Hydro Tech Environmental, Corp.

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May 29, 2015

New York City Office of Environmental Remediation
City Voluntary Cleanup Program
c/o Shaminder Chawla
100 Gold Street, 2nd Floor
New York, NY 10038

Re: 15CVCP153M
334-338 West 36th Street
New York, NY
Remedial Action Work Plan (RAWP) Stipulation List

Dear Mr. Chawla:

Hydro Tech Environmental Corp (the consultant) hereby submits a Remedial Action Work Plan (RAWP) Stipulation List for the 334-338 West 36th Street site (the Site) to the New York City Office of Environmental Remediation (OER) on behalf of 338 West LLC. This letter serves as an addendum to the RAWP to stipulate additional content, requirements, and procedures that will be followed during the Site remediation. The contents of this list are added to the RAWP and will supersede the content in the RAWP where there is a conflict in purpose or intent. The additional requirements/procedures include the following Stipulation List below:

1. The criterion attached in **Appendix 1** will be utilized if additional petroleum-containing tank or vessel is identified during the remedial action or subsequent redevelopment excavation activities. All petroleum spills will be reported to the NYSDEC hotline as required by applicable laws and regulations. This contingency plan is designed for heating oil tanks and other small or moderately sized storage vessels. If larger tanks, such as gasoline storage tanks are identified, OER will be notified before this criterion is utilized.

2. A pre-construction meeting is required prior to start of remedial excavation work at the site. A pre-construction meeting will be held at the site and will be attended by OER, the developer or developer representative, the consultant, excavation/general contractor, and if applicable, the soil broker.

3. A pre-approval letter from all disposal facilities will be provided to OER prior to any soil/fill material removal from the site. Documentation specified in the RAWP - Appendix 3 - Section 1.6 "Materials Disposal Off-Site" will be provided to OER. If a different disposal facility for the soil/fill material is selected, OER will be notified immediately.

4. Signage for the project will include a sturdy placard mounted in a publically accessible right of way to building and other permits signage will consist of the NYC VCP Information Sheet (attached **Appendix 2**) announcing the remedial action. The Information sheet will be laminated and permanently affixed to the placard.

5. If the site contains hazardous waste that will be excavated and disposed of off site, the OER will work with the development team to seek an exemption for your property from the $130/ton state Hazardous Waste Program Fee. To qualify for an exemption, the site must be enrolled in the city Voluntary Cleanup Program; hazardous waste must result from remedial action set forth in a cleanup plan approved by the OER and the OER must oversee the cleanup. It is the applicant's responsibility to notify your OER Project Manager, copying supervising Project Manager and Mr. Shaminder Chawla before hazardous waste is shipped from the site. Unless the NYSDEC is notified before waste is shipped from your site, you may not receive an exemption from the fee. The exemption does not cover, and the development team may remain liable for, the Special Assessment on Hazardous Waste (established by ECL§ 27-0923) that charges a fee of up to $27 per ton for hazardous waste generated that is due at the State Department of Taxation and Finance 30 days after the end of the quarter in which the waste was generated. **Appendix 3** includes additional information about the Exemption for Hazardous Waste Program Fee.

6. Collection and analysis of 5 end-point samples from the bottom of the excavation to evaluate the performance of the remedy with respect to attainment of Track 4 SCOs. A map indicating end-point sampling locations is attached in **Appendix 4**. Samples will be analyzed for SVOCs and Metals.

7. OER requires parties seeking City Brownfield Incentive Grants to carry insurance. For a cleanup grant, both the excavator and the trucking firm(s) that handle removal of soil must carry or be covered under a commercial general liability (CGL) policy that provides $1 million per claim in coverage. OER recommends that excavators and truckers also carry contractors' pollution liability (CPL) coverage, also providing $1 million per claim in coverage. The CGL policy, and the CPL policy if obtained, must name the City of New York, the NYC Economic Development Corporation, and Brownfield Redevelopment Solutions as additional insured. For an investigation grant, an environmental consultant must be a qualified vendor in the BIG program and carry $1 million of professional liability (PL) coverage. A fact sheet regarding insurance is attached as **Appendix 5**.

8. Daily reports will be provided during active excavation work. If no work is performed for extended time period, daily report frequency will be reduced to weekly basis. Daily report template is attached in **Appendix 6.**

9. An engineered composite site cover will be placed over the entire footprint of the Site. The composite cover system will be comprised of concrete foundation/slabs consisting of 6-inch thick slab in the rear yard to the south of building, 6-inch and 8-inch concrete slabs beneath the building areas and 2 feet 6 inches concrete slab beneath the elevators pit. Drawings of the composite site cover are provided as **Appendix 7**.

10. All hotspots identified in the RIR will be properly delineated and removed from the site including the locations of SP-1, SP-7, and SP-8.

11. Truck route is included in **Appendix 8.**

12. The stamped/signed RAWP certification page is included in **Appendix 9.**

13. The revised volume of soil excavation associated with this work is estimated at approximately 750 tons. The revised location of soil excavation is provided in **Appendix 10**.

Sincerely,
Hydro Tech Environmental, Corp.

Paul I. Matli, Ph.D.
Senior Project Manager

PM/ph
Enc.

cc: Samantha Morris, NYCOER, w/ Enc.
Pat Jones, 338 West, LLC, w/ Enc.

Appendix 1

Generic Procedures for Management of Underground Storage Tanks
Identified under the NYC VCP

Prior to Tank removal, the following procedures should be followed:

- Remove all fluid to its lowest draw-off point.
- Drain and flush piping into the tank.
- Vacuum out the "tank bottom" consisting of water product and sludge.
- Dig down to the top of the tank and expose the upper half.
- Remove the fill tube and disconnect the fill, gauge, product, vent lines and pumps. Cap and plug open ends of lines.
- Temporarily plug all tank openings, complete the excavation, remove the tank and place it in a secure location.
- Render the tank safe and check the tank atmosphere to ensure that petroleum vapors have been satisfactorily purged from the tank.
- Clean tank or remove to storage yard for cleaning.
- If the tank is to be moved, it must be transported by licensed waste transporter. Plug and cap all holes prior to transport leaving a 1/8 inch vent hole located at the top of the tank during transport.
- After cleaning, the tank must be made acceptable for disposal at a scrap yard, cleaning the tanks interior with a high pressure rinse and cutting the tank in several pieces.

During the tank and pipe line removal, the following field observations should be made and recorded:

- A description and photographic documentation of the tank and pipe line condition (pitting, holes, staining, leak points, evidence of repairs, etc.).
- Examination of the excavation floor and sidewalls for physical evidence of contamination (odor, staining, sheen, etc.).
- Periodic field screening (through bucket return) of the floor and sidewalls of the excavation, with a calibrated photoionization detector (PID).

<u>Impacted Soil Excavation Methods</u>

The excavation of the impacted soil will be performed following the removal of the existing tanks. Soil excavation will be performed in accordance with the procedures described under Section 5.5 of Draft DER-10 as follows:

- A description and photographic documentation of the excavation.
- Examination of the excavation floor and sidewalls for physical evidence of contamination (odor, staining, sheen, etc.).
- Periodic field screening (through bucket return) of the floor and sidewalls of the excavation, with calibrated photoionization detector (PID).

Final excavation depth, length, and width will be determined in the field, and will depend on the horizontal and vertical extent of contaminated soils as indentified through physical examination (PID response, odor, staining, etc.). Collection of verification samples will be performed to evaluate the success of the removal action as specified in this document.

The following procedure will be used for the excavation of impacted soil (as necessary and appropriate):

- Wear appropriate health and safety equipment as outlined in the Health and Safety Plan.
- Prior to excavation, ensure that the area is clear of utility lines or other obstructions. Lay plastic sheeting on the ground next to the area to be excavated.
- Using a rubber-tired backhoe or track mounted excavator, remove overburden soils and stockpile, or dispose of, separate from the impacted soil.
- If additional UST's are discovered, the NYSDEC will be notified and the best course of action to remove the structure should be determined in the field. This may involve the continued trenching around the perimeter to minimize its disturbance.
- If physically contaminated soil is present (e.g., staining, odors, sheen, PID response, etc.) an attempt will be made to remove it, to the extent not limited by the site boundaries or the bedrock surface. If possible, physically impacted soil will be removed using the backhoe or excavator, segregated from clean soils and overburden, and staged on separated dedicated plastic sheeting or live loaded into trucks from the disposal facility. Removal of the impacted soils will continue until visibly clean material is encountered and monitoring instruments indicate that no contaminants are present.
- Excavated soils which are temporarily stockpiled on-site will be covered with tarp material while disposal options are determined. Tarp will be checked on a daily basis and replaced, repaired or adjusted as needed to provide full coverage. The sheeting will be shaped and secured in such a manner as to drain runoff and direct it toward the interior of the property.

Once the site representative and regulatory personnel are satisfied with the removal effort, verification of confirmatory samples will be collected from the excavation in accordance with DER-10.

Appendix 2
NYC VCP Signage

NYC Voluntary Cleanup Program

This property is enrolled in the New York City Voluntary Cleanup Program for environmental remediation. This is a voluntary program administered by the NYC Office of Environmental Remediation.

For more information, log on to:

www.nyc.gov/oer

If you have questions or would like more information, please contact:

Shaminder Chawla at (212) 788-8841

or email us at brownfields@cityhall.nyc.gov

332-338 West 36th Street

Site #: 15CVCP153M

Appendix 3

Hazardous Waste Fee Exemption Fact Sheet

planNYC

NYC Office of Environmental Remediation

Exemption from the Hazardous Waste Program Fee

If your site is enrolled in the city Voluntary Cleanup Program and contains hazardous waste that will be excavated and disposed of offsite, OER can work with your development team to exempt your property from the $130/ton state Hazardous Waste Program fee. This exemption does not cover, and you remain liable for, the Special Assessment on Hazardous Waste (established by ECL§ 27-0923).

To qualify for an exemption from the Hazardous Waste Program Fee:

1. A site must be enrolled in the city Voluntary Cleanup Program;
2. Hazardous waste must result from remedial action set forth in a cleanup plan approved by OER; and
3. OER must oversee the cleanup.

Process for obtaining a Hazardous Waste Program Fee exemption:

For each VCP site, OER will submit three certifications to the New York State Department of Environmental Conservation (DEC):

1. OER will prepare a Notice of Potential Generation after a soil test shows a site contains hazardous waste. To prepare this Notice, you must provide your OER project manager with:

   - the site's EPA generator ID number;
   - the date of the soil test confirming hazardous waste;
   - the amount of hazardous waste in tons that you anticipate shipping offsite; and
   - the anticipated dates for the start and completion of remediation.

   DEC must receive this form **before** hazardous waste is shipped from your site. Otherwise your claim for an exemption may be denied.

2. After hazardous waste has been removed from the site, OER will distribute a Certification of Hazardous Waste Generation to your project team which when filled out documents how the hazardous waste was managed. Once completed, it must be signed by the generator (or site owner) and the site's Qualified Environmental Professional and returned to your OER project manager with a copy to Shana Holberston sholbertson@dep.nyc.gov and Mark McIntyre mmcintyre@cityhall.nyc.gov.

3. OER will then issue a Certification of Remedial Action that Generated Hazardous Waste to DEC representing OER's approval of how a site managed its hazardous waste.

Upon OER's submission of the last two certifications to DEC, the agency will issue a written statement exempting an individual site from the Hazardous Waste Program Fee. OER will then notify the project of the exemption.

For further information, please contact:

Shana Holberton
Program Manager
(212) 788-3220
SHolberton@dep.nyc.gov

or

Mark McIntyre
General Counsel
(212) 788-3015
MMcintyre@cityhall.nyc.gov

Contact OER to confirm that you are using the most updated version of this guidance.

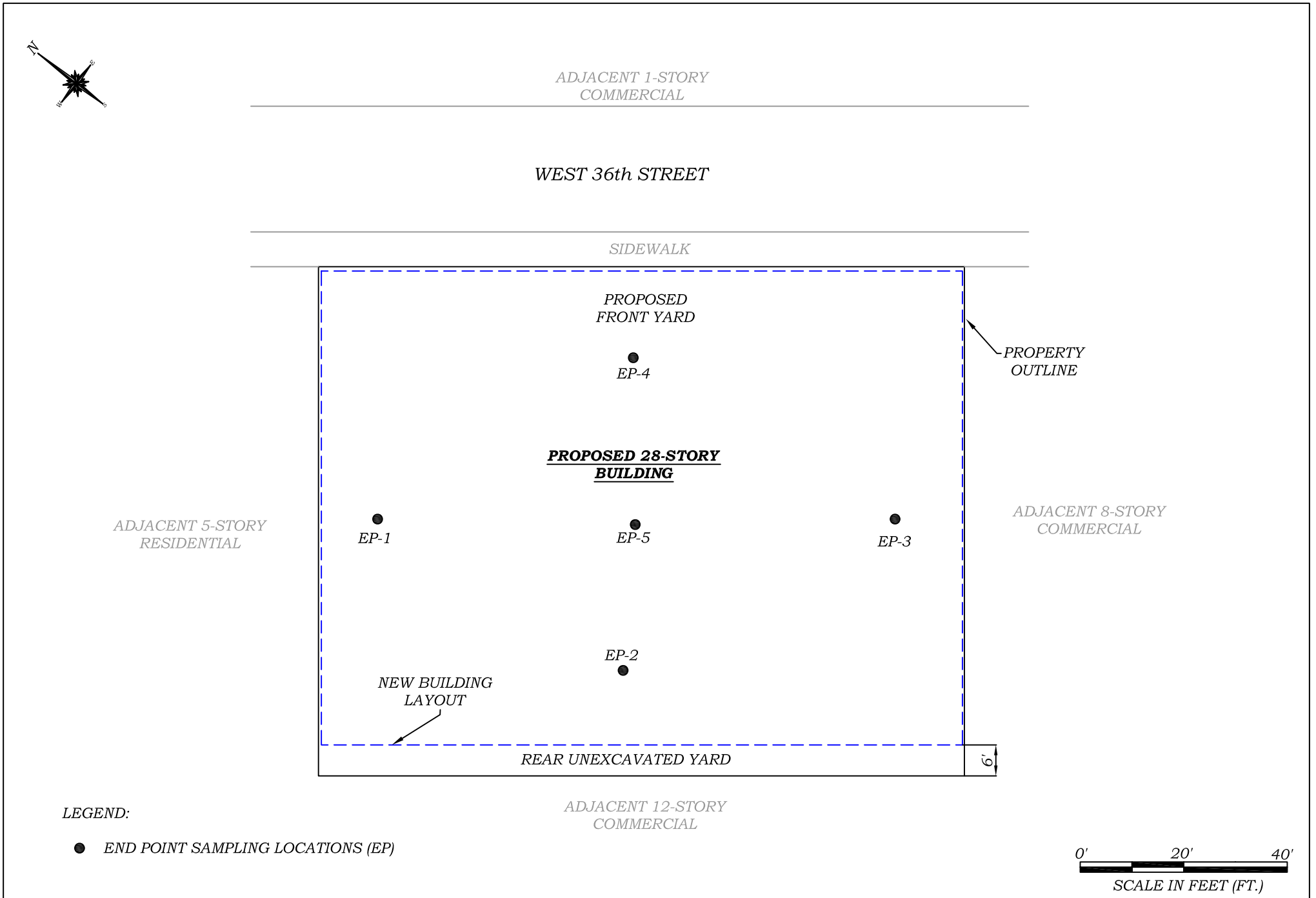
Ongoing Obligations:

Regardless of the Hazardous Waste Program Fee exemption, parties must:

- File a Hazardous Waste Annual Report with DEC by March 1 of each year if your site generated 15 tons of hazardous waste or more in the relevant calendar year. For details, see http://www.dec.ny.gov/chemical/8770.html To set forth the basis for an exemption from the Hazardous Waste Program Fee, put an X in the Exempt Remedial box in Box H of Section 1 of the Waste Generation and Management (GM) form and in the Comments Box (at the bottom of the form) include "New York City Voluntary Cleanup Program, VCP Site Number_____}"; and

- Make quarterly payments of the Special Assessment on Hazardous Waste to the state Department of Taxation and Finance. For details see: http://www.tax.ny.gov/bus/haz/hzrdwste.htm

Appendix 4
End-Point Sampling Map



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www.hydrotechenvironmental.com

338 West 36th Street
New York, NY.
HTE Job # 150024

Drawn By: C.Q.
Reviewed By: M.R
Approved By: M.R
Date: 02/09/15
Scale: AS NOTED

TITLE:

FIGURE : END POINT SAMPLING PLAN

Appendix 5
BIG Program Insurance Fact Sheet

planNYC
NYC Office of Environmental Remediation
NYC BIG Brownfield Incentive Grant Program

FACT SHEET – BIG PROGRAM INSURANCE REQUIREMENTS

Investigation Grants – for a developer or site owner to be eligible for a BIG investigation grant, its environmental consultant(s) must be:

- a Qualified Vendor in the BIG Program; and
- maintain Professional Liability (PL) insurance of $1M per claim and annual aggregate.

Cleanup Grants – for a developer or site owner to be eligible for a BIG cleanup grant:

- Its general contractor or excavation/foundation contractor hired to perform remedial work must maintain Commercial General Liability (CGL) insurance of at least $1M per occurrence and $2M in the general aggregate. It is recommended that the general contractor or excavation/foundation contractor also maintain a Contractors Pollution Liability policy (CPL) of at least $1M per occurrence.

- Its subcontractors who are hired by the general contractor etc. to perform remedial work at a site, including soil brokers and truckers, must also maintain a CGL policy in the amount and with the terms set forth above. It is recommended that subcontractors also maintain a CPL policy in the amount and with the terms set forth above.

  The CGL policy, and the CPL policy if in force, must list the city, EDC and BRS as additional insureds, include completed operations coverage and be primary and non-contributory to any other insurance the additional insureds may have.

