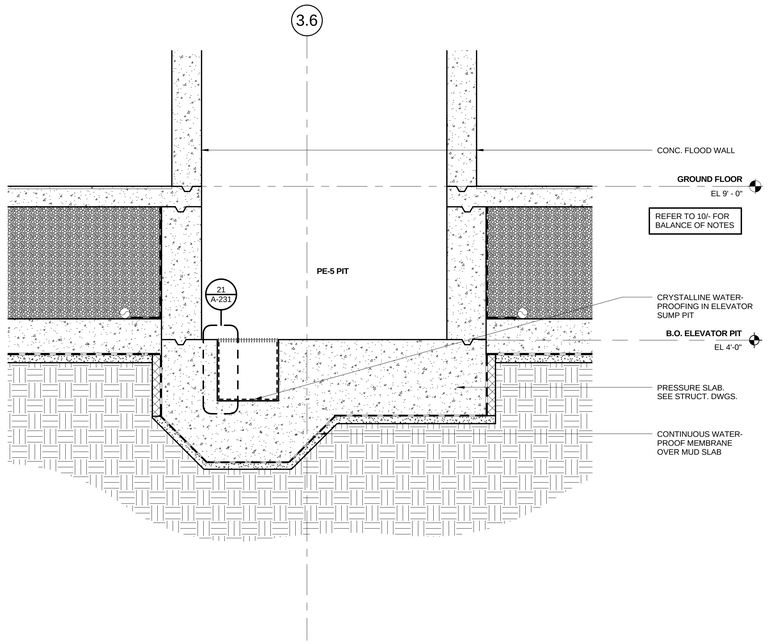
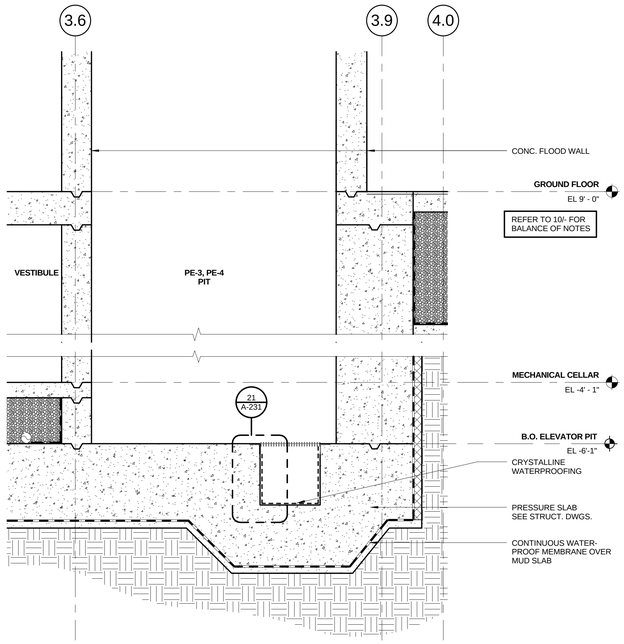
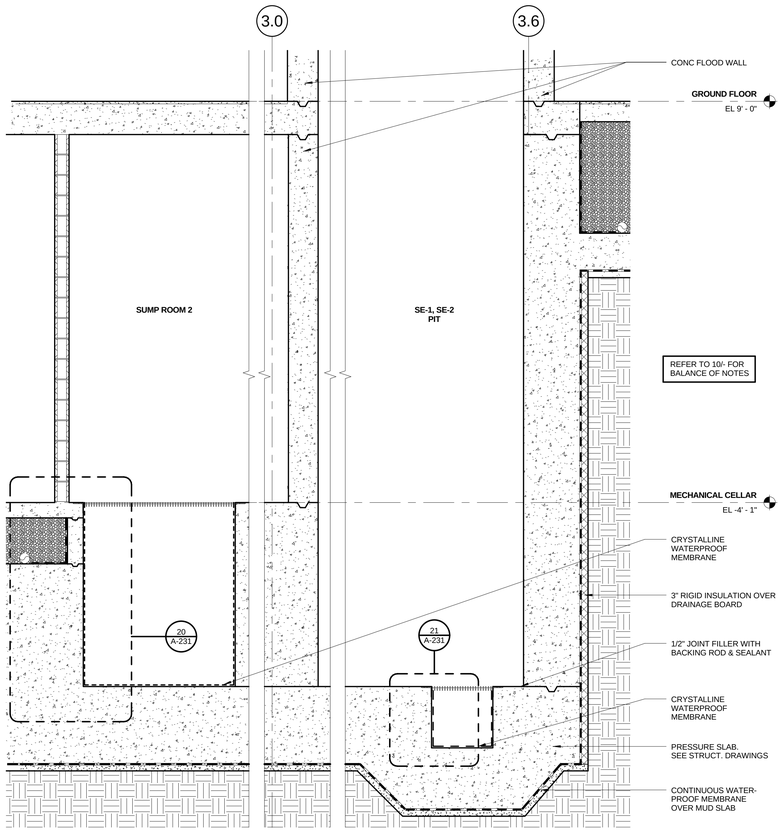


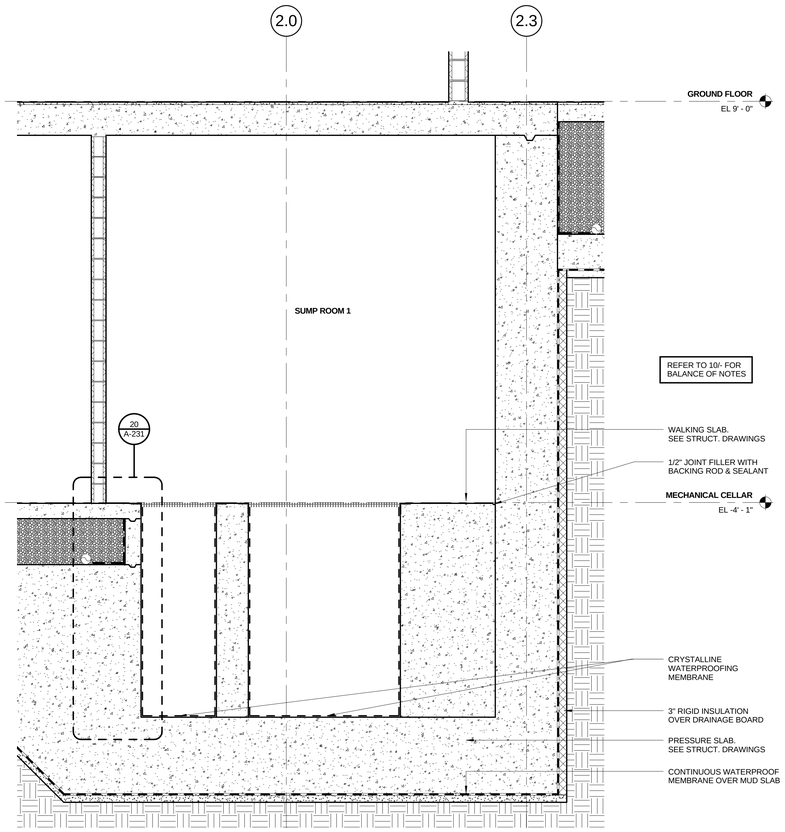
21 PE-5 ELEVATOR PIT SECTION
1/2" = 1'-0"



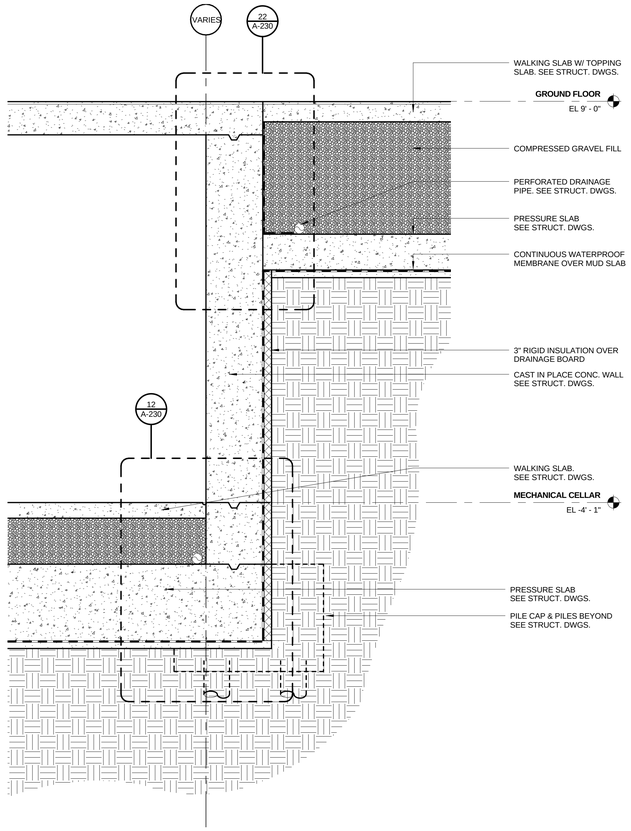
20 PE-3 & PE-4 ELEVATOR PIT SECTION
1/2" = 1'-0"



12 Dependent on SE-1 & SE-2 ELEVATOR PIT & SUMP PIT SECTION
1/2" = 1'-0"



11 SECTION THROUGH SUMP PITS
1/2" = 1'-0"



10 SECTION THROUGH TYPICAL FOUNDATION WALL
1/2" = 1'-0"

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Key Plan

No.	Issue Name	Date

No.	Issue Name	Date
4	OER Submission	12/10/2013
3	DD Flood Proofing Pricing	10/24/2013
2	ASI #1 Foundation Hardening	10/24/2013
1	Foundation CD's	11/21/2012

Sheet Title

FOUNDATION SECTIONS 1

Date 11/29/12

Project Number 1101

Sheet No. A-220.00

Scale 1/2" = 1'-0"

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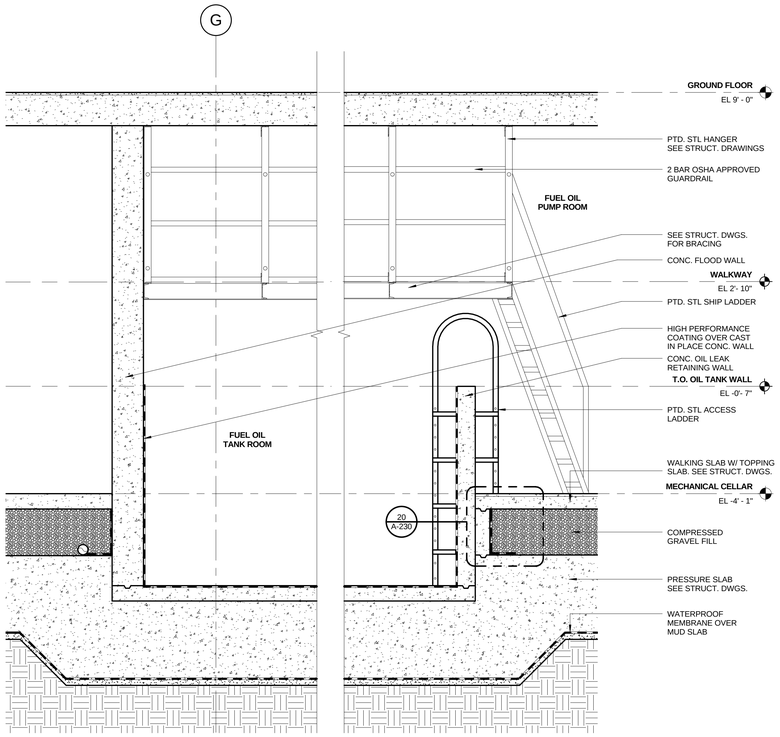
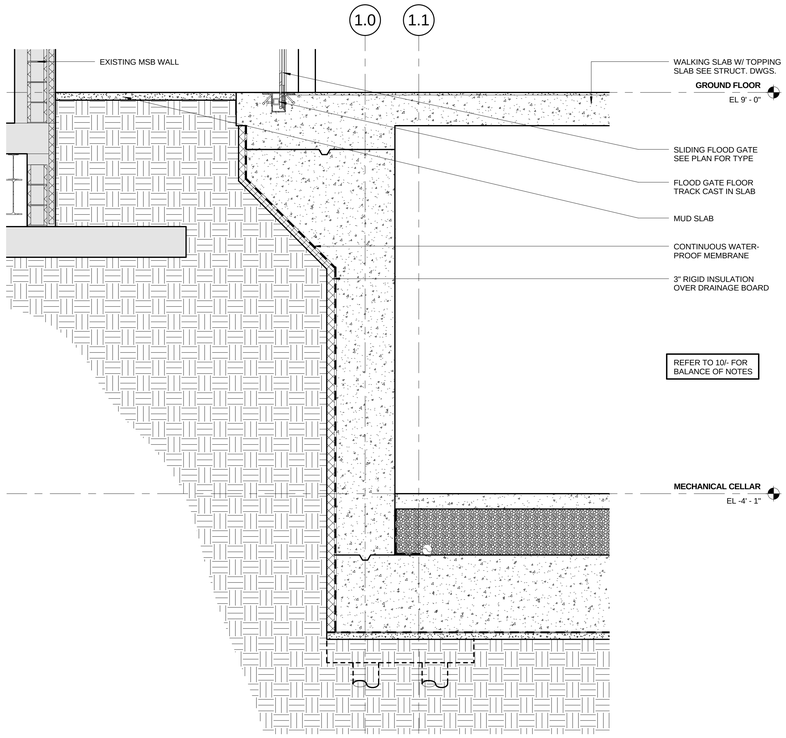
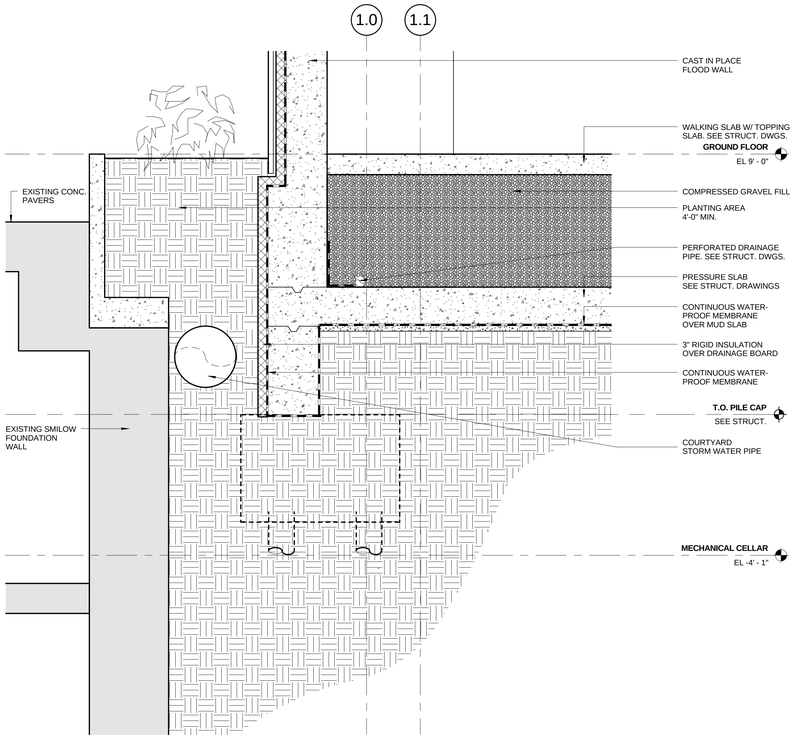