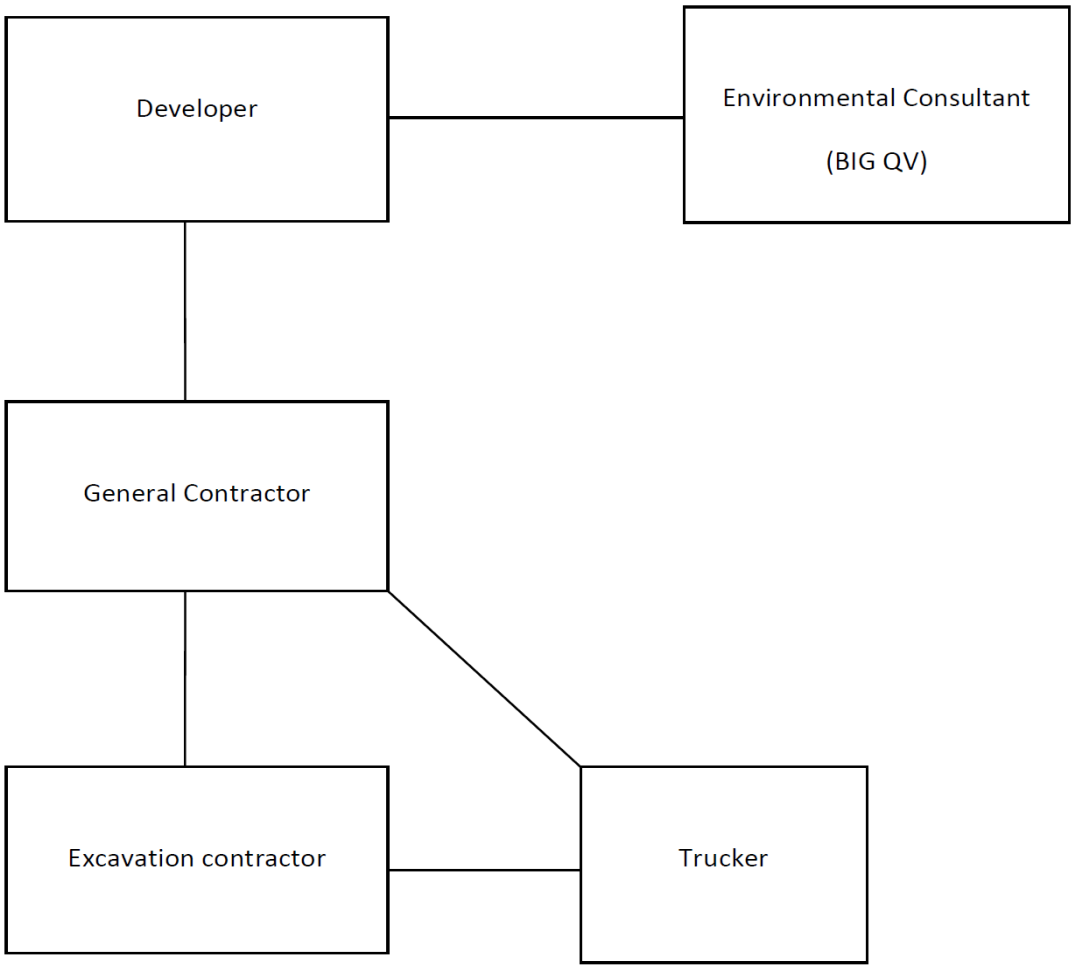
- Its environmental consultant(s) hired to oversee the cleanup must be:
  a. a BIG Qualifed Vendor; and
  b. maintain Professional Liability (PL) insurance of $1M per claim and annual aggregate.

If, in the alternative, the developer hires its environmental consultant to perform the cleanup, the environmental consultant must maintain CGL insurance in the amount and with the terms set forth above. It is recommended that the environmental consultant also maintain CPL coverage in the amount and with the terms set forth in the first two bulleted items listed above.

A schematic presenting the contractual relationships described above appears on page 2. Parties who must be named as Additional Insureds on Cleanup Grant insurance policies (CGL and CPL) are presented on page 3.

Example of Contractual Relationships for Cleanup Work

The Office of Environmental Remediation's Voluntary Cleanup Plan program requires applicants to identify the parties who are engaged in active remediation of their sites including: the General Contractor hired to remediate and/or the excavation contractor hired to excavate soil from the site and the trucking firm(s) that remove soil from the site for disposal at approved facilit(ies).



The chart above shows contractual relationships that typically exist for projects that are enrolled in the Voluntary Cleanup Program.

BIG Program Additional Insureds

The full names and addresses of the additional insureds required under the Required CGL Policy and recommended CPL Policy are as follows:

"City and its officials and employees"
New York City Mayor's Office of Environmental Remediation
253 Broadway, 14th Floor
New York, NY 10007

"NYC EDC and its officials and employees"
New York City Economic Development Corporation
110 William Street
New York, NY 10038

"BIG Grant Administrator and its officials and employees"
Brownfield Redevelopment Solutions, Inc.
739 Stokes Road, Units A & B
Medford, NJ 08055

Appendix 6
Daily Report Template

Generic Template for Daily Status Report

Instructions

The Daily Status Report submitted to OER should adhere to the following conventions:

- Remove this cover sheet prior to editing.
- Remove all the red text and replace with site-specific information.
- Submit the final version as a Word or PDF file.

Daily Status Reports

Daily status 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;
- 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.

DAILY STATUS REPORT

WEATHER	Snow		Rain		Overcast		Partly Cloudy	X	Bright Sun	
TEMP.	< 32		32-50		50-70	X	70-85		>85	

Prepared By: Enter Your Name Here

VCP Project No.:	14CVCP000M	E-Number Project No.:	14EHAN000M	Date:	01/01/2014
Project Name:	Name or Address				

Consultant: Person(s) Name and Company Name	Safety Officer: Person(s) Name and Company Name
General Contractor: Person(s) Name and Company Name	Site Manager/ Supervisor: Person(s) Name and Company Name
Work Activities Performed (Since Last Report): Provide details about the work activities performed.	
Working In Grid #: A1, B1, C1	

Samples Collected (Since Last Report): No samples collected or provide details
Air Monitoring (Since Last Report): No air monitoring performed or provide details Prestart Conditions – PID = 0.0 ppm, Dust = 0.000 High Conditions – PID = 0.0 ppm, Dust = 0.000
Problems Encountered: No problems encountered or provide details
Planned Activities for the Next Day/ Week: Provide details about the work activities planned for the next day/ week.

Example:

Facility # Name/ Location Type of Waste Solid Or Liquid	Facility # Name Location Type of Waste Solid *Or* Liquid		Facility # Name Location Type of Waste Solid *Or* Liquid		Facility # Name Location Type of Waste Solid *Or* Liquid		Facility # Name Location Type of Waste Solid *Or* Liquid		# # # # # # # Clean Earth Carteret, NJ petroleum soils Solid	
(Trucks, Cu.Yds. Or Gallons)	Trucks	Cu. Yds. *Or* Gallons	Trucks	Cu. Yds. *Or* Gallons	Trucks	Cu. Yds. *Or* Gallons	Trucks	Cu. Yds. *Or* Gallons	Trucks	Cu. Yds.
Today									5	120
Total									25	600

NYC Clean Soil Bank		Receiving Facility: Name/ Address (Approved by OER)			
Tracking No.:	13CCSB000				
Today	Trucks 5	Cu. Yds. 25	Total	Trucks 120	Cu. Yds. 600

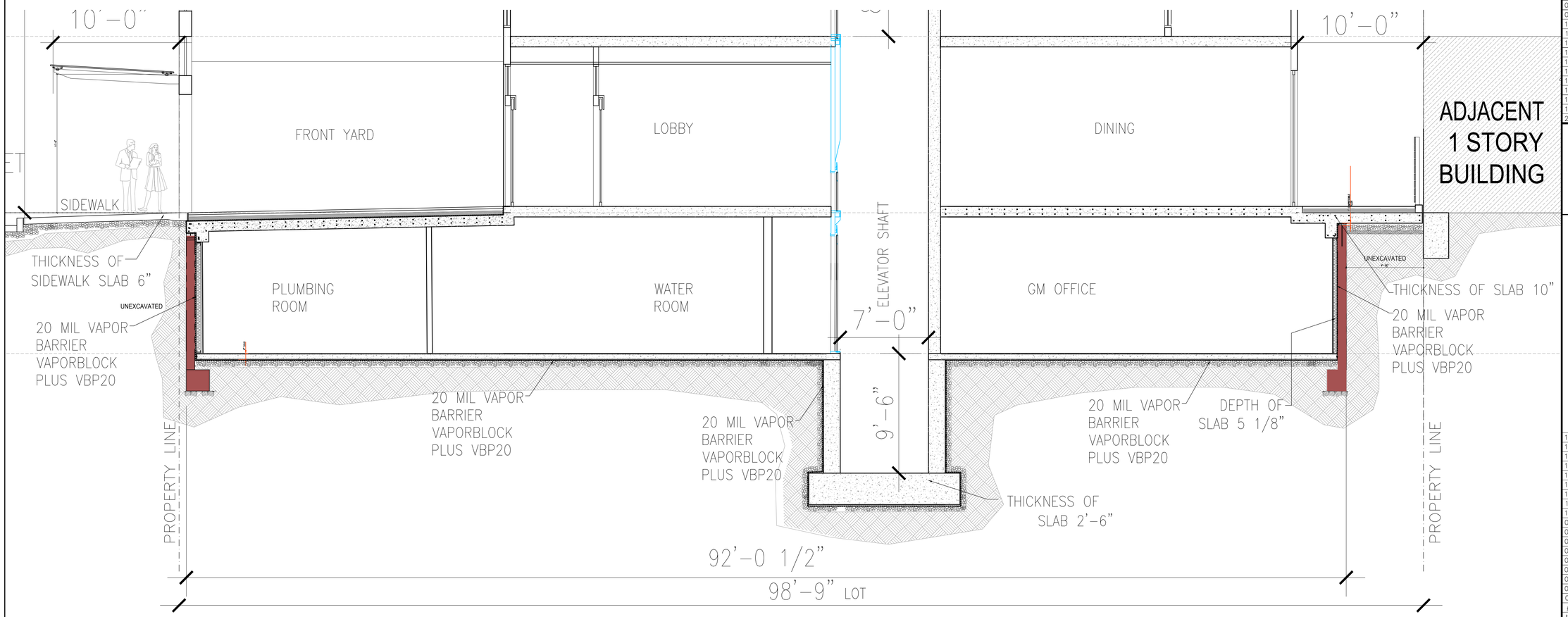
Site Grid Map

Insert the site grid map here

Photo Log

Photo 1 – provide a caption	Insert Photo Here – Photo of the entire site
Photo 2 – provide a caption	Insert Photo Here – Photo of the work activities performed
Photo 3 – provide a caption	Insert Photo Here – Photo of the work activities performed

Appendix 7
Composite Site Cover



1 CELLAR CROSS SECTION

1/4" = 1'-0"

NORTH

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

REVISIONS:

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SPRINGHILL SUITES ® Marriott

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01	12-11-14	ISSUED FOR DOB

ISSUED DRAWINGS:

GENE KAUFMAN ARCHITECT PC

525 BROADWAY, NEW YORK, N.Y. 10012
TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

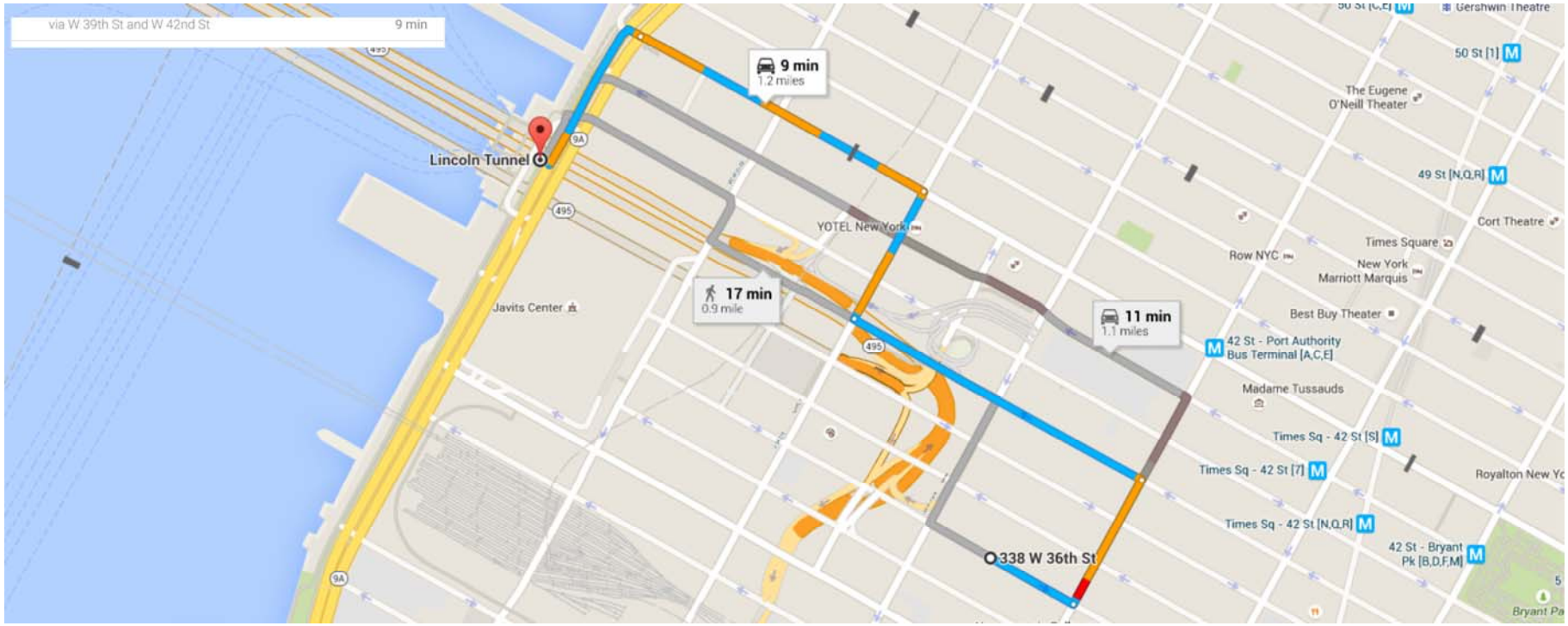
FOUNDATION SECTION

SEAL & SIGNATURE:

DATE: July 21, 2014
SCALE: AS NOTED
DRAWING NUMBER:

A-507.00

Appendix 8
Truck Route


via W 39th St and W 42nd St
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9 min
1.2 miles
Lincoln Tunnel
YOTEL New York
17 min
0.9 mile
Javits Center
11 min
1.1 miles
338 W 36th St
Gershwin Theatre
50 St [1]
The Eugene O'Neill Theater
49 St [N,Q,R]
Cort Theatre
Times Square
Row NYC
New York Marriott Marquis
Best Buy Theater
42 St - Port Authority Bus Terminal [A,C,E]
Madame Tussauds
Times Sq - 42 St [S]
Times Sq - 42 St [7]
Times Sq - 42 St [N,Q,R]
42 St - Bryant Pk [B,D,F,M]

Appendix 9
Stamped/Signed RAWP Certification

CERTIFICATION

I, Shaik A. Saad, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for designing the remedial program for the 338 West 36th Street site, OER site number 15EH-N351M and NYC Voluntary Cleanup site number [VCP site number]. I certify to the following:

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

Shaik A. Saad
Name

071078
PE License Number

Signature

5/27/15
Date

PE Stamp

STATE OF NEW YORK
SHAIK A. SAAD
071078
LICENSED PROFESSIONAL ENGINEER

I, Mark E. Robbins, am a qualified Environmental Professional. I will have primary direct responsibility for implementation of the remedial program for the 338 West 36th Street site, OER site number 15EH-N351M and NYC Voluntary Cleanup site number [VCP site number]. I certify to the following:

- 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.

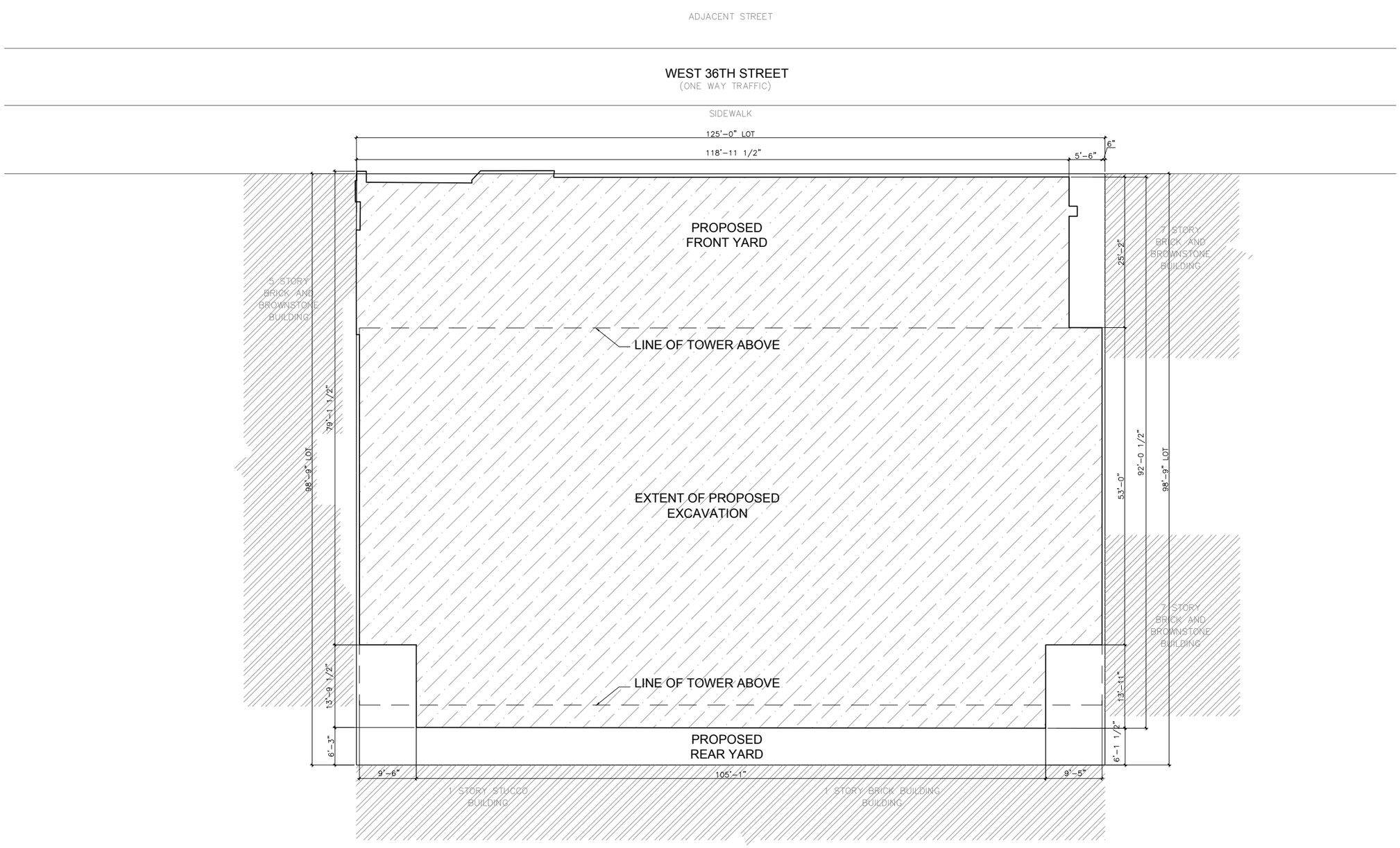
Mark E. Robbins
QEP Name

QEP Signature

5/27/15
Date

Appendix 10

Revised Location of Soil Excavation



1 PROPOSED REDEVELOPMENT PLAN
1/8"=1'-0"

NORTH

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

REVISIONS:

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02	05-11-15	ISSUED FOR DOB
01	12-11-14	ISSUED FOR DOB

#	DATE	DESCRIPTION

ISSUED DRAWINGS:

GENE KAUFMAN ARCHITECT PC
525 BROADWAY, NEW YORK, N.Y. 10012
TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

PROPOSED REDEVELOPMENT PLAN

SEAL & SIGNATURE:

REGISTERED ARCHITECT GENE KAUFMAN 016255 STATE OF NEW YORK

DATE: July 21, 2014
SCALE: 1/8" = 1'0"
DRAWING NUMBER:

PAGE#: OF 41

338 WEST 36TH STREET

MANHATTAN, NEW YORK

Remedial Action Work Plan

NYC VCP Project Number 15CVCP153M
OER Project Number 15EH-N351M

Prepared For:
338 West LLC
420 Great Neck Road
Great Neck, New York, 11201

Prepared By:
Hydro Tech Environmental, Corp.
15 Ocean Avenue,
Brooklyn, NY 11225
718-636-0800
pmatli@hydrotechenvironmental.com

MAY 2015

REMEDIAL ACTION WORK PLAN
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APPENDICES

Appendix 1: Proposed Development Plans

Appendix 2: Citizen Participation Plan

Appendix 3: Sustainability Statement

Appendix 4: Soil/Materials Management Plan

Appendix 5: Vapor Barrier Specifications

Appendix 6: Construction Health and Safety Plan

LIST OF ACRONYMS

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

Acronym	Definition
	Environmental Remediation
NYS DOH	New York State Department of Health
NYS DOT	New York State Department of Transportation
ORC	Oxygen-Release Compound
OSHA	United States Occupational Health and Safety Administration
PCBs	Polychlorinated Biphenyls
PE	Professional Engineer
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
SSDS	Sub-Slab Depressurization System
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
USGS	United States Geological Survey
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VOC	Volatile Organic Compound

CERTIFICATION

I, Shaik A. Saad, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for designing the remedial program for the 338 West 36th Street site, OER site number 15EH-N351M and NYC Voluntary Cleanup site number 15CVCP153M. I certify to the following:

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

Shaik A. Saad
Name

PE License Number

Signature

Date

PE Stamp

I, Mark E. Robbins, am a qualified Environmental Professional. I will have primary direct responsibility for implementation of the remedial program for the 338 West 36th Street site, OER site number 15EH-N351M and NYC Voluntary Cleanup site number [VCP site number]. I certify to the following:

- 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.

Mark E. Robbins
QEP Name

QEP Signature

Date

EXECUTIVE SUMMARY

338 West LLC is working with the NYC Office of Environmental Remediation (OER) in the New York City Voluntary Cleanup Program to investigate and remediate a 12,344-square foot site located at 338 West 36th 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 Background

The Site is located at 338 West 36th Street in the Garment District section in Manhattan, New York and is identified as Block 759 and Lot 61 on the New York City Tax Map. **Figure 1** shows the Site location. The Site is 12,344-square feet and is bounded by West 36th Street to the northeast, a 12-story commercial building to the southwest, an 8-story commercial building to the southeast, and a 5-story residential building to the northwest. Currently, the Site contains a 5-story vacant building with a full cellar down to approximately 11 feet 2 inches below street curb elevation. The most recent use of Site was a postgraduate mental health center. A map of the site boundary is shown in **Figure 2**.

Summary of Redevelopment Plan

The proposed future use of the Site will consist of a new 28-story hotel tower with a cellar of approximately 11,023 square feet of space. The cellar space will be utilized as offices, a gym and mechanical and utility rooms. The first floor will be developed as the lobby and a bar/restaurant area and the second through twenty-eighth floors will be developed with 566 guest rooms. The proposed hotel will be 187,816-square feet in total gross floor area and 250 feet in height. The new building will be equipped with four elevators, the pits of which will extend to 9 feet 6 inches below existing cellar slab. The new building will be setback 6 feet 3 inches from the southern property line and this area will be designated as a rear yard. Four foundation walls

in existing cellar will be maintained and used as the north, south, east and west foundation walls of proposed cellar. Only minor excavation will take place across the proposed build area of Site by matching existing cellar elevation at 11 feet 2 inches below street curb elevation. The foundation design will consist of spread footings with a slab of 6 inches and 8 inches slab poured on top of 6-inch bed of gravel. The open space to the south of new building will be capped with a 6-inch concrete slab.

Layout of the proposed site development is presented in **Figure 3** and **Appendix 1**. The current zoning designation is C6-4M. The proposed use is consistent with existing zoning for the property.

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

Summary of Surrounding Property

The Site is located in a commercial and residential neighborhood. West 36th Street, a 4-story and a 12-story industrial and manufacturing buildings are located to the northeast; a 25-story Double Tree by Hilton is located to the north; a 5-story residential building is located to the northwest; a 14-story TRYP by Wyndham and a 12-story industrial and manufacturing building are located to the southwest; a 5-story residential building is located to the south; and an 8-story Hotel Barbour is located to the southeast.

Within a 500-foot radius of the Site, there are a variety of land uses including: residential (multi-story residential apartments), commercial, industrial, parking, mixed used buildings, institutions and vacant lots. Properties located within a ¼-mile radius of the Site are zoned C6-4M, C1-7A, C6-4 (general commercial districts) and MI-6 (industrial and business zone).

Within a 250-foot radius of the Site, no sensitive receptor is identified. The surrounding land uses include industrial, commercial, residential and parking buildings.

Figure 4 shows the surrounding land usage.

Summary of Past Site Uses and Areas of Concern

Based upon the review of the Fire Insurance Maps and Regulatory Agency documents from the previous investigations listed below:

- Phase I Environmental Site Assessment, June 13, 2014, by EBI Consulting

A Site history was established. From pre-1890 to 1903, the Site was occupied by six 4-story residential structures. From 1904 to present, the Site has been occupied by a 5-story commercial building with a full cellar, which had been utilized as a church and a mental health center.

The AOC identified for this site is:

- The presence of historic fill material beneath the cellar of the current building across the entire site
- The presence of in-ground hydraulic lift

Summary of Work Performed under the Remedial Investigation

1. Conducted a Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Performed a Ground-Penetrating Radar (GPR) survey throughout the entire Site;
3. Installed eight (8) soil borings across the entire project Site, and collected a total of sixteen (16) soil samples for chemical analysis from the soil borings to evaluate soil quality; these included eight (8) samples from zero to 2 feet and eight (8) samples from 2 to 4 feet below the cellar level of the current building;
4. Collected one (1) groundwater sample from existing monitoring well in sidewalk along the northeastern boundary for chemical analysis to evaluate groundwater quality;
5. Installed six (6) soil vapor probes to a depth of 2 inches below the existing building slab and collected six (6) sub-slab soil vapor samples for chemical analysis.

Summary of Findings of Remedial Investigation

1. Elevation of the property is 35 feet.

2. Depth to groundwater measured in a bedrock monitoring well is 11.25 feet beneath the street curb elevation as results of artesian pressure in the well.
3. Groundwater flow is presumed to be toward west beneath the Site.
4. Refusal that is likely indicative of bedrock was encountered at 4 feet beneath existing cellar slab at Site.
5. The GPR survey identified no anomalies indicative of USTs.
6. Up to 4 feet of historic fill material was encountered at the Site beneath the cellar level of the exist building.
7. Soil/fill samples collected during the remedial investigations were compared to the 6NYCRR Part 375 Track 1 Unrestricted Use Soil Cleanup Objectives (SCOs) as well as Track 2 Restricted Commercial Use SCOs. Soil/fill samples collected during RI show acetone (max. 0.060 mg/kg) was detected at concentrations exceeding their respective Track 1 SCOs in two out of eight shallow samples. Chlorinated VOCs were not detected in any samples. Twelve SVOCs including acenaphthene (26.7 mg/kg), benzo(a)anthracene (max. 50.9 mg/kg), benzo(a)pyrene (max. 12.9 mg/kg), benzo(b)fluoranthene (max. 9.19 mg/kg), benzo(k)fluoranthene (max. 14.9 mg/kg), chrysene (max. 53.4 mg/kg), dibenzo(a,h)anthracene (max. 3.67 mg/kg), dibenzofuran (max. 19.6 mg/kg), indeno(1,2,3-cd)pyrene (max. 6.9 mg/kg), naphthalene (max. 500 mg/kg), phenanthrene (max. 152 mg/kg) and phenol (0.73 mg/kg) at concentrations exceeding Track 1 SCOs in eight shallow samples and three deep samples. Of these SVOCs, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene also exceed their respective Track 2 SCOs in seven shallow samples and two deep samples indicating hotspot areas at SP1, SP-7 and SP-8 locations. Pesticides and PCBs were not detected in any samples. Four metals including copper (64.8 mg/kg), lead (max. 137 mg/kg), mercury (max. 1.16 mg/kg) and nickel (max. 79.9 mg/kg) were detected at concentrations exceeding their respective Track 1 SCOs but below Track 2 SCOs in all samples except one deep sample.
8. The groundwater sample collected during the RI was compared to the 6NYCRR Part 703.5 Class GA groundwater standards. Groundwater results show two VOCs including

2-butanone (120 µg/L) and acetone (190 µg/L) were detected at concentrations exceeding their respective GQS. No chlorinated VOCs were detected during the RI. Three SVOCs including acenaphthene, acenaphthylene and bis(2-ethylhexyl)phthalate were detected at concentrations below the GQS. No pesticides or PCBs were detected during the RI. Four dissolved metals including antimory (27 µg/L), manganese (742 µg/L), selenium (11 µg/L) and sodium (311,000 µg/L) were detected at concentrations exceeding their respective GQS. Two additional groundwater wells will be installed after building demolition and prior to start of construction.

9. Soil vapor samples collected during the RI were compared to the compounds listed by the New York State Department of Health (NYSDOH) located in the NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion, dated October 2006. Soil vapor results collected during the RI show a wide range of compounds throughout the property including petroleum related (BTEX and their associated derivatives) and chlorinated compounds. The total concentration of BTEX compounds range from 56.7 $\mu g/m^3$ to 511 $\mu g/m^3$. Trace concentrations of chlorinated VOCs were detected in all sub-slab soil vapor samples. Among the detected chlorinated VOCs, methylene chloride was detected in two sub-slab vapor samples at a maximum concentration of 1.5 $\mu g/m^3$ and PCE was detected in one sub-slab vapor sample at a concentration of 2.1 $\mu g/m^3$. 111-TCA, TCE, and Carbon tetrachloride were not detected in any sub-slab vapor samples. The concentration of all VOCs detected in soil gas samples were below the guidance matrix established by NYSDOH.

Summary of the Remedial Action

The proposed remedial action achieves protection of public health and the environment for the intended use of the property. The proposed remedial action achieves all of the remedial action objectives established for the project and addresses applicable standards, criterion, and guidance; is effective in both the short-term and long-term 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. Additional site characterization including installation of two monitoring wells and collection of groundwater samples in two newly installed and one existing monitoring wells. This investigation will be conducted after demolition of existing building is completed. The monitoring wells will be installed in the southwestern and northern portions of the Site, where high concentrations of naphthalene were detected in on-site soil (SP-1 and SP-7).
2. Preparation of a Community Protection Statement and performance of all required NYC VCP Citizen Participation activities according to an approved Citizen Participation Plan.
3. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.
4. Establishment of Track 4 Site-specific Soil Cleanup Objectives (SCOs).
5. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.
6. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency of one sample for each 800 cubic yards as generally dictated by disposal facilities.
7. Excavation and removal of soil/fill exceeding Track 4 Site Specific SCOs. For new development, minor excavation is proposed within the footprints of the new cellar to a depth of 6 inches and to 9 feet 6 inches below existing cellar slab within the footprints of the elevators pit. Approximately, 300 tons of soils will be excavated and removed from this property.
8. If elevated levels of naphthalene are identified in additional site characterization groundwater samples, all soils with elevated naphthalene concentrations will be removed to achieve naphthalene levels below groundwater protection standards, this will include the proper delineation and hot spot removal of soil in the locations of SP-1, SP-7 and SP-8.
9. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a PID. Appropriate segregation of excavated media on-Site.

10. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and non-contaminated materials.
11. Removal of all USTs that are encountered during soil/fill removal actions. Registration of tanks and reporting of any petroleum spills associated with USTs and appropriate closure of these petroleum spills in compliance with applicable local, State and Federal laws and regulations.
12. Transportation and off-Site disposal of all soil/fill material at licensed or permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Sampling and analysis of excavated media as required by disposal facilities. Appropriate segregation of excavated media on-Site.
13. Collection and analysis of four end-point samples to determine the performance of the remedy with respect to attainment of SCOs.
14. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.
15. Construction of an engineered composite cover consisting of 6-inch thick concrete slab in the rear yard to the south of building, 6-inch and 8-inch concrete slabs beneath the building areas and 2 feet 6 inches concrete slab beneath the elevators pit.
16. Installation of a vapor barrier system beneath the building slab and on the inside of sub-grade foundation sidewalls to mitigate soil vapor migration into the building. The vapor barrier system will consist of a 20-mil VaporBlock® Plus™ VBP20 on the interior sidewalls of the existing cellar and a 46-mil Grace Preprufe 300R around and beneath the elevators pit and beneath the building slab throughout the full building area.
17. Performance of all activities required for the remedial action, including acquisition of required permits and attainment of pretreatment requirements, in compliance with applicable laws and regulations.
18. Dewatering is required. Dewatering will be performed in compliance with city, state, and federal laws and regulations. Extracted groundwater will either be containerized for off-site licensed or permitted disposal or will be treated under a permit from New York City Department of Environmental Protection (NYCDEP) to meet pretreatment requirements prior to discharge to the sewer system.

19. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
20. 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.
21. Submission of an approved Site Management Plan (SMP) in the Remedial Action Plan (RAR) for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.
22. The property will continue to be registered with an E-Designation at the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. Institutional Controls will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER-approval.

COMMUNITY PROTECTION STATEMENT

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

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

Project Information:

- Site Name: 338 West 36th Street
- Site Address: 338 West 36th Street, Manhattan
- NYC Voluntary Cleanup Program Project Number: 15CVCP153M

Project Contacts:

- OER Project Manager: Samantha Morris, 212-788-8841
- Site Project Manager: Paul I. Matli, 631-848-4581
- Site Safety Officer: Paul I. Matli, 631-848-4581
- Online Document Repository: http://www.nyc.gov/html/oer/html/repository/RManhattan.shtml

Remedial Investigation and Cleanup Plan: Under the oversight of the NYC OER, a thorough 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 to identify contaminant sources present on the property. The cleanup plan has been designed to address all contaminant sources that have been identified during the study of this 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 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 RAWP are in compliance with applicable safety requirements of the United States Occupational Safety and Health Administration (OSHA). This RAWP includes many protective elements including those discussed below.

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

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

Community Air Monitoring Plan: Community air monitoring will be performed during this cleanup project to ensure that the community is properly protected from contaminants, dust and odors. Air samples will be tested in accordance with a detailed plan called the Community Air Monitoring Plan 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 applicable NYC noise control standards. If you observe problems in these areas, please contact the onsite Project Manager or NYC Office of Environmental Remediation Project Manager listed on the first page of this Community Protection Statement document.

Quality Assurance: This cleanup plan requires that evidence be provided to illustrate that all cleanup work required under the plan has been completed properly. This evidence will be summarized in the final report, called the Remedial Action Report. 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 requirements of the NYC Department of Buildings.

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 and provides project contact names and numbers, and a link to the document repository where project documents can be viewed.

Complaint Management: The contractor performing this cleanup is required to address all complaints. If you have any complaints, you can call the facility Project Manager or the NYC Office of Environmental Remediation Project Manager listed on the first page of this Community Protection Statement document, 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, odor and erosion. Stockpiles will be frequently inspected. Damaged tarp covers will be

promptly replaced. Stockpiles will be protected with silt fences. Hay bales will be used, as needed, to protect storm water catch basins and other discharge points.

Trucks and Covers: Loaded trucks leaving the Site will be covered in compliance with applicable laws and regulations to prevent dust and odor. Trucks will be properly recorded in logs and records and placarded in compliance with applicable City, State and Federal laws, including those of the New York State Department of Transportation. 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 applicable laws and regulations.

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

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

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

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

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

Long-Term Site Management: To provide long-term protection after 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 either in the property's deed or established through a city environmental designation registered with the Department of Buildings. A certification of continued protectiveness of the cleanup will be required from time to time to show that the approved cleanup is still effective.

REMEDIAL ACTION WORK PLAN

1.0 Project Background

338 West LLC is working with the NYC Office of Environmental Remediation (OER) in the New York City Voluntary Cleanup Program and/or in the "E" Designation Program to investigate and remediate a property located at 338 West 36th Street in the Garment District 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, and complies with applicable environmental standards, criteria and guidance and applicable laws and regulations.

1.1 Site Location and Background

The Site is located at 338 West 36th Street in the Garment District section in Manhattan, New York and is identified as Block 759 and Lot 61 on the New York City Tax Map. **Figure 1** shows the Site location. The Site is 12,344-square feet and is bounded by West 36th Street to the northeast, a 12-story commercial building to the southwest, an 8-story commercial building to the southeast, and a 5-story residential building to the northwest. Currently, the Site contains a 5-story vacant building with a full cellar down to approximately 11 feet 2 inches below street curb elevation. The most recent use of Site was a postgraduate mental health center. A map of the site boundary is shown in **Figure 2**.