21 SECTION THROUGH FUEL OIL TANK ROOM
1/2" = 1'-0"



20 NORTH EDGE CONDITION AT MSB INTERFACE
1/2" = 1'-0"



12 NORTH EDGE CONDITION AT PLANTER
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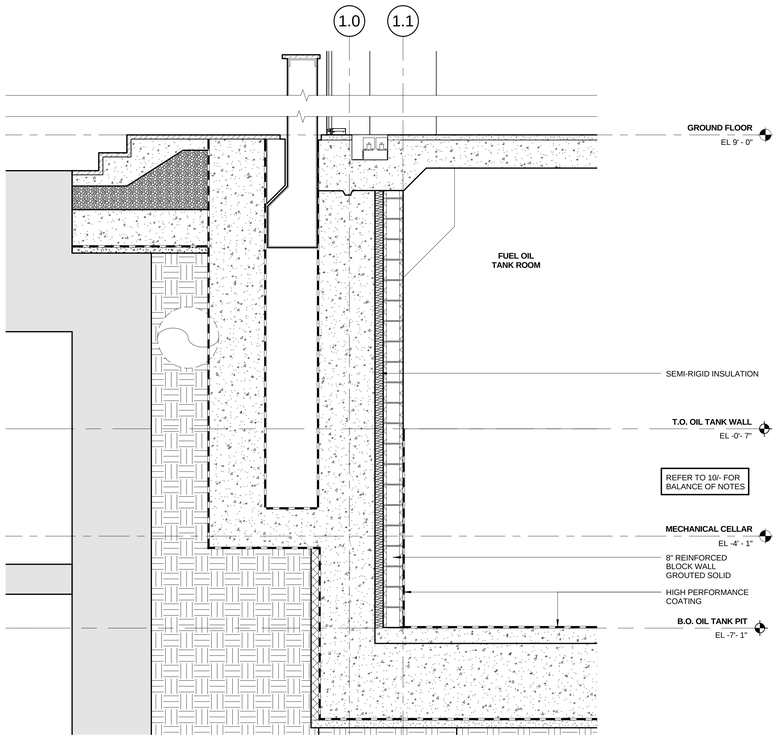

11 NORTH EDGE CONDITION AT FLOOD BARRIER & OIL TANK ROOM
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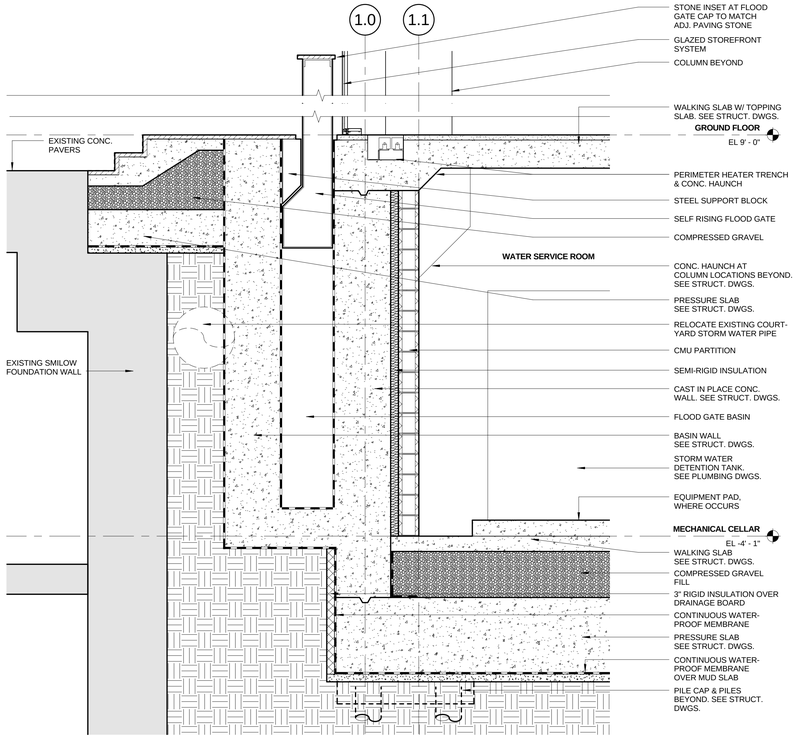

10 NORTH EDGE CONDITION AT FLOOD BARRIER & WATER SERVICE ROOM
1/2" = 1'-0"

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Key Plan

No.	Issue Name	Date
4	OER Submission	12/10/2013
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1	Foundation CD's	11/21/2012

Sheet Title

FOUNDATION SECTIONS 2

Date
11/29/12

Project Number
1101

Sheet No.
A-221.00

Scale
1/2" = 1'-0"

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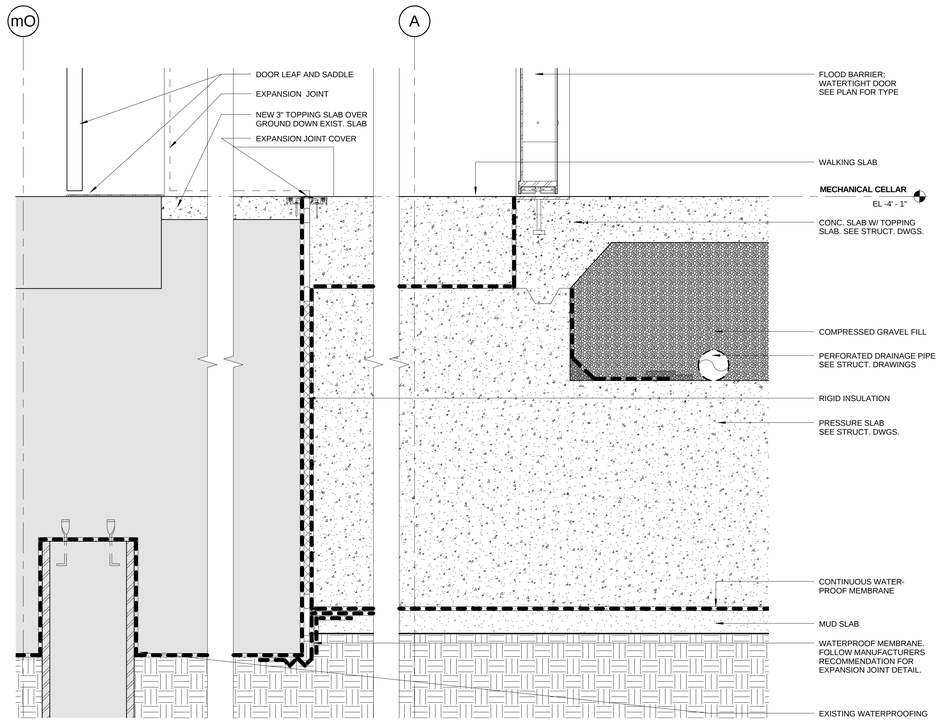
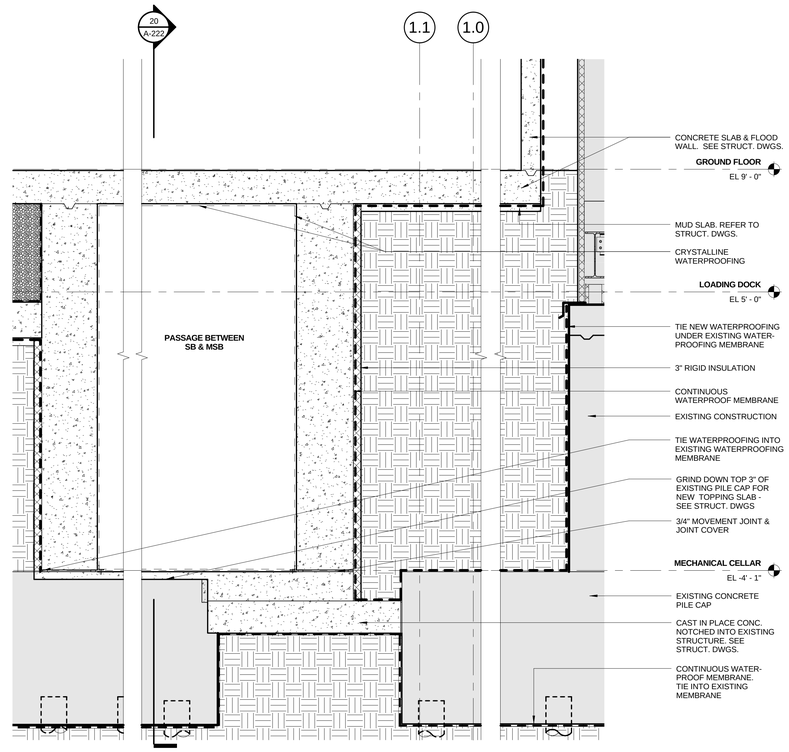


22 MOVEMENT JOINT SECTION DETAIL
1 1/2" = 1'-0"



21 N/S SECTION - MSB/ SB CONNECTION
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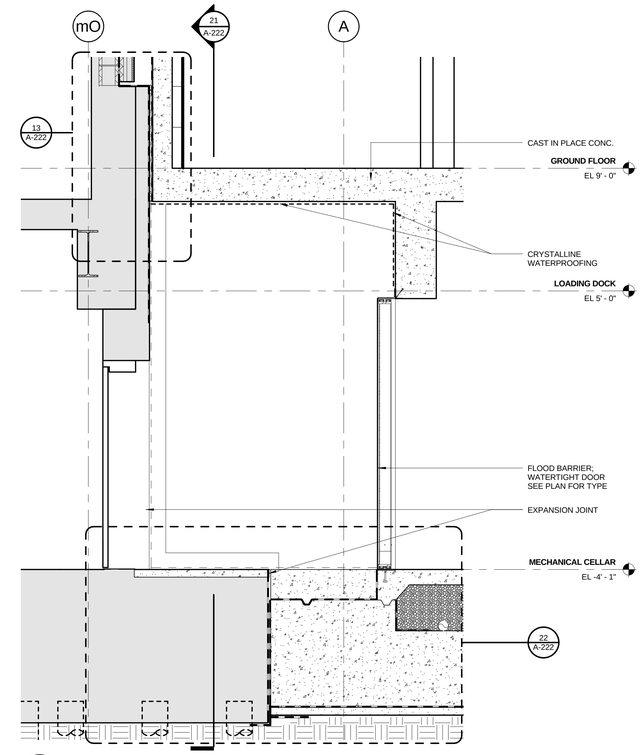