1.2 Redevelopment Plan

The proposed future use of the Site will consist of a new 28-story hotel tower with a cellar of approximately 11,023 square feet of space. The cellar space will be utilized as offices, a gym and mechanical and utility rooms. The first floor will be developed as the lobby and a bar/restaurant area and the second through twenty-eighth floors will be developed with 566 guest rooms. The proposed hotel will be 187,816-square feet in total gross floor area and 250 feet in

height. The new building will be equipped with four elevators, the pits of which will extend to 9 feet 6 inches below existing cellar slab. The new building will be setback 6 feet 3 inches from the southern property line and this area will be designated as a rear yard. Four foundation walls in existing cellar will be maintained and used as the north, south, east and west foundation walls of proposed cellar. Only minor excavation will take place across the proposed build area of Site by matching existing cellar elevation at 11 feet 2 inches below street curb elevation. The foundation design will consist of spread footings with a slab of 6 inches and 8 inches slab poured on top of 6-inch bed of gravel. The open space to the south of new building will be capped with a 6-inch concrete slab.

Layout of the proposed site development is presented in **Figure 3** and **Appendix 1**. The current zoning designation is C6-4M. The proposed use is consistent with existing zoning for the property.

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

1.3 Description of Surrounding Property

The Site is located in a commercial and residential neighborhood. West 36th Street, a 4-story and a 12-story industrial and manufacturing buildings are located to the northeast; a 25-story Double Tree by Hilton is located to the north; a 5-story residential building is located to the northwest; a 14-story TRYP by Wyndham and a 12-story industrial and manufacturing building are located to the southwest; a 5-story residential building is located to the south; and an 8-story Hotel Barbour is located to the southeast.

Within a 500-foot radius of the Site, there are a variety of land uses including: residential (multi-story residential apartments), commercial, industrial, parking, mixed used buildings, institutions and vacant lots. Properties located within a ¼-mile radius of the Site are zoned C6-4M, C1-7A, C6-4 (general commercial districts) and MI-6 (industrial and business zone).

Within a 250-foot radius of the Site, no sensitive receptor is identified. The surrounding land uses include industrial, commercial, residential and parking buildings.

Figure 4 shows the surrounding land usage.

1.4 Summary of Past Site Uses and Areas of Concern

Based upon the review of the Fire Insurance Maps and Regulatory Agency documents from the previous investigations listed below:

- Phase I Environmental Site Assessment, June 13, 2014, by EBI Consulting

A Site history was established. From pre-1890 to 1903, the Site was occupied by six 4-story residential structures. From 1904 to present, the Site has been occupied by a 5-story commercial building with a full cellar, which had been utilized as a church and a mental health center.

The AOC identified for this site is:

- The presence of historic fill material beneath the cellar of the current building across the entire site
- The presence of in-ground hydraulic lift

1.5 Summary of Work Performed under the Remedial Investigation

1. Conducted a Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Performed a Ground-Penetrating Radar (GPR) survey throughout the entire Site;
3. Installed eight (8) soil borings across the entire project Site, and collected a total of sixteen (16) soil samples for chemical analysis from the soil borings to evaluate soil quality; these included eight (8) samples from zero to 2 feet and eight (8) samples from 2 to 4 feet below the cellar level of the current building;
4. Collected one (1) groundwater sample from existing monitoring well in sidewalk along the northeastern boundary for chemical analysis to evaluate groundwater quality;
5. Installed six (6) soil vapor probes to a depth of 2 inches below the existing building slab and collected six (6) sub-slab soil vapor samples for chemical analysis.

1.6 Summary of Findings of Remedial Investigation

A remedial investigation was performed and the results are documented in a companion document called "Remedial Investigation Report, 338 West 36th Street", dated April 2015 (RIR).

1. Elevation of the property is 35 feet.
2. Depth to groundwater measured in a bedrock monitoring wells is 11.25 feet beneath the street curb elevation as results of artesian pressure in the well.
3. Groundwater flow is presumed to be toward west beneath the Site.
4. Refusal that is likely indicative of bedrock was encountered at 4 feet beneath existing cellar slab at Site.
5. The GPR survey identified no anomalies indicative of USTs.
6. Up to 4 feet of historic fill material was encountered at the Site beneath the cellar level of the exist building.
7. Soil/fill samples collected during the remedial investigations were compared to the 6NYCRR Part 375 Track 1 Unrestricted Use Soil Cleanup Objectives (SCOs) as well as Track 2 Restricted Commercial Use SCOs. Soil/fill samples collected during RI show acetone (max. 0.060 mg/kg) was detected at concentrations exceeding their respective Track 1 SCOs in two out of eight shallow samples. Chlorinated VOCs were not detected in any samples. Twelve SVOCs including acenaphthene (26.7 mg/kg), benzo(a)anthracene (max. 50.9 mg/kg), benzo(a)pyrene (max. 12.9 mg/kg), benzo(b)fluoranthene (max. 9.19 mg/kg), benzo(k)fluoranthene (max. 14.9 mg/kg), chrysene (max. 53.4 mg/kg), dibenzo(a,h)anthracene (max. 3.67 mg/kg), dibenzofuran (max. 19.6 mg/kg), indeno(1,2,3-cd)pyrene (max. 6.9 mg/kg), naphthalene (max. 500 mg/kg), phenanthrene (max. 152 mg/kg) and phenol (0.73 mg/kg) at concentrations exceeding Track 1 SCOs in eight shallow samples and three deep samples. Of these SVOCs, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene also exceed their respective Track 2 SCOs in seven shallow samples and two deep samples indicating hotspot areas at SP1, SP-7 and SP-8 locations. Pesticides and PCBs were not detected in any samples. Four

metals including copper (64.8 mg/kg), lead (max. 137 mg/kg), mercury (max. 1.16 mg/kg) and nickel (max. 79.9 mg/kg) were detected at concentrations exceeding their respective Track 1 SCOs but below Track 2 SCOs in all samples except one deep sample.

8. The groundwater sample collected during the RI was compared to the 6NYCRR Part 703.5 Class GA groundwater standards. Groundwater results showed two VOCs including 2-butanone (120 µg/L) and acetone (190 µg/L) were detected at concentrations exceeding their respective GQS. No chlorinated VOCs were detected during the RI. Three SVOCs including acenaphthene, acenaphthylene and bis(2-ethylhexyl)phthalate were detected at concentrations below the GQS. No pesticides or PCBs were detected during the RI. Four dissolved metals including antimory (27 µg/L), manganese (742 µg/L), selenium (11 µg/L) and sodium (311,000 µg/L) were detected at concentrations exceeding their respective GQS. Additional groundwater wells will be installed after building demolition and prior to start of construction.

9. Soil vapor samples collected during the RI were compared to the compounds listed by the New York State Department of Health (NYSDOH) located in the NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion, dated October 2006. Soil vapor results collected during the RI show a wide range of compounds throughout the property including petroleum related (BTEX and their associated derivatives) and chlorinated compounds. The total concentration of BTEX compounds range from 56.7 $\mu g/m^3$ to 511 $\mu g/m^3$. Trace concentrations of chlorinated VOCs were detected in all sub-slab soil vapor samples. Among the detected chlorinated VOCs, methylene chloride was detected in two sub-slab vapor samples at a maximum concentration of 1.5 $\mu g/m^3$ and PCE was detected in one sub-slab vapor sample at a concentration of 2.1 $\mu g/m^3$. 111-TCA, TCE, and Carbon tetrachloride were not detected in any sub-slab vapor samples. The concentration of all VOCs detected in soil gas samples were below the guidance matrix established by NYSDOH.

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:

Soil

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

Groundwater

- Prevent direct exposure to contaminated groundwater.

Soil Vapor

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

3.0 Remedial Alternatives Analysis

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

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

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

Alternative 1:

- Selection of NYSDEC 6NYCRR Part 375 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 Unrestricted Use SCOs have been achieved with post-excavation endpoint sampling. Based on the results of the Remedial Investigation and the proposed redevelopment plan, it is expected that this alternative would require excavation across the entire Site to the depth of bedrock at approximately 4 feet beneath existing cellar slab. In conclusion, If soil/fill containing analytes at concentrations above Track 1

Unrestricted Use SCOs is still present at the base of the excavation after removal of all soil required for construction of the new building's cellar is complete, additional excavation will be performed to ensure complete removal of soil that does not meet Track 1 Unrestricted Use SCO.

- No Engineering or Institutional Controls are required for a Track 1 cleanup, however, a vapor barrier system would be installed as part of new development to prevent potential exposures from soil vapor in the future."
- As part of new development, placement of a final cover over the entire Site.

Alternative 2:

- Removal of all soil/fill exceeding Track 4 Site-specific SCOs and confirmation that Track 4 Site-specific SCOs have been achieved with post-excavation end point sampling. Based on the results of the Remedial Investigation, it is expected that this alternative would be achieved by a minimum excavation to 6 inches beneath existing cellar slab for the layout of new cellar slab. Excavation for construction of the new building will include an excavation to 9 feet 6 inches below existing cellar slab for the elevators pit in the central portion of the new building. If soil/fill containing analytes at concentrations above Track 4 Site-Specific SCOs is still present at the base of the excavation after removal of all soil required for construction of the new building's cellar is complete, additional excavation will be performed to ensure complete removal of soil that does not meet Track 4 Site-Specific SCOs.
- Placement of a composite cover system over the entire Site to prevent exposure to remaining soil/fill;
- Installation of a waterproofing/vapor barrier system beneath the building slab and existing interior walls to prevent potential exposures from soil vapor;
- Establishment of use restrictions including prohibitions on the use of groundwater from the Site; prohibitions of restricted Site uses, such as farming or vegetable gardening, to prevent future exposure pathways; and prohibition of a higher level of land use without OER approval;
- Establishment of an approved Site Management Plan (SMP) 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. The SMP will note that the property owner and property owner's successors and assigns must comply with the approved SMP; and

- The property will continue to be registered with an E-Designation 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 all soil/fill exceeding Track 1 Unrestricted Use SCO's and groundwater protection standards, thus eliminating potential for direct contact with contaminated soil/fill once construction is complete and eliminating the risk of contaminants leaching into groundwater. Since groundwater is anticipated to be encountered during the excavation of elevators pit, dewatering activities will be required during these activities. At such, there would be risk of contact with groundwater during the remedial soil excavation. Installing a waterproofing/vapor barrier system beneath the building foundations would prevent potential migration of soil vapors into the new building. Alternative 2 would achieve comparable protections of human health and the environment by a minimal excavation and removal of historic fill to a minimum depth of 6 inches below existing cellar slab for the layout of cellar slab at the Site and by ensuring that remaining soil/fill on-Site meets Track 4 Site-Specific SCO's, as well as by placement of Institutional and Engineering Controls, including 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 continuing the E-designation on the property would ensure that the

composite cover system remains intact and protective of public health. Establishment of Track 4 Site-Specific SCO's would minimize the risk of contamination leaching into groundwater.
For both Alternatives, potential exposure to contaminated soils or groundwater during construction would be minimized by implementing a Construction Health and Safety Plan, an approved Soil/Materials Management Plan, and Community Air Monitoring Plan (CAMP). Potential contact with contaminated groundwater would be prevented as its use is prohibited by city laws and regulations. Potential future migration of off-Site soil vapors into the new building would be prevented by installing a vapor barrier below the building slab and inside face of foundations walls below grade.

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 of soil to achieve Track 1 Unrestricted Use SCO's and Protection of Groundwater SCO's. Compliance with SCGs for soil vapor would also be achieved by installing a waterproofing/vapor barrier system below the new building's basement slab and continuing the vapor barrier on inside face of subgrade foundation walls, as part of development.

Alternative 2 would achieve compliance with the remedial goals, chemical-specific SCG's and RAOs for soil through removal of soil to meet Track 4 Site-Specific SCO's. Compliance with SCG's for soil vapor would also be achieved by installing a waterproofing/vapor barrier system below the new building's basement slab and continuing the vapor barrier on inside face of subgrade foundation walls. A Site Management Plan would ensure that these controls remained protective for the long term.

Health and safety measures contained in the CHASP and Community Air Monitoring Plan (CAMP) will be implemented during Site redevelopment under this RAWP. For both

Alternatives, focused attention on means and methods employed during the remedial action would ensure that handling and management of contaminated material would be in compliance with applicable SCGs. These measures will protect on-site workers and the surrounding community from exposure to Site-related contaminants.

Short-Term Effectiveness and Impacts

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

Both alternatives require excavation of fill material. More fill material will be excavated for Track 1 alternative. Both alternatives would result in short-term dust generation impacts associated with excavation, handling, load out of materials, and truck traffic. Short-term impacts could potentially be higher for Alternative 1 since excavation of more amount of historical fill material would take place. However, focused attention to means and methods during a Track 1 removal action, including community air monitoring and appropriate truck routing, would minimize the overall impact of these activities.

An additional short-term adverse impact and risks to the community associated with both remedial alternatives is increased truck traffic. Truck traffic will be routed on the most direct course using major thoroughfares where possible and flag persons will be used to protect pedestrians at Site entrances and exits.

The potential adverse impact to the community, workers and the environment for both alternatives would be minimized through implementation of control plans including a Construction Health and Safety Plan, a Community Air Monitoring Plan (CAMP) and a Soil/Materials Management Plan (SMMP), during all on-Site soil disturbance activities and would minimize the release of contaminants into the environment. Both alternatives provide short-term effectiveness in protecting the surrounding community by decreasing the risk of

contact with on-Site contaminants. Construction workers operating under appropriate management procedures and a Construction Health and Safety Plan (CHASP) would provide protection from on-Site contaminants by using personal protective equipment would be worn consistent with the documented risks within the respective work zones.

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 Engineering Controls/Institutional Controls (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 ECs.
Alternative 1 would achieve long-term effectiveness and permanence related to on-Site contamination by permanently removing all impacted soil/fill above Track 1 Unrestricted Use SCO's. Removal of on-Site contaminant sources will also prevent future groundwater contamination.

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

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 will permanently eliminate the toxicity, mobility, and volume of contaminants from on-Site soil by removing all soil in excess of Track 1 Unrestricted Use SCO's.

Alternative 2 would remove most of the historic fill at the Site, and all remaining on-Site soil/fill beneath the new building will meet Track 4 Site-Specific SCO's.
Alternative 2 would remove a lesser total mass of contaminants from the Site than Alternative 1. The removal of soil across the Site to 4 feet below cellar slab in order to attain Track 1 would be restricted by the presence of footings of existing cellar walls of existing building.

Implementability

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

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

Since historic fill at the Site was found during the RI to extend to a depth of up to 4 feet below cellar slab across the entire Site and the new building requires excavation to a minimum of 6 inches below existing cellar slab for the layout of cellar slab within the proposed building footprint and an elevator pit to 9 feet 6 inches below existing cellar slab (or 20 feet 8 inches bgs), the costs associated with excavation in Alternative 1 would be much larger than Alternative 2. Costs associated with Alternative 1 would be potentially be higher than Alternative 2 as soil across the entire Site will need to be removed to 4 feet below cellar slab. Additional costs would include disposal of additional soil, and import of clean soil for backfill. However, long-term costs for Alternative 2 are likely higher than Alternative 1 based on implementation of a Site Management Plan as part of Alternative 2.

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

Community Acceptance

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

This RAWP will be subject to a public review under the NYC VCP and will provide the opportunity for detailed public input on the remedial alternatives and the selected remedy. This public comment will be considered by OER prior to approval of this plan. The Citizen Participation Plan for the project is provided in **Appendix 2**. Observations here will be supplemented by public comment received on the RAWP. Under both alternatives, the overall

goals of the remedial program, to protect public health and the environment and eliminate potential contaminant exposures, have been broadly supported by citizens in NYC communities.

Land use

This evaluation criterion addresses the proposed use of the property. This evaluation has considered reasonably anticipated future uses of the Site and takes into account: current use and historical and/or recent development patterns; applicable zoning laws and maps; 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 current, intended, and reasonably anticipated future land use of the Site and its surroundings are compatible with the selected remedy of soil remediation. The proposed future use of the Site includes a new 28-story hotel tower with a cellar.
Temporary short-term project impacts are being mitigated through site management controls and truck traffic controls during remediation activities. Following remediation, the Site will meet either Track 1 Unrestricted Use SCOs or Track 4 Site-Specific SCOs, both of which are protective of public health and the environmental for its planned use.

The Site is not in close proximity to important cultural resources, including federal or state historic or heritage sites or Native American religious sites, natural resources, waterways, wildlife refuges, wetlands, or critical habitats of endangered or threatened species. The Site is located in an urban area and not in proximity to fish or wildlife and neither alternative would result in any potential exposure pathways of contaminant migration affecting fish or wildlife. The remedial action is also protective of groundwater natural resources. The Site does not lie in a Federal Emergency Management Agency (FEMA)-designated flood plain. Both alternatives are

equally protective of natural resources and cultural resources. Improvements in the current environmental condition of the property achieved by both alternatives considered in this plan are consistent with the City's goals for cleanup of contaminated land.

Sustainability of the Remedial Action

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

While Alternative 2 would potentially result in lower energy usage based on reducing the volume of material transported off-Site, both remedial alternatives are comparable with respect to the opportunity to achieve sustainable remedial action. The remedial plan for either alternative would take into consideration the shortest trucking routes during off-Site disposal of historic fill and other soils, which would reduce greenhouse gas emissions and conserve energy used to fuel trucks. The New York City Clean Soil Bank program is available for reuse of any clean native soils under either alternative. A complete list of green remedial activities considered as part of the NYC VCP is included in a Sustainability Statement, included as **Appendix 3.**

4.0 Remedial Action

4.1 Summary of Preferred Remedial Action

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

The proposed remedial action will consist of:

1. Additional site characterization including installation of two monitoring wells and collection of groundwater samples in two newly installed and one existing monitoring wells. This investigation will be conducted after demolition of existing building is completed. The monitoring wells will be installed in the southwestern and northern portions of the Site, where high concentrations of naphthalene were detected in on-site soil (SP-1 and SP-7).
2. Preparation of a Community Protection Statement and performance of all required NYC VCP Citizen Participation activities according to an approved Citizen Participation Plan.
3. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.
4. Establishment of Track 4 Site-specific Soil Cleanup Objectives (SCOs).
5. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.
6. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency of one sample for each 800 cubic yards as generally dictated by disposal facilities.
7. Excavation and removal of soil/fill exceeding Track 4 Site Specific SCOs. For new development, minor excavation is proposed within the footprints of the new cellar to

a depth of 6 inches and to 9 feet 6 inches below existing cellar slab within the footprints of the elevators pit. Approximately, 300 tons of soils will be excavated and removed from this property.

8. If elevated levels of naphthalene are identified in additional site characterization groundwater samples, all soils with elevated naphthalene concentrations will be removed to achieve naphthalene levels below groundwater protection standards, this will include the proper delineation and hot spot removal of soil in the locations of SP-1, SP-7 and SP-8.
9. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a PID. Appropriate segregation of excavated media on-Site.
10. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and non-contaminated materials.
11. Removal of all USTs that are encountered during soil/fill removal actions. Registration of tanks and reporting of any petroleum spills associated with USTs and appropriate closure of these petroleum spills in compliance with applicable local, State and Federal laws and regulations.
12. Transportation and off-Site disposal of all soil/fill material at licensed or permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Sampling and analysis of excavated media as required by disposal facilities. Appropriate segregation of excavated media on-Site.
13. Collection and analysis of four end-point samples to determine the performance of the remedy with respect to attainment of SCOs.
14. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.
15. Construction of an engineered composite cover consisting of 6-inch thick concrete slab in the rear yard to the south of building, 6-inch and 8-inch concrete slabs beneath the building areas and 2 feet 6 inches concrete slab beneath the elevators pit.
16. Installation of a vapor barrier system beneath the building slab and on the inside of sub-grade foundation sidewalls to mitigate soil vapor migration into the building. The

vapor barrier system will consist of a 20-mil VaporBlock® Plus™ VBP20 on the interior sidewalls of the existing cellar and a 46-mil Grace Preprufe 300R around and beneath the elevators pit and beneath the building slab throughout the full building area.

17. Performance of all activities required for the remedial action, including acquisition of required permits and attainment of pretreatment requirements, in compliance with applicable laws and regulations.
18. Dewatering is required. Dewatering will be performed in compliance with city, state, and federal laws and regulations. Extracted groundwater will either be containerized for off-site licensed or permitted disposal or will be treated under a permit from New York City Department of Environmental Protection (NYCDEP) to meet pretreatment requirements prior to discharge to the sewer system.
19. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
20. 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.
21. Submission of an approved Site Management Plan (SMP) in the Remedial Action Plan (RAR) for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.
22. The property will continue to be registered with an E-Designation at the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. Institutional Controls will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER-approval.

4.2 Soil Cleanup Objectives and Soil/ Fill Management

Track 4 Soil Cleanup Objectives (SCOs) are proposed for this project. The SCOs for this Site will:

Contaminant	Site-Specific SCO's
Total SVOCs	750 ppm
Naphthalene	Groundwater protection standards
Lead	1200 ppm
Mercury	2.8 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 4**. 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.

Soil/Fill Excavation and Removal

The new Site development will require excavation to a minimum depth of 6 inches below existing cellar slab within the proposed building footprint for the layout of cellar foundations and 9 feet 6 inches below existing cellar slab (or 20 feet 8 inches bgs) for the elevators pit. The building areas will be capped with a 6-inch concrete slab in the cellar. The location of planned excavations is shown in **Figure 5**. The total quantity of soil/fill to be excavated and disposed off-Site is estimated at 300 tons. For each disposal facility to be used in the remedial action, a letter from the developer/QEP to the receiving facility requesting approval for disposal and a letter back to the developer/QEP providing approval for disposal will be submitted to OER prior to any transport and disposal of soil at a facility.

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

End-point Sampling

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

- Semi-volatile organic compounds by EPA Method 8270; and
- Target Analyte List metals;

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

Confirmation End-point Sampling

Removal actions for development purposes under this plan will be performed in conjunction with confirmation end-point soil sampling. Four confirmation samples will be collected from the base of the excavation at locations determined by OER. To evaluate attainment of Track 4 Site-specific SCOs, analytes will include those for which SCOs have been developed, including SVOCs, lead, mercury, nickel and copper according to analytical methods described above. Location of the end-point samplings is included in **Figure 6**.

Hotspot End-point Sampling

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

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

4. For contaminated soil removal, post remediation soil samples for laboratory analysis should be taken immediately after contaminated soil removal. If the excavation is enlarged horizontally, additional soil samples will be taken pursuant to bullets 1-3 above.

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

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

Quality Assurance/Quality Control

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

Field QA/QC will include the following procedures:

- Calibration of field equipment, including PID, on a daily basis;
- Use of dedicated and/or disposable field sampling equipment;
- Proper sample handling and preservation;
- Proper sample chain of custody documentation; and
- Completion of report logs.

The above procedures will be executed as follows:

- Disposable sampling equipment will be used to minimize cross-contamination between samples;
- For each of the parameters analyzed, a sufficient sample volume will be collected to adhere to the specific analytical protocol, and provide sufficient sample for reanalysis if necessary;
- Because plasticizers and other organic compounds inherent in plastic containers may contaminate samples requiring organic analysis, samples will be collected in glass containers;
- Appropriate sample preservation techniques, including cold temperature storage at 4º C, will be utilized to ensure that the analytical parameters concentrations do not change between the time of sample collection and analysis; and
- Samples will be analyzed prior to the expiration of the respective holding time for each analytical parameter to ensure the integrity of the analytical results.

Import of Soils

Import of soils onto the property will be performed in conformance with the Soil/Materials Management Plan in **Appendix 4**. Imported soil will meet the lower of:

- Site Specific Track 4 SCO's, and

The estimated quantity of soil to be imported into the Site for backfill and cover soil is 500 tons.

Reuse of Onsite Soils

Soil reuse is not planned on this project.

4.3 Engineering Controls

The excavation required for the proposed Site development will achieve Track 4 Site Specific SCOs. Engineering Controls will be employed in the remedial action to address residual contamination remaining at the site. The Site has 2 primary Engineering Control Systems. These are:

(1) Composite Cover System
(2) Soil 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 will be comprised of:

- 6-inch thick concrete slab in rear yard;
- 6-inch and 8-inch concrete slabs beneath all building areas;
- 2 feet 6 inches concrete slab beneath the elevators pit.

The composite cover system will be a permanent engineering control. The system will be inspected and its performance certified at specified intervals as required by this RAWP and the Site Management Plan. A Soil and Materials 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 Remedial Action Report.

Figure 7 shows the typical design and location for each remedial cover type used on this Site.

Vapor Barrier System

Migration of soil vapor from onsite or offsite sources into the building will be mitigated with a combination of building slab and vapor barrier. In order to prevent subsurface vapors from impacting the interior air of the building at the Site, a 20-mil VaporBlock® Plus™ VBP20 will on the interior sides of the existing cellar foundation walls and a 46-mil Grace Preprufe 300R will be installed under the slab and around and beneath the elevators pit in accordance with manufacturer specifications.

A plan showing the location of the proposed vapor barrier system is provided in **Figure 7**. Product specification sheets are provided in **Appendix 5**. The Remedial Action Report will include as-built drawings and diagrams; manufacturer documentation; and photographs.
The Remedial Action Report will include a PE-certified letter (on company letterhead) from the primary contractor responsible for installation oversight and field inspections and a copy of the manufacturer's certificate of warranty.

The Vapor Barrier System is a permanent engineering control and will be inspected and its performance certified at specified intervals as required by this RAWP and the Site Management Plan. A Soil and Materials 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 vapor barrier system is disturbed after the remedial action is complete. Maintenance of these systems will be described in the Site Management Plan in the Remedial Action Report.

4.4 Institutional Controls

A series of Institutional Controls (IC's) are required under this Remedial Action to assure permanent protection of public health by elimination of exposure to residual materials. These IC's define the program to operate, maintain, inspect and certify the performance of Engineering Controls and Institutional Controls on this property. Institutional Controls would be implemented in accordance with a Site Management Plan included in the final Remedial Action Report (RAR). Institutional Controls would be:

- Continued registration of the E-Designation for the property. This RAWP includes a description of all ECs and ICs and summarizes the requirements of the SMP which will note that the property owner and property owner's successors and assigns must comply with the approved SMP;
- Submittal of a SMP in the RAR for approval by OER that provides procedures for appropriate operation, maintenance, inspection, and certification of ECs and IC's. 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 determine 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 use and will not be used for a higher level of use 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 Voluntary Cleanup Agreement with OER. This includes a plan for: (1) implementation of EC's and ICs; (2) operation and maintenance of EC's; (3) inspection and certification of IC's and EC's.

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

4.6 Qualitative Human Health Exposure Assessment

The objective of the qualitative exposure assessment is to identify potential receptors and pathways for human exposure to the contaminants of concern (COC) that are present at, or

migrating from, the Site. The identification of exposure pathways describes the route that the COC takes to travel from the source to the receptor. An identified pathway indicates that the potential for exposure exists; it does not imply that exposures actually occur.

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

Known and Potential Contaminant Sources

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

Soil:

- SVOCs – Benzo(a)anthracene , benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, dibenzofuran and indeno(1,2,3-cd)pyrene were detected at concentrations exceeding their respective Track 2 Restricted SCOs in 7 shallow samples and 2 deep samples.
- Metals and pesticides were identified, but none exceeded Restricted Residential Use SCOs.

Groundwater:

- VOCs – 2-Butanone (120 µg/L) and 4-chlorotoluene (190 µg/L) were detected at concentrations exceeding their respective Groundwater Quality Standards and Guidance Values.
- Dissolved metals – Antimony (27 µg/L), magnesium (742 µg/L), selenium (11 µg/L) and sodium (311,000 µg/L) were detected at concentrations above their respective Groundwater Quality Standards and Guidance Values.

Soil Vapor:

- Chlorinated VOCs and petroleum related VOCs were detected at low concentrations.

Nature, Extent, Fate and Transport of Contaminants

Soil:

- SVOCs are distributed throughout the soils at elevated concentrations (exceeding Track 2 Commercial SCOs) beneath the existing cellar slab. Metals and pesticides were detected ay low concentrations and are not a concern. VOCs detected in groundwater were not detected in soils. Two additional groundwater well are required to be installed. If groundwater samples show naphthalene, then soil hotspots at SP-1, SP-7 and SP-8 will be required to be excavated to meet groundwater protection standards. Soil vapors detected low concentrations of VOCs and are not a concern.

Receptor Populations

On-Site Receptors: The site is currently a 5-story vacant building with a full cellar and the entrance of the building is locked. Onsite receptors are limited to trespassers, site representatives and visitors granted access to the property. During construction, potential on-site receptors include construction workers, site representatives, and visitors. Under proposed future conditions, potential on-site receptors include adult and child building residents, workers and visitors.

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

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

Potential Routes of Exposure

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

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

Potential Exposure Points

Current Conditions: The site is currently occupied by a 5-story vacant building surrounded with concrete alley, thus there are no potential exposure pathways from ingestion, inhalation, or dermal absorption of soil/ fill. Groundwater is not exposed at the site. The site is served by the public water supply and groundwater is not used at the site for potable supply and there is no potential for exposure. Since the site is currently developed with a 5-story vacant building with a full cellar, there is potential for soil vapor to accumulate on site.

Construction/ Remediation Conditions: During the remedial action, onsite workers will come into direct contact with surface and subsurface soils as a result of on-Site construction and excavation activities. On-Site construction workers potentially could ingest, inhale or have dermal contact with exposed impacted soil and fill. Similarly, off-Site receptors could be exposed to dust and vapors from on-Site activities. Given the depth of groundwater, direct contact with groundwater during the excavation of elevator would be expected. 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 through the implementation of the Community Air-Monitoring Program and a Construction Health and Safety Plan.

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

Overall Human Health Exposure Assessment

Soil vapor intrusion could be the only exposure pathway under the current site condition. There are potential complete exposure pathways that require mitigation during implementation of the remedy. There are no complete exposure pathways under future conditions after the site is developed. This assessment takes into consideration the reasonably anticipated use of the site, which includes a residential structure, site-wide surface cover, and a subsurface vapor barrier system for the building. Under current conditions, on-Site exposure pathways exist for those with access to the Site and trespassers. During remedial construction, on-Site and off-Site exposures to contaminated dust from historic fill material will be addressed through dust controls, and through the implementation of the Community Air Monitoring Program, the Soil/Materials Management Plan, and a Construction Health and Safety Plan. 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. There are no surface waters in close proximity to the Site that could be impacted or threatened.

Environmental Media & Exposure Route	**Human Exposure Assessment for Proposed Remedial Action**
Direct contact with surface and subsurface soils	• There is no direct contact with soil because the site will be completely covered with an engineered composite cover. Future contact with soil will be prevented by the implementation of a Site Management Plan and Soil and Materials Management Plan for any future ground intrusive work
Ingestion of groundwater	• The area is served by an upstate water supply and groundwater is not being used for potable water supply. Groundwater use for potable supply onsite is prohibited by municipal law.

Environmental Media & Exposure Route	Human Exposure Assessment for Proposed Remedial Action
Direct contact with groundwater	• There is no direct contact with groundwater because the site will be completely covered with an engineered composite cover. Future contact with groundwater will be prevented by the implementation of a Site Management Plan and Soil and Materials Management Plan for any future ground intrusive work
Direct contact with soil vapor	• Soil vapor is not impacted at the site • Contact with impacted soil vapor will be prevented by a soil vapor barrier

5.0 Remedial Action Management

5.1 Project Organization and Oversight

Principal personnel who will participate in the remedial action include Paul I. Matli, Project Geologist and Rachel Ataman, Vice President of Technical Services. The Professional Engineer (PE) and Qualified Environmental Professionals (QEP) for this project are Shaik A. Saad and Mark E. Robbins.

5.2 Site Security

Site access will be controlled by through gated entrances to the fenced property. Barriers will be installed around work areas as needed to delineate and restrict access to the work area. For work areas of limited size, barrier tape will be sufficient to delineate and restrict access. For larger worker areas, temporary fencing will be provided.

5.3 Work Hours

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. The hours of operation will be conveyed to OER during the pre-construction meeting.

5.4 Construction Health and Safety Plan

The Health and Safety Plan is included in **Appendix 6**. The Site Safety Coordinator will be Paul I. Matli. 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, such as 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 HASP and will comply with all requirements of 29 CFR 1910.120. Site-specific training will be provided to field personnel. Additional safety training may be added depending on the tasks performed. Emergency telephone numbers will be posted at the site location before any remedial work begins. A safety meeting will be conducted before each shift begins. Topics to be discussed include task hazards and protective measures (physical, chemical, environmental); emergency procedures; PPE levels and other relevant safety topics. Meetings will be documented in a log book or specific form.

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

5.5 Community Air Monitoring Plan

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 and sediment samples or the collection of groundwater samples from existing monitoring wells. 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 bailing/purging, and taking a reading prior to leaving a sample location. Depending upon the proximity of potentially exposed individuals, continuous monitoring may be performed during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence. Exceedances of action levels observed during performance

of the 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 shutdown.

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

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/m3) 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/m3 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/m3 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/m3 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 including NYC Building Code to assure safety. Utility companies and other responsible authorities will be contacted to locate and mark the locations, and a copy of the Mark-Out Ticket will be retained by the contractor prior to the start of drilling, excavation or other invasive subsurface operations. Overhead utilities may also be present within the anticipated work zones. Electrical hazards associated with drilling in the vicinity of overhead utilities will be prevented by maintaining a safe distance between overhead power lines and drill rig masts.

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

Dewatering

Dewatering is anticipated during remediation and construction.

Dewatering will be performed during the excavation and construction of elevators pit at the depth of 20 feet 8 inches bgs. Dewatering for this site will utilize a pumping system, settling tanks and possibly a treatment system prior to discharge into the city sewer system. All required permits would be obtained from NYCDEP prior to any discharge of groundwater into the sewer system.

Equipment and Material Staging

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

Stabilized Construction Entrance

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

Truck Inspection Station

An outbound-truck inspection station will be set up close to the Site exit. Before exiting the Site, trucks will be required to stop at the truck inspection station and will be examined for evidence of contaminated soil on the undercarriage, body, and wheels. Soil and debris will be removed. Brooms, shovels and clean 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 property; loose materials will be secured to prevent dislocation and blowing by wind or water; heavy equipment such as excavators and generators will be removed from excavated areas, trenches and depressions on the property to high ground or removed from the property; an inventory of the property with photographs will be performed to establish conditions for the site and equipment prior to the event; stockpile covers for soil and fill will be secured by adding weights such as sandbags for added security and worn or ripped stockpile covers will be replaced with competent covers; stockpiled hazardous wastes will be removed from the property; stormwater management systems will be inspected and fortified, including, as necessary: clean and reposition silt fences, hay bales; clean storm sewer filters and traps; and secure and protect pumps and hosing.

Storm Response

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

Storm Response Reporting

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

5.8 Traffic Control

Drivers of trucks leaving the Site with soil/fill will be instructed to proceed without stopping in the vicinity of the Site to prevent neighborhood impacts. The planned route on local roads for trucks leaving the site is shown on **Figure 8**.

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 business day. Those reports will include:

- Project number and statement of the activities and an update of progress made and locations of excavation and other remedial work performed;
- Quantities of material imported and exported from the Site;
- Status of on-Site soil/fill stockpiles;

- A summary of all citizen complaints, with relevant details (basis of complaint; actions taken; etc.);
- A summary of CAMP results noting all excursions. CAMP data may be reported;
- 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.

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, and approved by, 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 with basis 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;
- Text description with thorough detail of all engineering and institutional controls (if Track 1 remedial action is not achieved)
- As-built drawings for all constructed remedial elements;
- Manifests for al soil or fill disposal;
- Photographic documentation of remedial work performed under this remedy;
- Site Management Plan (if Track 1 remedial action is not achieved);
- Description of any changes in the remedial action from the elements provided in this RAWP and associated design documents;
- Tabular summary of all end point sampling results (including all soil test results from the remedial investigation for soil that will remain on site) and all soil/fill waste characterization results, QA/QC results for 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 soil or fill material removed from the Site including a map showing the location of these excavations and hotspots, tanks or other contaminant source areas;
- Full accounting of the disposal destination of all contaminated material removed from the Site. Documentation associated with disposal of all material will include transportation and disposal records, and letters approving receipt of the material;

- Account of the origin and required chemical quality testing for material imported onto the Site;
- Continue registration of the property with an E-Designation by the NYC Department of Buildings (if Track 1 remedial action is not achieved);
- The RAWP and Remedial Investigation Report will be included as appendices to the RAR;
- Reports and supporting material will be submitted in digital form and final PDF's will include bookmarks for each appendix.