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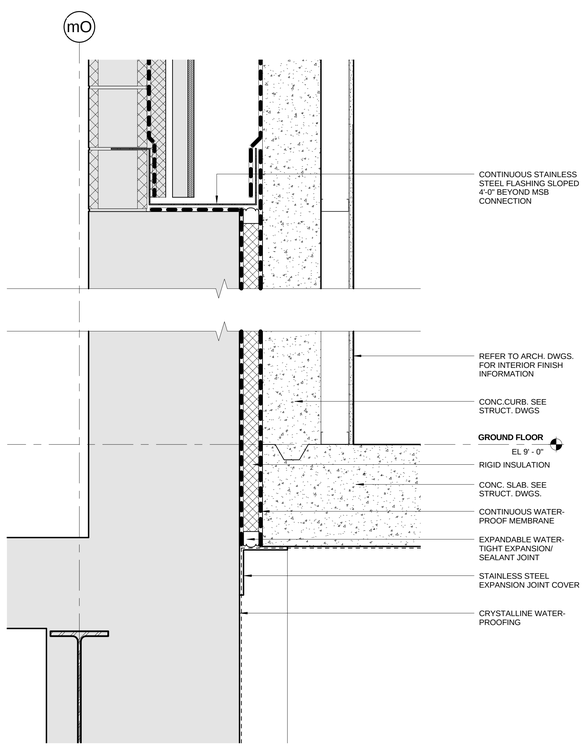
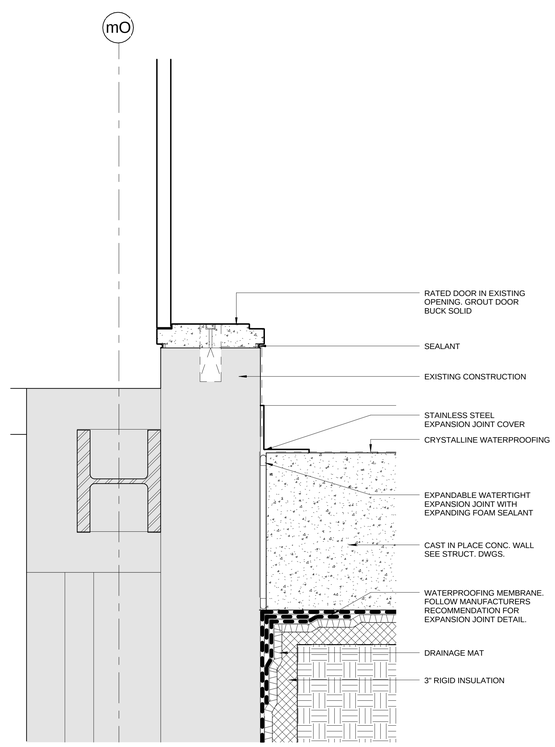
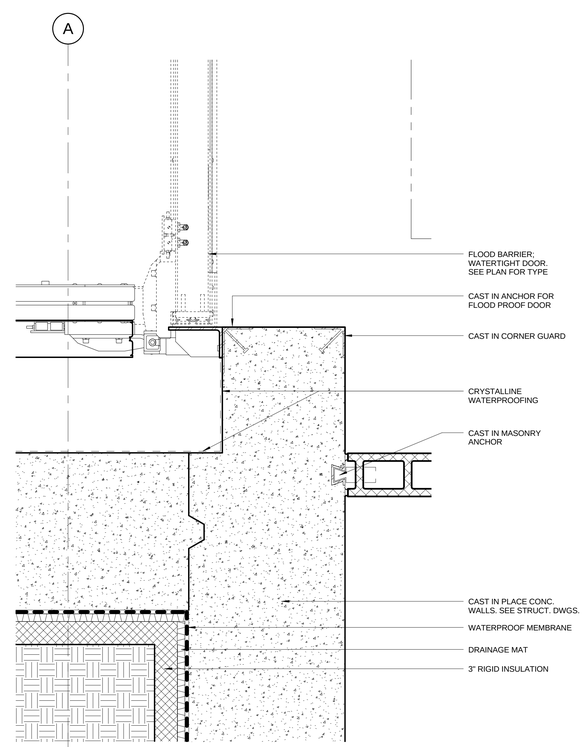


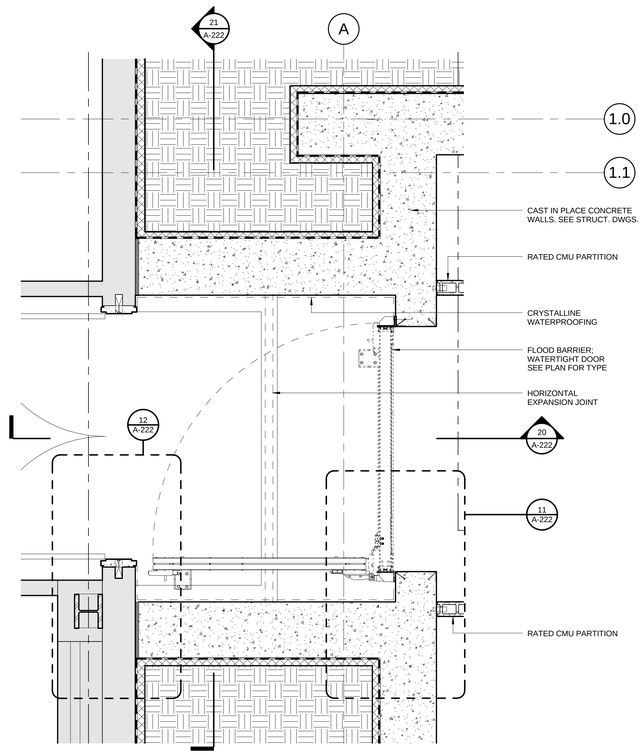
13 MSB SECTION DETAIL - MOVEMENT JOINT
1 1/2" = 1'-0"



12 PLAN DETAIL AT MSB CONNECTION
1 1/2" = 1'-0"



11 PLAN DETAIL AT FLOOD DOOR
1 1/2" = 1'-0"



10 FLOOD DOOR ENLARGED PLAN - MSB/SB CONNECTION
1/2" = 1'-0"

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Key Plan

No.	Issue Name	Date
4	OER Submission	12/10/2013
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2	ASI #1 Foundation Hardening	10/24/2013
1	Foundation CD's	11/21/2012

Sheet Title

FOUNDATION SECTIONS 3

Date 11/29/12

Project Number 1101

Sheet No. A-222.00

Scale As indicated

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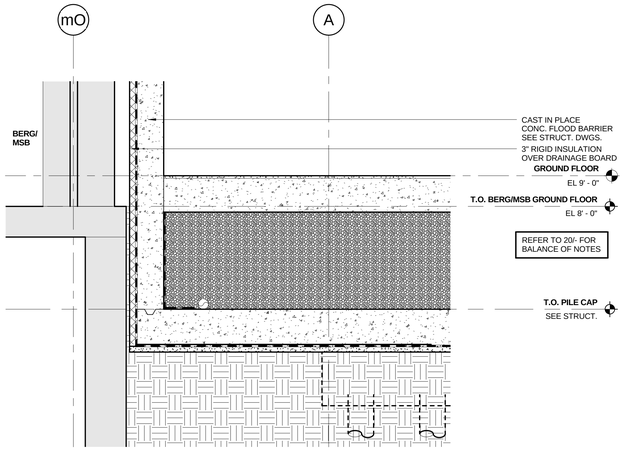
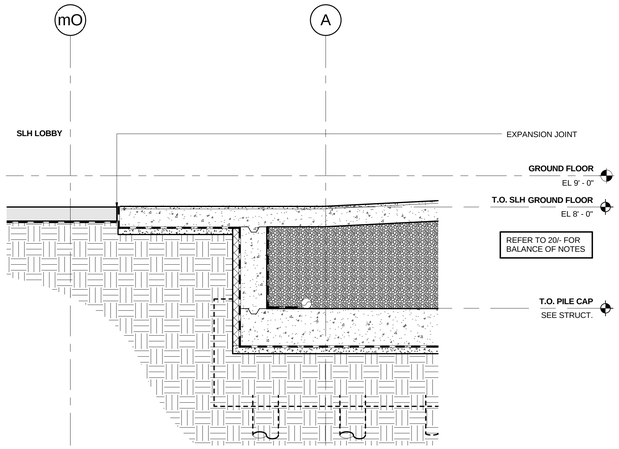


22 WEST EDGE CONDITION AT BERG/MSB
1/2" = 1'-0"



21 WEST EDGE CONDITION AT SLH CONNECTION
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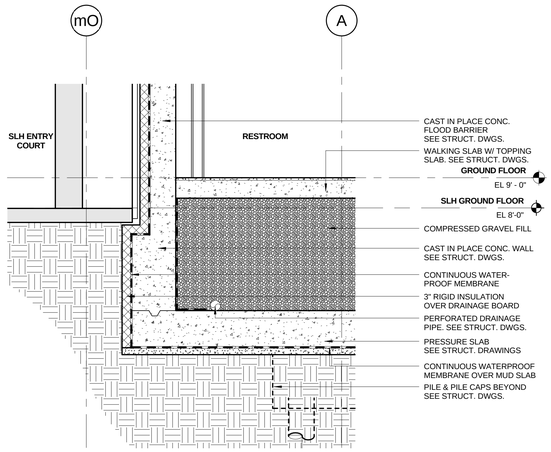