Remedial Action Report Certification

I, Shaik A. Saad, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for implementation of the remedial program for the 338 West 36th Street site, site number [VCP site number]. I certify to the following:

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

Name

PE License Number

Signature

Date

PE Stamp

I, Mark E. Robbins, am a Qualified Environmental Professional. I had primary direct responsibility for implementation of the remedial program for the 338 West 36th Street site, site number [VCP site number]. I certify to the following:

- The OER-approved Remedial Action Work Plan dated August 15, 2012 and Stipulations in a letter dated September 10, 2014 were implemented and that all requirements in those documents have been substantively complied with. I certify that contaminated soil, fill, liquids or other material from the property were taken to facilities licensed to accept this material in full compliance with applicable laws and regulations.

QEP Name

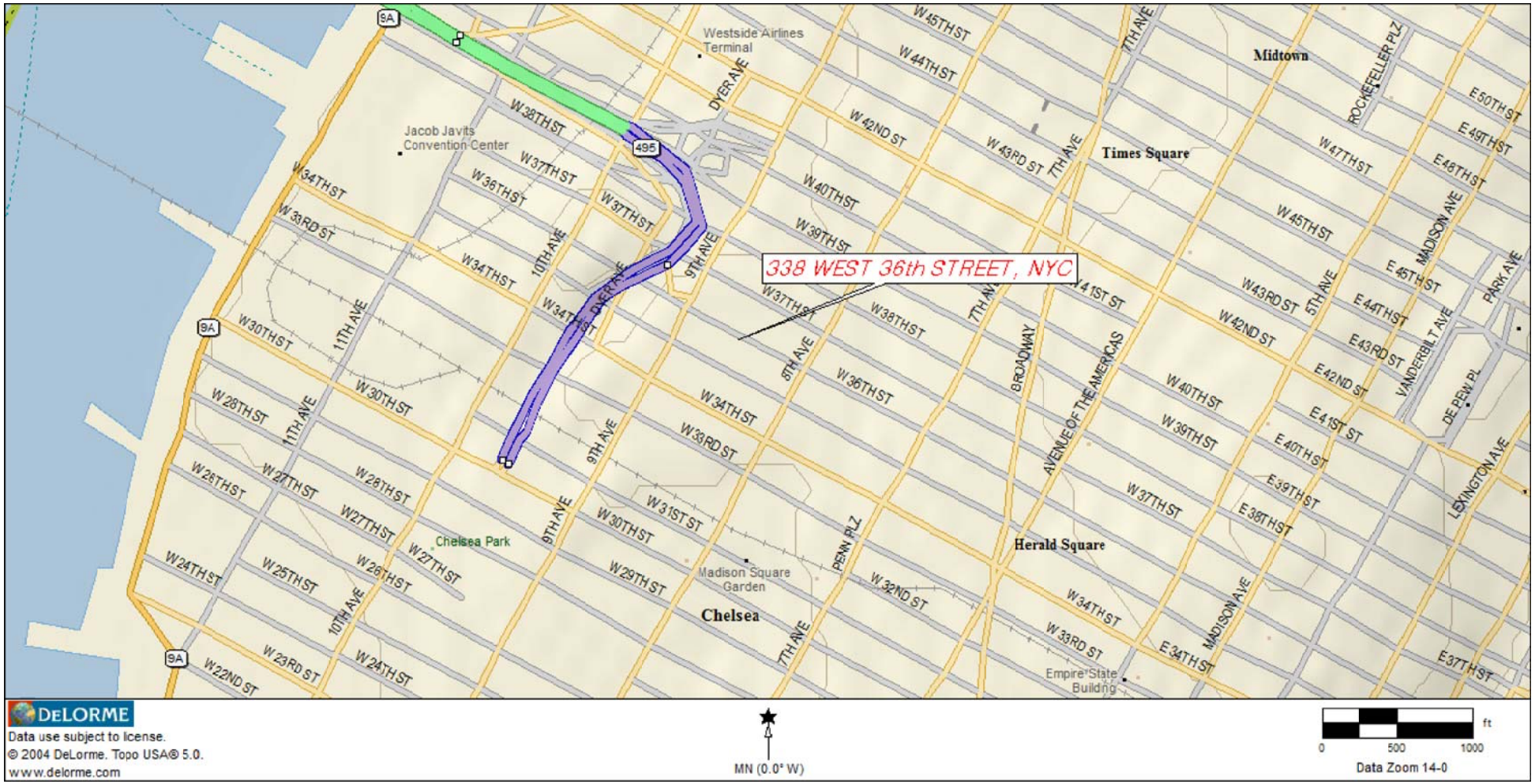
QEP Signature

Date

7.0 Schedule

The table below presents a schedule for the proposed remedial action and reporting. If the schedule for remediation and development activities changes, it will be updated and submitted to OER. Currently, a 24-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	2	1
Remedial Excavation	5	3
Demobilization	24	2
Submit Remedial Action Report	35	2



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NYC OFFICE:
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www.hydrotechenvironmental.com

338 West 36th Street
New York, NY.
HTE Job # 150024

Drawn By: C.Q.
Reviewed By: M.R
Approved By: M.R
Date: 02/09/15
Scale: AS NOTED

TITLE:

FIGURE 1: SITE LOCATION MAP

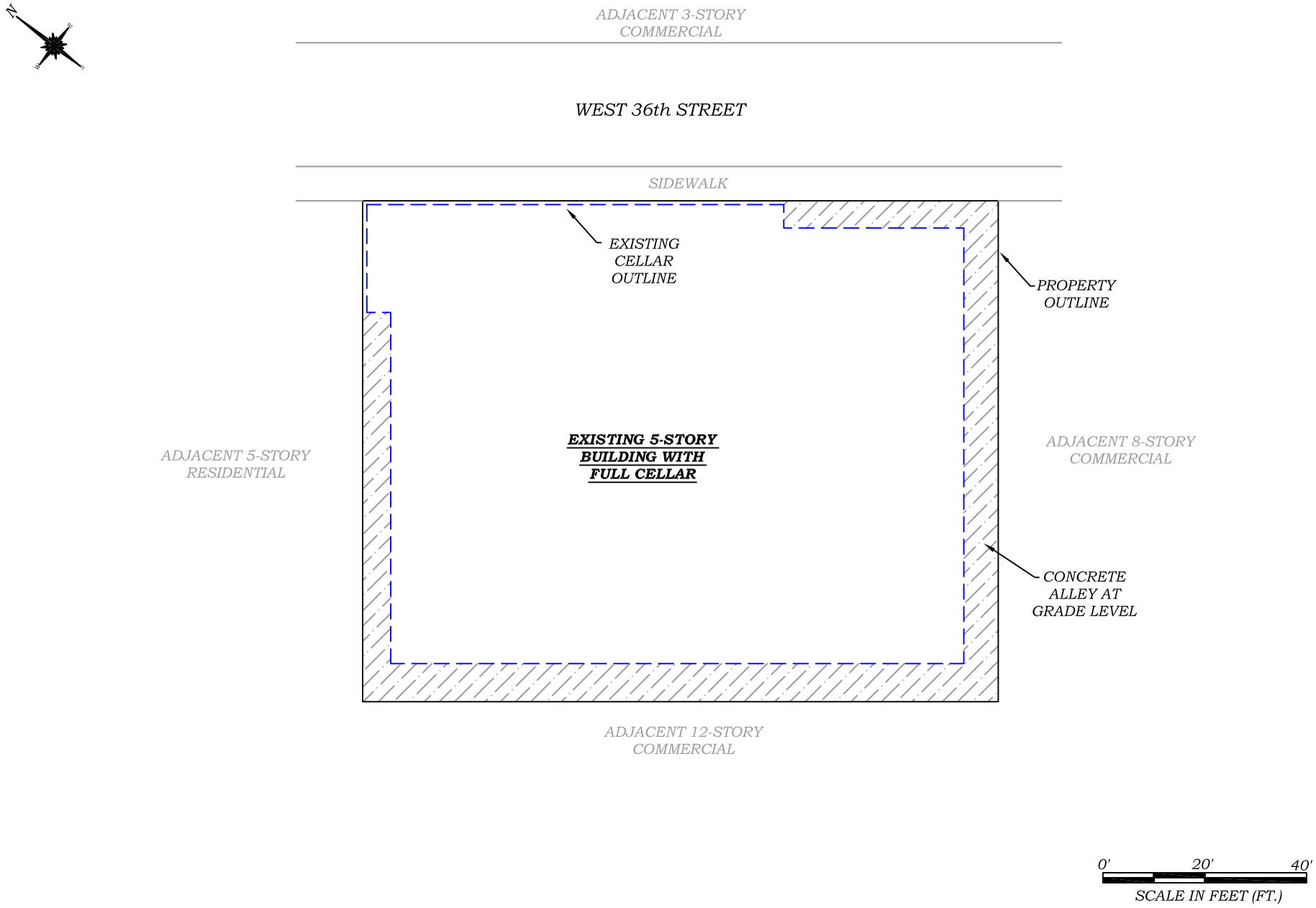

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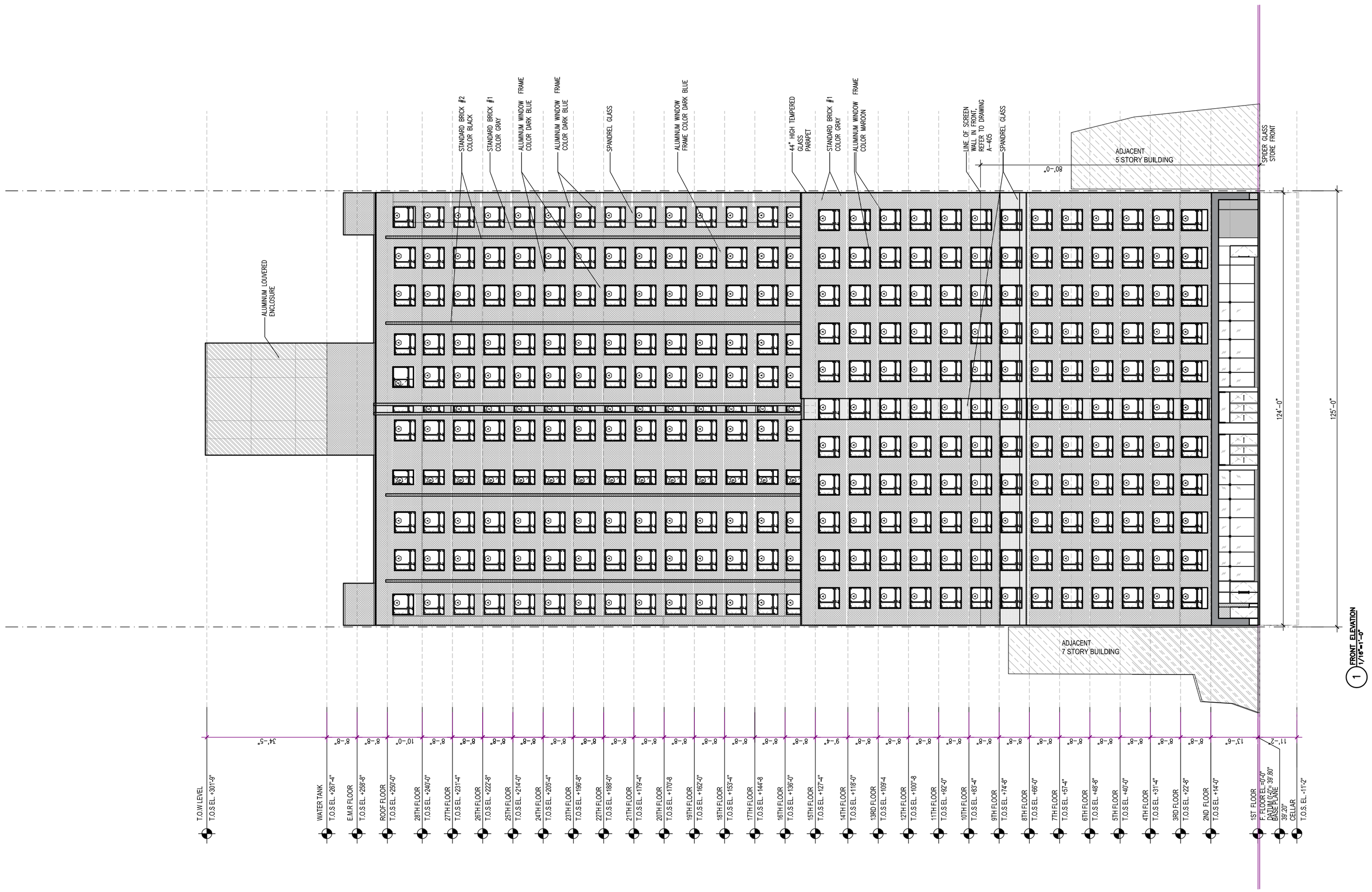
FIGURE 2: SITE BOUNDARY MAP

Figure-3: Proposed Redevelopment Plan



THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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FAIRFIELD INN & SUITES SM Marriott

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ISSUED DRAWINGS:

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FRONT ELEVATION

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REGISTERED ARCHITECT GENE KAUFMAN 023704 STATE OF NEW YORK

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PAGE#: - OF 41

Land Use

All land use categories

2003 2005 2007 2009 2014

- 1 & 2 Family Residential
- Multi-family Residential
- Mixed Use
- Open space & outdoor recreation
- Commercial
- Institutions
- Industrial
- Parking
- Transportation / Utilities
- Vacant Lots

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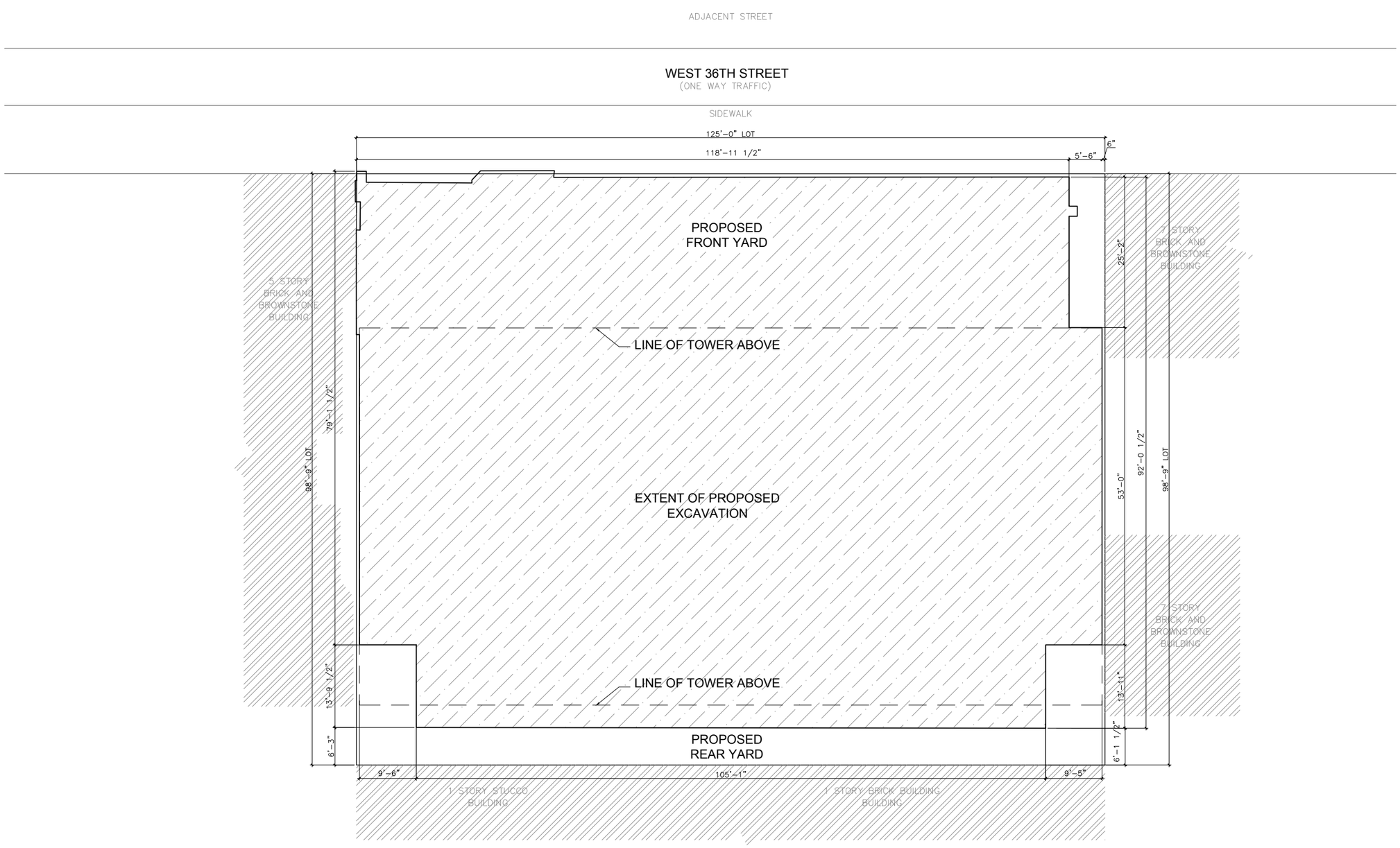
FIGURE 4: LAND-USE MAP