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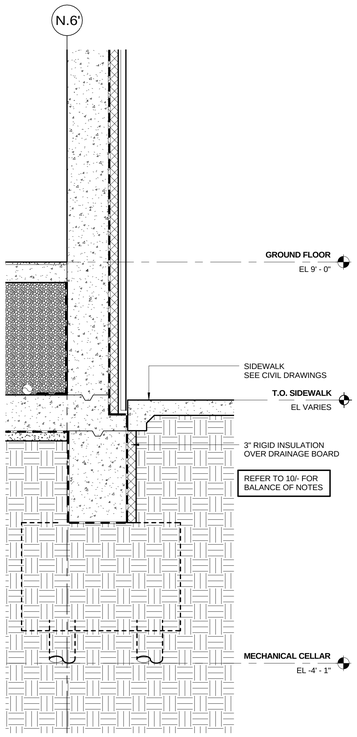
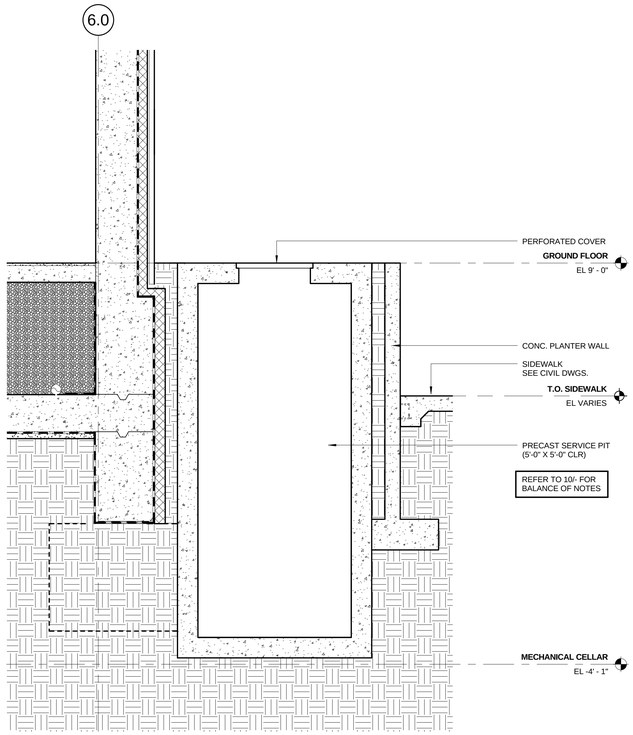
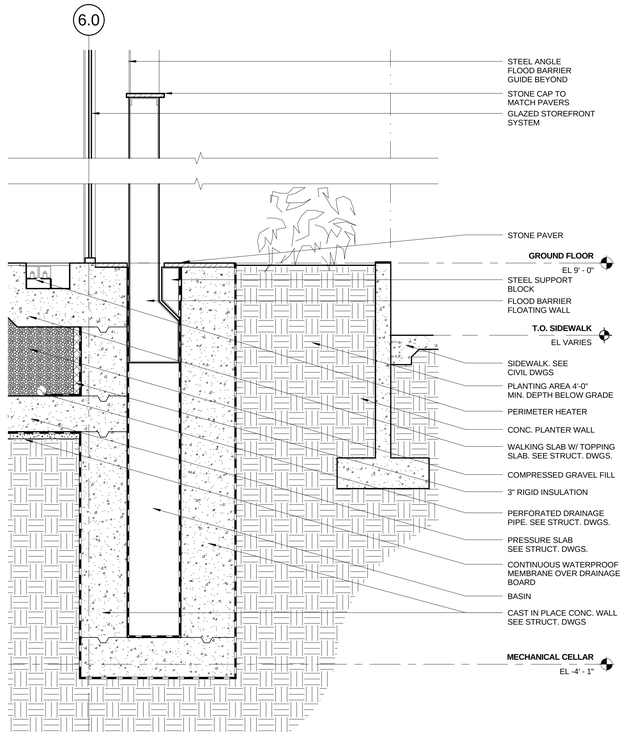


13 EAST EDGE CONDITION AT SIDEWALK
1/2" = 1'-0"



12 SOUTH EDGE CONDITION AT SELF RISING FLOOD GATE SERVICE PIT
1/2" = 1'-0"



11 SOUTH EDGE CONDITION AT SELF RISING FLOOD GATE
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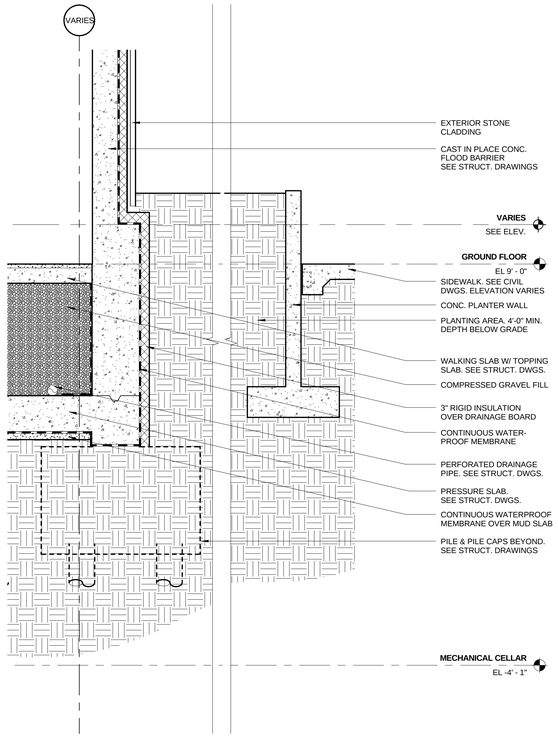

10 TYPICAL PLANTER EDGE CONDITION
1/2" = 1'-0"

Project Title

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Key Plan

No.	Issue Name	Date
4	OER Submission	12/10/2013
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1	Foundation CD's	11/21/2012

Sheet Title

FOUNDATION SECTIONS 4

Date
11/29/12

Project Number
1101

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Scale
1/2" = 1'-0"