Figure-5: Layout of Planned Site Excavation



1 PROPOSED REDEVELOPMENT PLAN
1/8"=1'-0"

NORTH

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PROPOSED REDEVELOPMENT PLAN

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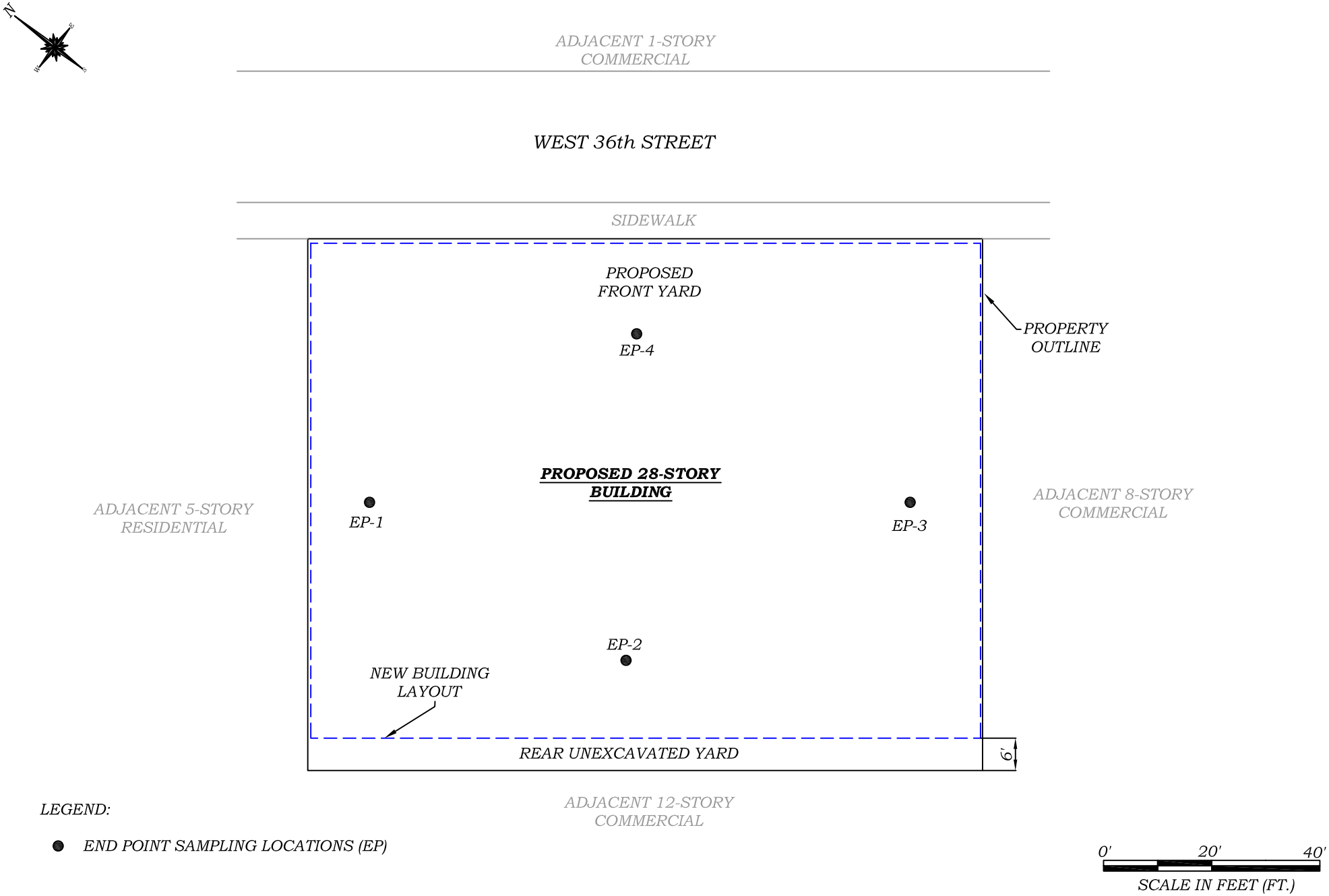

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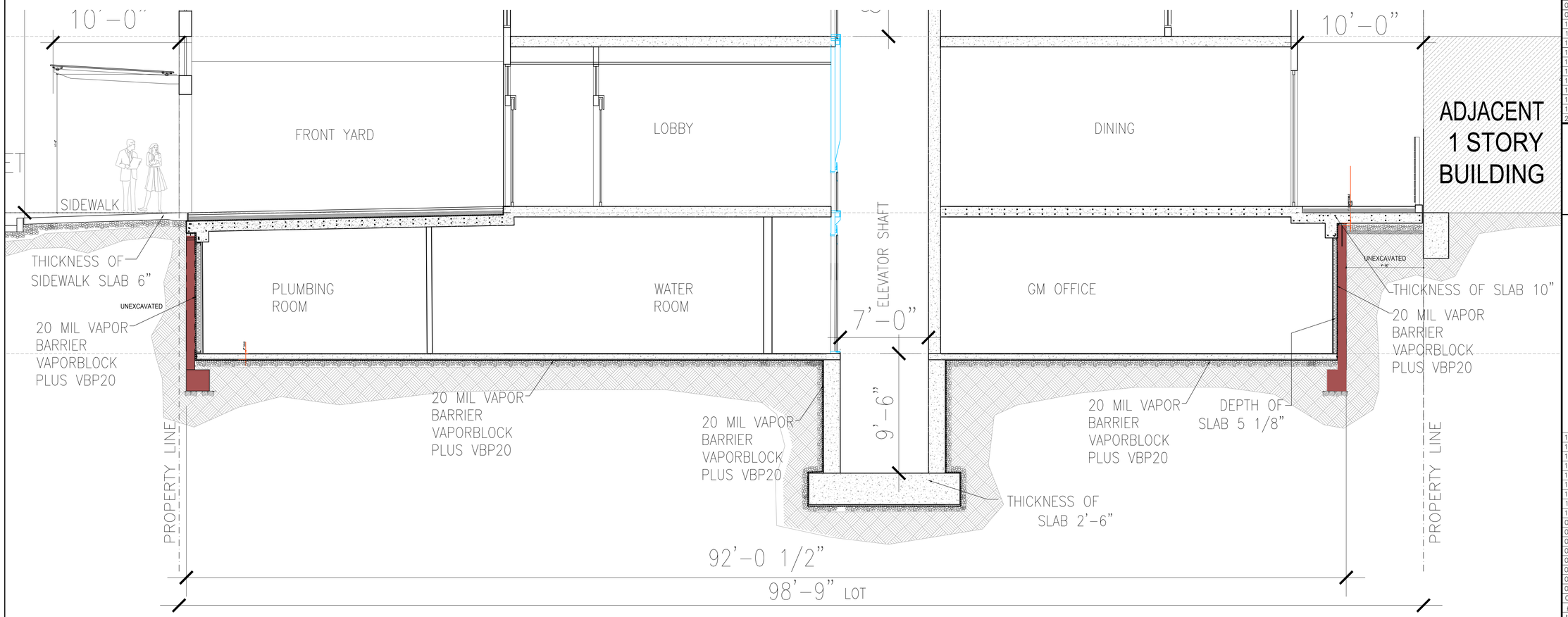
FIGURE 6: END POINT SAMPLING PLAN

Figure-7: Diagram of Engineering Controls



1 CELLAR CROSS SECTION

1/4" = 1'-0"

NORTH

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FOUNDATION SECTION

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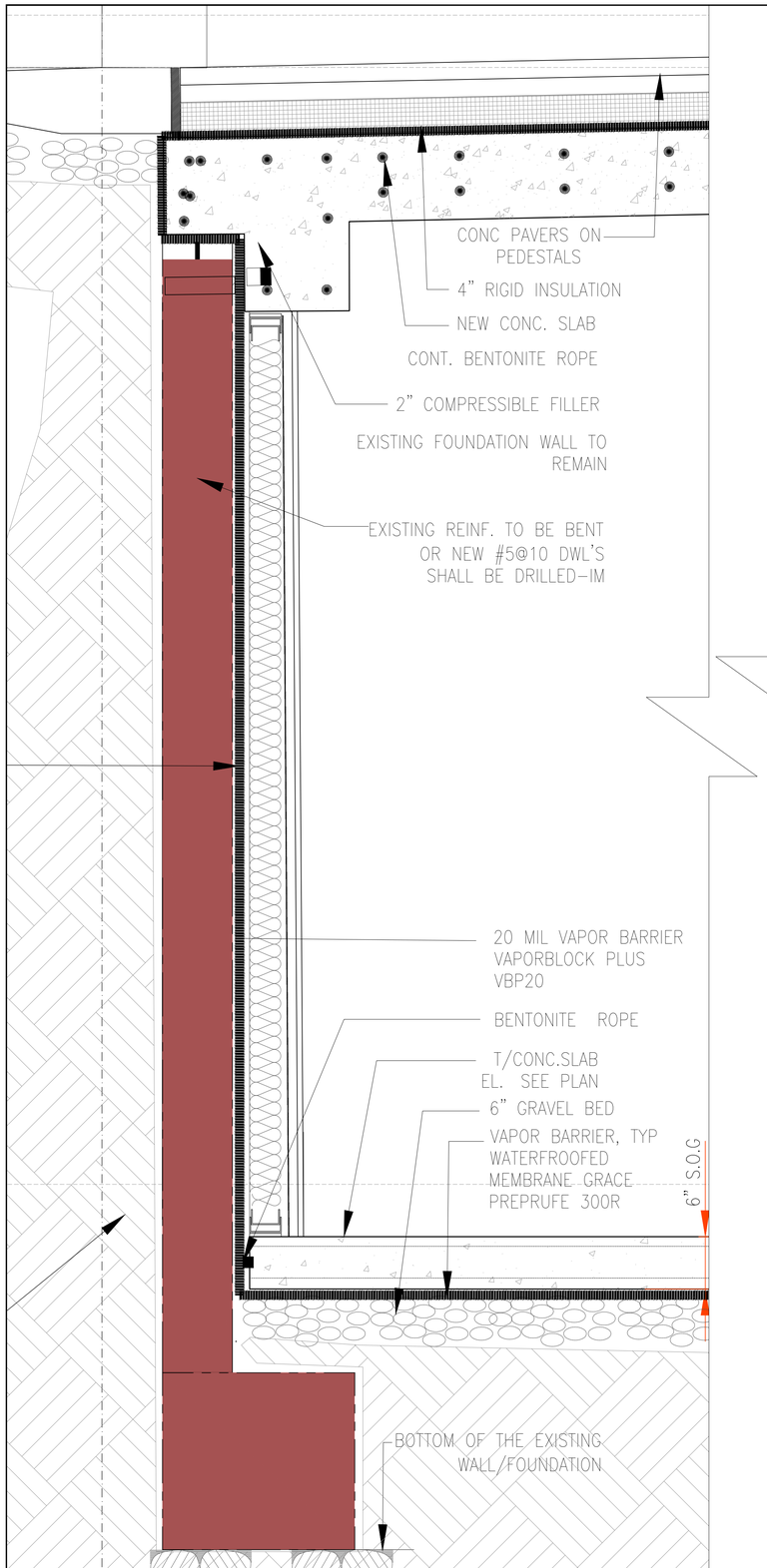
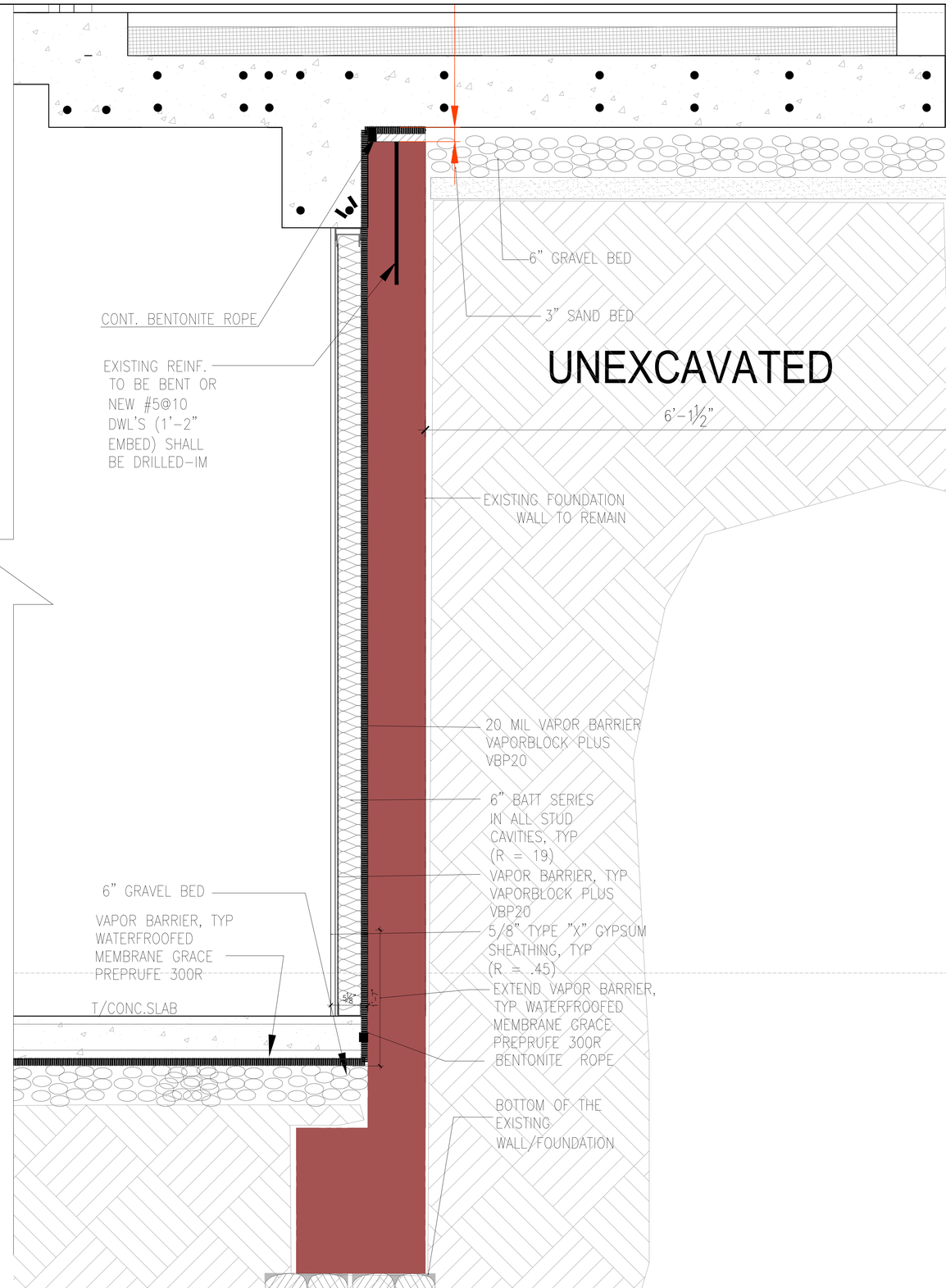


1 WALL SECTION @ FRONT FOUNDATION WALL

1 1/2" = 1'-0"



2 WALL SECTION @ REAR FOUNDATION WALL

1 1/2" = 1'-0"

NORTH

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TYPICAL WALL SECTION-7

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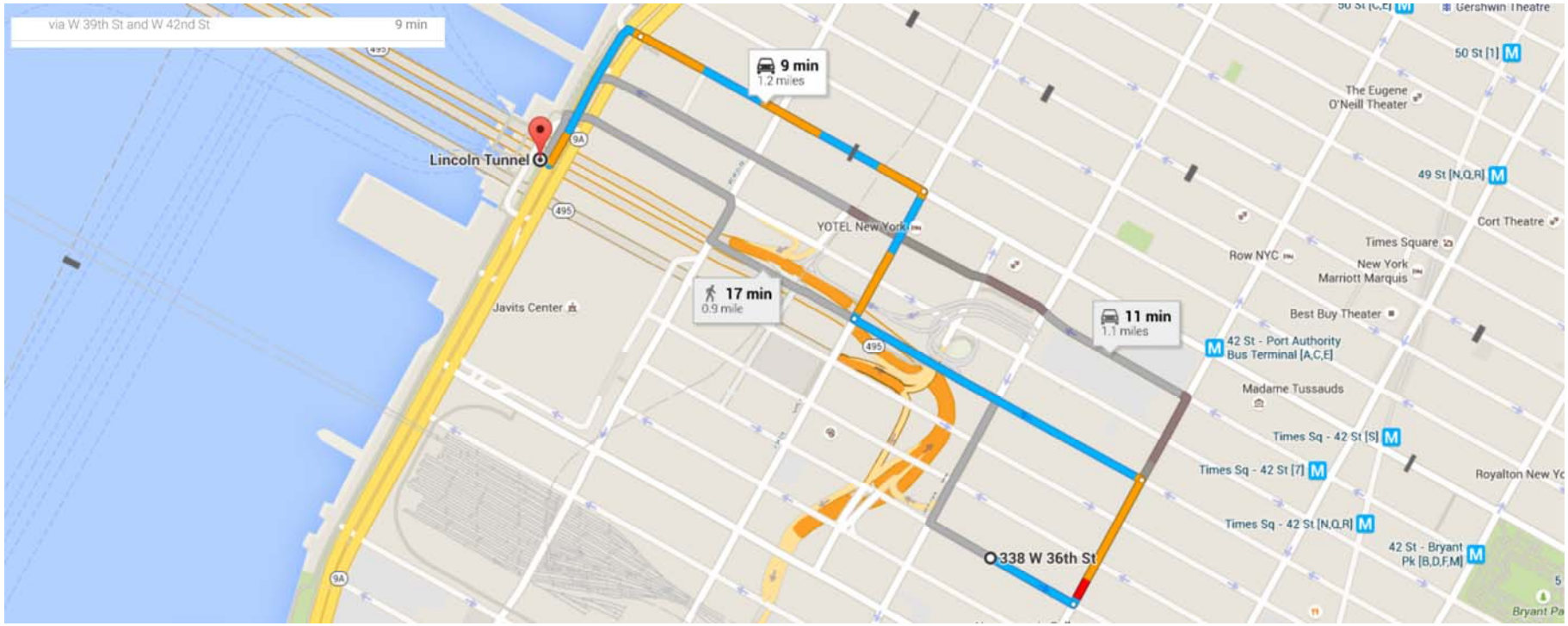
Figure-8: Waste Transport Vehicle Route


via W 39th St and W 42nd St
9 min
9 min
1.2 miles
Lincoln Tunnel
YOTEL New York
17 min
0.9 mile
Javits Center
11 min
1.1 miles
338 W 36th St
Gershwin Theatre
50 St [1]
The Eugene O'Neill Theater
49 St [N,Q,R]
Cort Theatre
Times Square
Row NYC
New York Marriott Marquis
Best Buy Theater
42 St - Port Authority Bus Terminal [A,C,E]
Madame Tussauds
Times Sq - 42 St [S]
Times Sq - 42 St [7]
Times Sq - 42 St [N,Q,R]
42 St - Bryant Pk [B,D,F,M]