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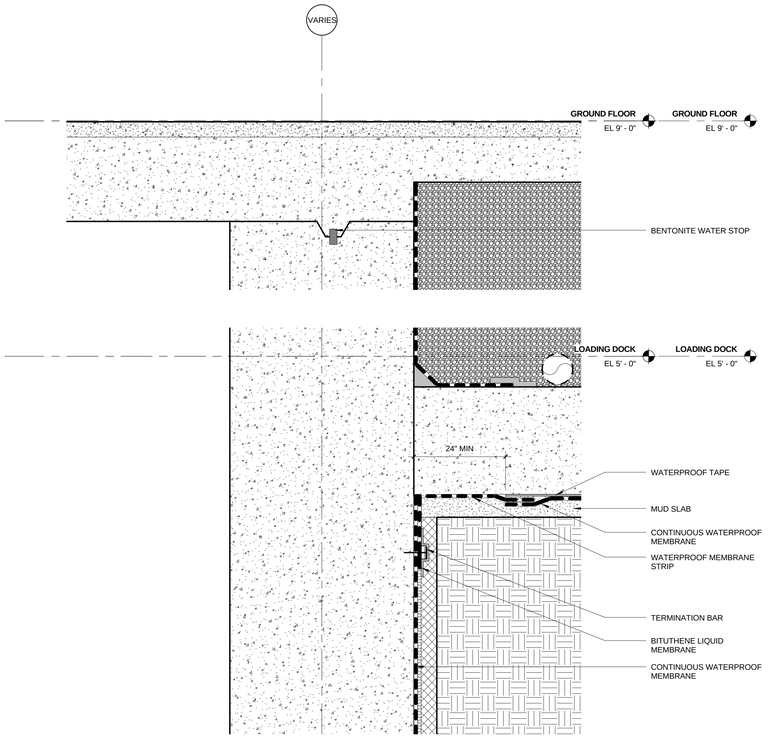

22 SECTION DETAIL - WATERPROOFING AT ELEVATED SLAB
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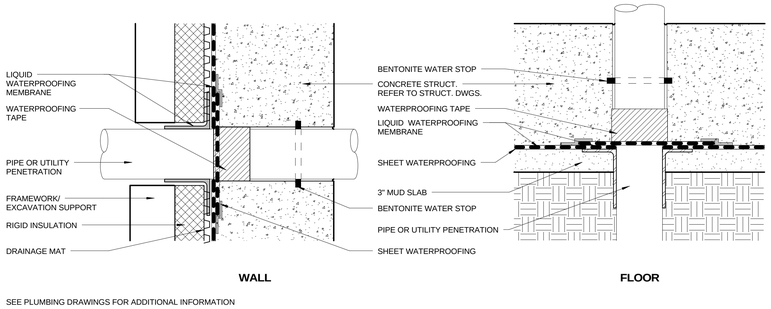
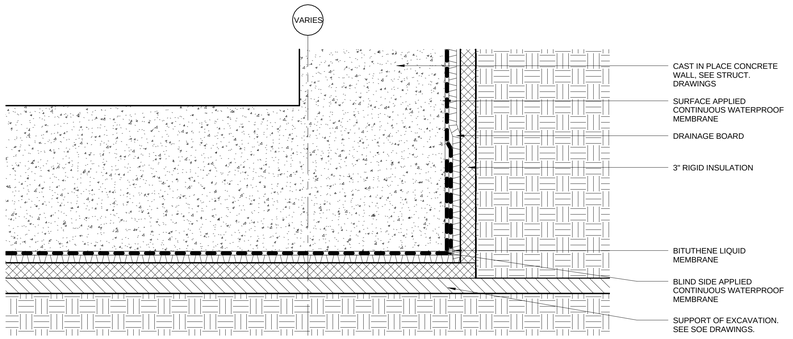


SEE PLUMBING DRAWINGS FOR ADDITIONAL INFORMATION

31 TYPICAL PENETRATION DETAIL
1 1/2" = 1'-0"



30 PLAN DETAIL - FOUNDATION WALL WATERPROOFING
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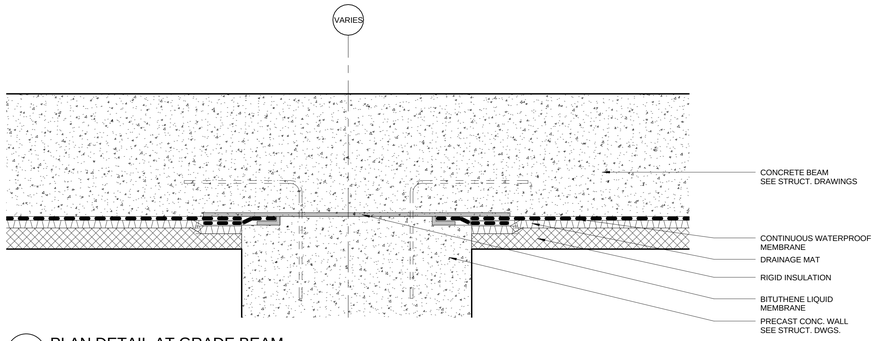
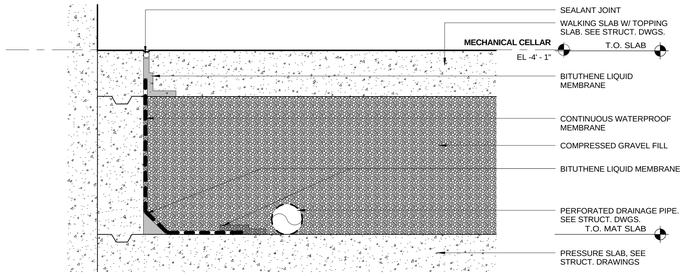


21 PLAN DETAIL AT GRADE BEAM
1 1/2" = 1'-0"



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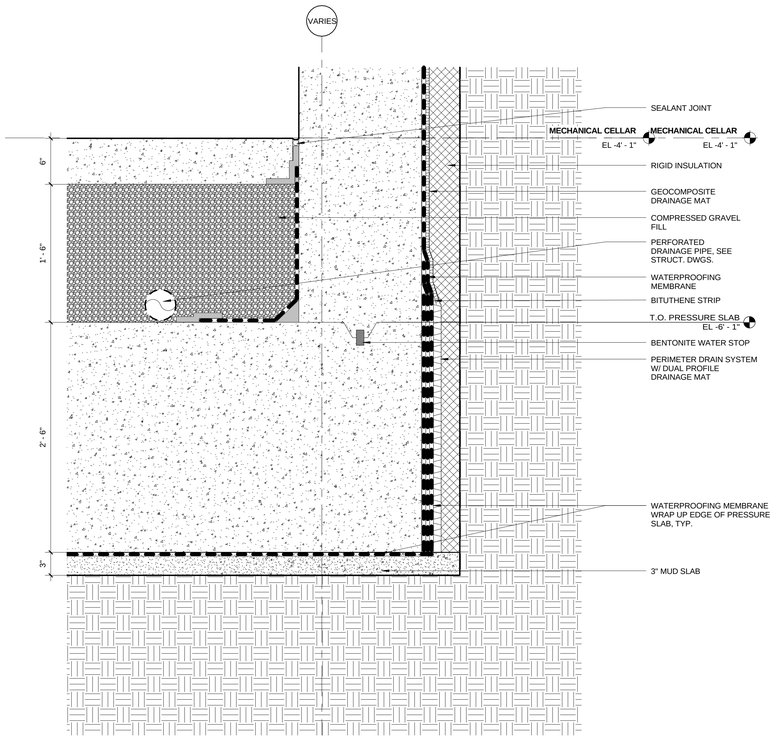
1 1/2" = 1'-0"



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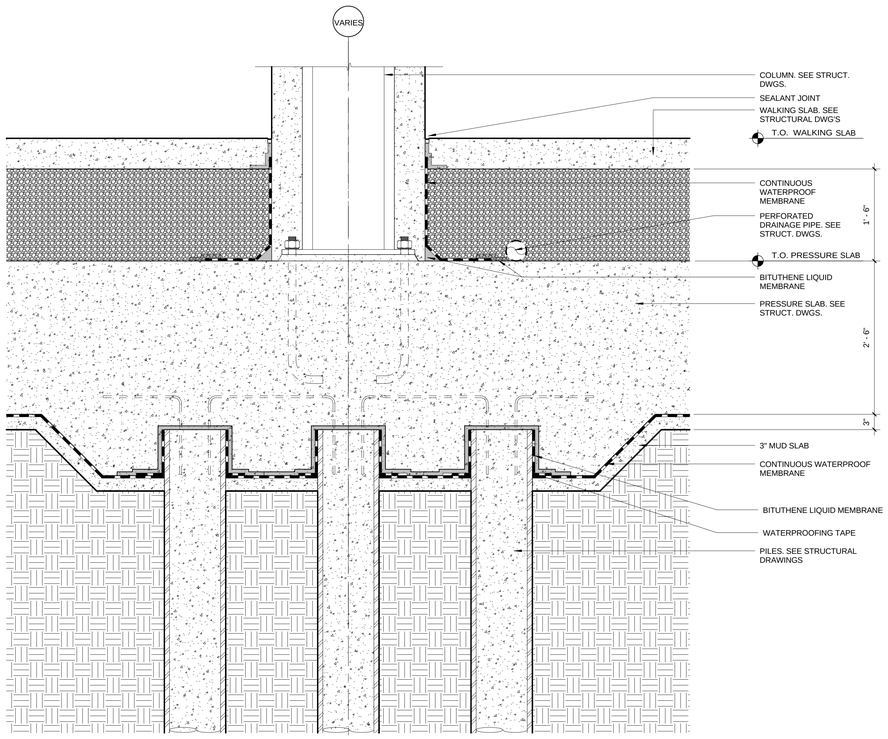
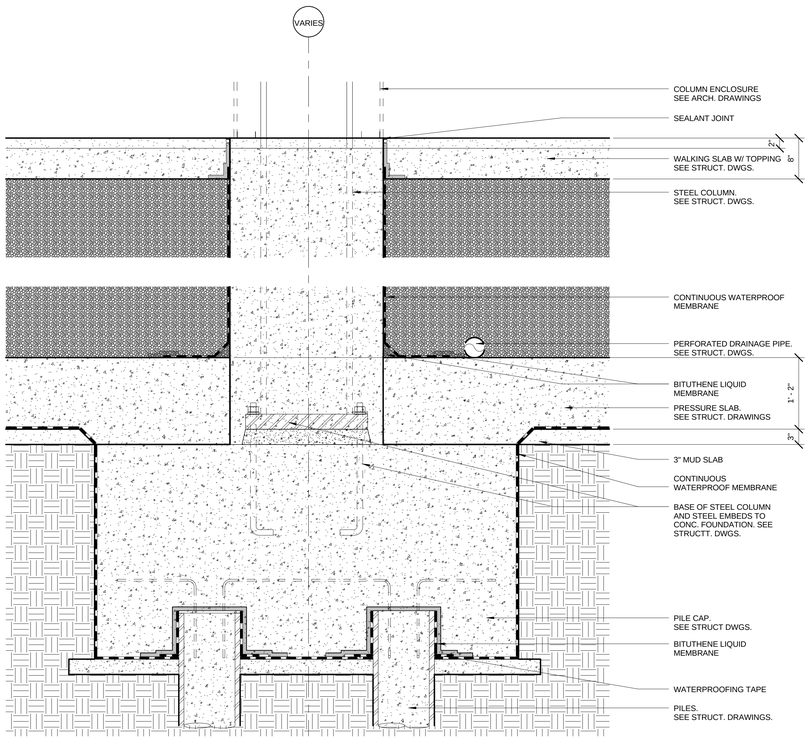


11 TYPICAL WATERPROOFING DETAIL AT GRADE BEAM PILE CAP
1" = 1'-0"



10 SECTION DETAIL - TYPICAL STEEL INTERIOR COLUMN PILE SUPPORT
1" = 1'-0"

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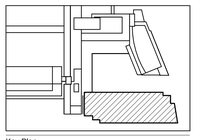

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No.	Issue Name	Date
4	OER Submission	12/10/2013
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Sheet Title
FOUNDATION DETAILS 1

Date
11/29/12

Project Number
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A-230.00

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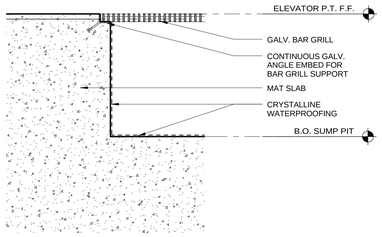

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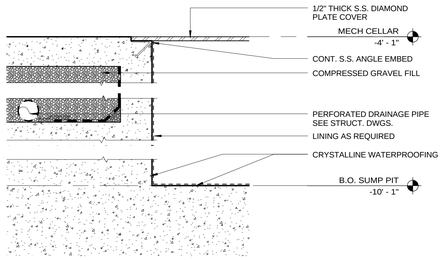

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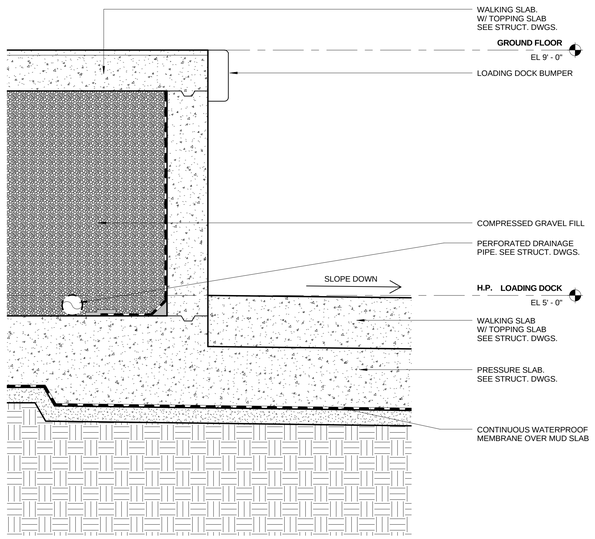
1" = 1'-0"



10 SECTION DETAIL AT LOADING DOCK
1" = 1'-0"

Project Title

NYU Langone Medical Center Science Building

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Seal

Key Plan

No.	Issue Name	Date
4	OER Submission	12/10/2013
3	DD Flood Proofing Pricing	10/24/2013
2	ASI #1 Foundation Hardening	10/24/2013
1	Foundation CD's	11/21/2012

Sheet Title

FOUNDATION DETAILS 2

Date
11/29/12

Project Number
1101

Sheet No.
A-231.00

Scale
1" = 1'-0"

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