APPENDIX 1

PROPOSED DEVELOPMENT PLANS

GENERAL NOTES:

1. ALL WORK TO BE PERFORMED IN COMPLIANCE WITH THE NEW YORK CITY BUILDING CODE, LATEST EDITION AND ALL SUPPLEMENTS.
2. CONTRACTOR SHALL VERIFY ALL CONDITIONS AND DIMENSIONS IN THE FIELD AND BE RESPONSIBLE FOR ACCURATE COORDINATION WHERE POSSIBLE. EXISTING FRAMING DIMENSIONS WAS TAKEN FROM EXISTING DWGS. AND SHALL BE VERIFIED ON SITE. DISCREPANCIES SHALL BE REPORTED TO ARCH. AND ENGINEER BEFORE PROCEEDING.
3. TEMPORARY SHORING IS REQUIRED AT ALL LOCATIONS WHERE PARTIAL REMOVAL OF BEAMS IS REQUIRED. CONTRACTOR IS RESPONSIBLE FOR ENGINEERING AND CONTROLLED INSPECTION OF TEMPORARY SYSTEMS.
4. THE CONTRACTOR SHALL USE THESE DRAWINGS IN CONJUNCTION WITH THE ARCHITECTURAL AND MECHANICAL DEMOLITION DRAWINGS. IN THE EVENT OF CONFLICTS, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT AND THE ENGINEER.
5. U.O.N., ALL ELEVATIONS SHOWN ON THIS SET ARE BASED ON A PROJECT SPECIFIC DATUM LOCATED AT THE FIRST FLOOR LEVEL => ±0'-0" = +39.8 BPMD (MANHATTAN TOPOGRAPHICAL BUREAU VERTICAL DATUM, WHICH IS 1.65' BELOW THE NORTH AMERICAN VERTICAL DATUM OF 1988 [NAVD1988])

NON-STRUCTURAL ITEMS SHOWN ON THE STRUCTURAL/FOUNDATION DRAWINGS

1. THE FOLLOWING NON-STRUCTURAL ITEMS MAY BE SHOWN ON THE STRUCTURAL AND/OR FOUNDATION DRAWINGS FOR THE PURPOSE OF CLARITY IN INTERFACE WITH STRUCTURAL AND/OR FOUNDATION WORK. ITEMS BELOW MAY NOT BE FULLY DEFINED ON THE STRUCTURAL/FOUNDATION DRAWINGS. THE INFORMATION FOR NON-STRUCTURAL ELEMENTS IS FURNISHED BY OTHER CONSULTANTS AS LISTED BELOW. ALL RFI AND SHOP DRAWINGS RELATED TO THESE NON-STRUCTURAL ITEMS SHALL BE SUBMITTED TO THE CONSULTANTS LISTED BELOW FOR THEIR REVIEW AND APPROVAL.

GEOTECHNICAL ENGINEER:
- FOUNDATION/UNDERSLAB WATERPROOFING, DAMPPROOFING SYSTEMS
- WALL AND UNDERSLAB DRAINAGE SYSTEM, INCLUDING SUMP PITS, GRAVEL & PIPING, CLEANOUTS
- ROCK ANCHORS
- CAISSONS AND PILES, INCLUDING REINFORCMENT
- ROCK CONTOURS

ARCHITECT OF RECORD:
- SUMP PITS
- WATERPROOFING/DAMPPROOFING APPLIED TO EXPOSED SURFACES, ELEVATOR OR SUMP PIT INTERIOR SURFACES
- PAINT
- FIREPROOFING
- CONCRETE CURBS: HEIGHT, WIDTH, EXTENT, LOCATION
- BRICK, BLOCK, TILE MASONRY, METAL PANELS, PRECAST FACADE PANELS, CURTAIN WALLS AND ALL OTHER FACADE SYSTEMS
- ROOFING SYSTEMS, DRAIN LOCATIONS, SLOPES TO DRAINS FILLS, INSULATION, PAVERS OR GRAVEL
- FLOATING/SECONDARY SLABS

MASONRY NOTES

1. SEE ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR COMPLETE REQUIREMENTS FOR C.M.U. MASONRY CONSTRUCTION AND APPEARANCE. DETAILS AND NOTES SHOWN ON THE STRUCTURAL DRAWINGS ARE INTENDED TO SUPPLEMENT ARCHITECTURAL REQUIREMENTS AND TO DEFINE ELEMENTS WHICH PROVIDE STRUCTURAL STRENGTH AND STABILITY.
2. DETAILS, SECTIONS, SCHEDULES, ETC. AND THESE NOTES, REPRESENT THE MINIMUM REQUIREMENTS FOR STRUCTURAL ADEQUACY. WHERE ARCHITECTURAL REQUIREMENTS DIFFER FROM STRUCTURAL, THE MORE STRINGENT SHALL BE FOLLOWED.
3. CODE: MASONRY WALL CONSTRUCTION SHALL CONFORM TO THE NEW YORK CITY BUILDING CODE AND TO ACI 530/ASCE-5 AS REFERENCED BY THE NYC CODE.
4. MASONRY UNITS SHALL BE LIGHTWEIGHT HOLLOW LOAD BEARING CONCRETE MASONRY (CMU). COMPRESSIVE STRENGTH OF MASONRY F'M SHALL BE A MINIMUM OF 1,500 PSI.
5. MORTAR SHALL BE TYPE M OR S.
6. HORIZONTAL JOINT REINFORCEMENT SHALL BE TRUSS TYPE GALVANIZED COLD-DRAWN STEEL WIRE CONFORMING TO ASTM A 951.
7. PROVIDE HORIZONTAL JOINT REINFORCEMENT IN EVERY OTHER JOINT (16" O.C. VERTICALLY) UNLESS PLANS OR DETAILS CALL FOR CLOSER SPACING OR ADDITIONAL REINFORCEMENT.
8. BAR REINFORCEMENT: ASTM A 615 GRADE 60, PER SCHEDULE. FOR ADDITIONAL REINFORCEMENT SEE WALL REINFORCEMENT ELEVATION.
9. ALL CELLS WITH REINFORCEMENT SHALL BE GROUTED SOLID FOR THE FULL EXTENT OF BAR, VERTICAL AND HORIZONTAL.
10. GROUT SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2,000 PSI. GROUT SHALL BE "FINE" AS DEFINED BY ASTM C 476.
11. STEEL ANGLES: ASTM A 36. STEEL IN AN EXTERIOR WALL OR EXPOSED TO THE EXTERIOR SHALL BE GALVANIZED. 12. CONTRACTOR SHALL COORDINATE ALL MASONRY WORK WITH WORK OF OTHER TRADES: ARCHITECTURAL, STRUCTURAL, MEP.

FOUNDATION NOTES:

A. EXCAVATION NOTES:

1. ALL FOUNDATIONS SHALL BEAR ON CLASS 1C ROCK WITHN A ALLOWABLE BEARING PRESSURE OF 20 TON/SF AS SPECIFIED ON FINAL GEOTECHNICAL REPORT.
2. STRUCTURAL DESIGN HAS BEEN PERFORMED IN ACCORDANCE WITH FINAL GEOTECHNICAL REPORT FROM "URS" DATED MARCH 19, 2015.
2. WHERE EXISTING FOOTING OR FOUNDATIONS OF ADJACENT PROPERTY IS LOWER THAN ELEVATIONS SHOWN, NEW MAT FOUNDATION IS TO BE LOWERED TO SAME ELEVATION. WHERE NEW MAT FOUNDATION IS LOWER THAN EXISTING CONTRACTOR IS TO ESTABLISH EXISTING CONDITIONS BEFORE FOUNDATIONS, COMMENCING WORK AND NOTIFY THE ENGINEER.
3. ALL UNDERPINNING, SHEETING, SHORING OR OTHER CONSTRUCTION REQUIRED FOR THE SUPPORT OF ADJACENT PROPERTIES, BUILDINGS, SIDEWALKS, UTILITIES, ETC., SHALL BE SUBJECT TO CONTROLLED INSPECTION AS REQUIRED BY THE CODE. THE CONTRACTOR SHALL RETAIN A LICENSED PROFESSIONAL ENGINEER ACCEPTABLE TO THE ENGINEER OF RECORD TO PROVIDE THE NECESSARY DESIGN AND THE SHALL PREPARE AND FILE THE REQUIRED FORMS FOR THE WORK WITH THE REQUIRED INSPECTION. THE CONTRACTOR'S PROFESSIONAL ENGINEER BUILDING DEPARTMENT.

B. CONCRETE AND STEEL REINFORCEMENT

1. ALL CONCRETE SHALL BE NORMAL WEIGHT CONTROLLED CONCRETE, U.O.N., AND COMPLY WITH A.C.I. BUILDING CODE AND THE CURRENT NEW YORK CITY BUILDING CODE.
2. CONCRETE STRENGTH SHALL BE AS FOLLOWS, UNLESS OTHERWISE NOTED:
   - FOUNDATION PIERS, FOOTINGS AND MAT FND'S — 8000 PSI MIN.
   - FOUNDATION WALLS AND COLUMN BUTTRESSES — 6000 PSI MIN.
   - COLUMN PIERS (IF ANY) — 6000 PSI MIN.
   - SLAB ON GROUND * — 6000 PSI MIN.

   * IF SLAB ON GROUND IS POURED BEFORE THE COLUMNS ABOVE AND THE COLUMN STRENGTH IS 6000 PSI OR GREATER, THE SLAB ON GROUND STRENGTH IS TO BE ACCORDING TO THE *"DETAIL OF BEAM AND SLAB CONCRETE PLACEMENT AT HIGH STRENGTH COLUMN."* IN ADDITION, THE DOWELS EXTENDING ABOVE THE FOOTINGS, PIERS OR PILE CAPS ARE TO BE LENGTHENED A MIN. 12", BEYOND THAT SHOWN OR CALLED FOR IN THE DETAILS.
3. ALL STEEL REINFORCEMENT SHALL HAVE AN ULTIMATE TENSILE STRENGTH OF 90,000 PSI AS PER A.S.T.M. A615-94 GRADE 60. A.S.T.M. A775-94D FOR EPOXY COATED REINFORCING BARS, AND A.S.T.M. A884-94a FOR EPOXY COATED STEEL WIRE AND WELDED WIRE FABRIC FOR REINFORCEMENT. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL THE NECESSARY CHAIRS, REBARS, TIES, SPACERS, ETC., TO SECURE AND SUPPORT THE REINFORCING WHILE PLACING THE CONCRETE.
4. ALL BARS MARKED CONTINUOUS, SHALL BE LAPPED 36 DIAMETERS AT SPLICES AND CORNERS EXCEPT AS OTHERWISE SHOWN ON PLANS. LAP CONTINUOUS TOP BARS AT CENTER BETWEEN SUPPORTS AND BOTTOM BARS AT SUPPORTS. HOOK TOP BARS AT DISCONTINUOUS ENDS.
5. VERTICAL CONSTRUCTION JOINTS IN ALL WALLS SHALL BE USED ONLY IF UNAVOIDABLE, OR UNLESS OTHERWISE NOTED, AND TO BE LOCATED AT LEAST 4'-0" FROM ANY SUPPORTING COLUMN OR WALL OPENING. DISTANCE BETWEEN JOINTS IN WALL SHALL BE ALLOWED AS PER SPECIFICATIONS. NO HORIZONTAL CONSTRUCTION JOINTS WILL BE ALLOWED IN GRADE BEAMS.
6. IN NO CASE SHALL TRUCKS, BULLDOZERS, OR OTHER HEAVY EQUIPMENT BE PERMITTED CLOSER THAN 8'-0" FROM ANY FOUNDATION WALL UNLESS APPROVED BY THE ENGINEER.
7. TEMPORARY BRACING SHALL BE PROVIDED FOR ALL BUTTRESSES. WHERE BUTTRESSES DO NOT EXIST OR SPACING BETWEEN BUTTRESSES EXCEED 25 FEET, AND WHERE THE DIFFERENCE IN LEVEL BETWEEN INSIDE AND OUTSIDE GRADE IS MORE THAN 4'-0", INTERMEDIATE BRACING SHALL BE PROVIDED. WHERE RAMPS OCCUR, THE GRADE ELEVATION OUTSIDE OF RAMP WALLS SHALL BE USED IN FIGURING THE DIFFERENCE IN LEVEL. CORNER BUTTRESSES NEED NOT BE BRACED. NO BACKFILLING IS TO BE DONE BEFORE ALL SLABS BRACING WALLS ARE IN PLACE UNLESS APPROVED BY THE ENGINEER. PROVIDE TEMPORARY BRACING FOR ALL PIERS AND SUMP PITS.
8. CONTRACTOR TO INSTALL ALL PIPE SLEEVES, BOXED OPENINGS, ANCHOR BOLTS, ETC., AS REQUIRED FOR THE VARIOUS TRADES. WALL POCKETS TO RECEIVE BEAMS AND SLABS SHALL BE PROVIDED AS REQUIRED FOR THE SUPERSTRUCTURE. SHOP DRAWINGS SHOWING THE POSITION OF OPENINGS SHALL BE SUBMITTED TO THE STRUCTURAL ENGINEER PRIOR TO PLACING CONCRETE.
9. MINIMUM COVER FOR REINFORCING STEEL SHALL BE ¾" FOR INTERIOR SLABS AND INTERIOR WALL SURFACES; 1½" FOR BEAMS, GIRDERS, AND COLUMNS (TIES, STIRRUPS OR PRIMARY REINFORCEMENT). FOR ALL CONCRETE EXPOSED TO WEATHER AND EARTH FILL, COVER SHALL BE 2" (1½" FOR STIRRUPS). FOR CONCRETE PLACED AGAINST EARTH, MINIMUM COVER SHALL BE 3".
10. THE CONTRACTOR MUST SUBMIT REINFORCING SHOP DRAWINGS TO THE STRUCTURAL ENGINEER FOR REVIEW. NO CONSTRUCTION IS TO BE STARTED UNTIL THE SHOP DRAWINGS ARE REVIEWED BY THE ENGINEER.
11. THE STRUCTURAL ENGINEER OR HIS FIELD QUALIFIED REPRESENTATIVE MUST CHECK AND APPROVE ALL STEEL REINFORCING PRIOR TO CONCRETE PLACEMENT.

C. CODES AND TESTS

1. THIS STRUCTURE HAS BEEN DESIGNED UNDER THE PROVISIONS OF THE NEW YORK CITY BUILDING CODE AS AMENDED AND A.C.I. 318.
2. ALL CONTROLLED CONCRETE SHALL COMPLY WITH THE A.C.I. 318 BUILDING CODE. APPLICATION FOR CONTROLLED CONCRETE WITH CONCRETE TESTS AND CURVES OF TESTS FOR THE PRELIMINARY DESIGN MIX PREPARED BY AN APPROVED LABORATORY MUST BE SUBMITTED TO THE ENGINEER FOR FILING WITH THE BUILDING DEPARTMENT. NO CONCRETE SHALL BE PLACED WITHOUT THE DESIGN MIX BEING APPROVED BY THE BUILDING DEPARTMENT.
3. DESIGN AND CONSTRUCTION OF FORMWORK IS TO COMPLY WITH THE A.C.I. 318 BUILDING CODE AND NEW YORK CITY BUILDING CODE AS AMENDED.
4. THE DESIGN DETAILS AND NOTES INCLUDED HEREIN ARE IN COMPLIANCE WITH LOCAL LAW 17/95.

SUPERSTRUCTURE CONCRETE NOTES

A. CONCRETE

1. ALL CONCRETE SHALL BE NORMAL WEIGHT CONTROLLED CONCRETE, U.O.N., AND COMPLY WITH THE A.C.I. BUILDING CODE AND THE CURRENT NEW YORK CITY BUILDING CODE.
2. CONCRETE STRENGTH SHALL BE AS FOLLOWS, UNLESS OTHERWISE NOTED:
   - SHEAR WALLS, LINK BEAMS & COLUMNS — REFER TO COLUMN SCHEDULE
   - SLABS AND BEAMS (U.O.N. ON PLANS) — 6000 PSI MIN.
3. NO CONCRETE SHALL BE PLACED UNTIL THE CONTRACTOR HAS INSTALLED ALL THE INSERTS AND DOVETAILS NECESSARY TO PROVIDE SUPPORT FOR MULLIONS, APPLIED FINISHES, PARTITIONS, PIPES, DUCTS, EQUIPMENT, ETC., AS REQUIRED IN ARCHITECTURAL, H.V.A.C. AND STRUCTURAL DRAWINGS. WHERE BRICK VENEER EXCEEDS 18" IN HEIGHT, PROVIDE DOVETAIL TYPE MASONRY ANCHORS SPACED AT 24" O/C IN ALL BACK UP VERTICAL CONCRETE SURFACES.
4. CONTRACTOR SHALL VERIFY LOCATIONS AND DIMENSIONS OF ALL SLOTS, PIPEDE SLEEVES, DUCTS AND ANY OTHER CONCRETE PENETRATIONS AS REQUIRED FOR VARIOUS TRADES BEFORE CONCRETE IS PLACED.

SHOP DRAWINGS SHOWING COMPOSITE LAYOUT OF ALL PENETRATIONS MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.

5. ALL PLUMBING AND ELECTRICAL SLOTS SHALL BE FILLED WITH CONCRETE TO THE SAME DEPTH AS FLOOR AFTER CONDUITS AND/OR PIPES ARE INSTALLED.
6. NO PIPES OR CONDUITS EXCEEDING 1/3 SLAB THICKNESS IN OUTSIDE DIAMETER NOR OVER NOMINAL 2" INSIDE DIAMETER SHALL BE EMBEDDED SHOULD BE PLACED CLOSER THAN 3 DIAMETER ON CENTER NOR PASS WITHIN 24" OF COLUMN FACE, U.O.N. JUNCTION BOXES MAY BE PLACED IN STRUCTURAL CONCRETE SLAB BUT SHALL NOT EXCEED 4½"x4½"x3½" IN DEPTH AND SHALL BE SEPARATED FROM OTHER JUNCTION BOXES BY NOT LESS THAN 8" OF CONCRETE.
7. ALL MEMBERS IN THE FLOOR SYSTEM INCLUDING BEAMS, BRACKETS, COLUMN CAPITALS AND HAUNCHES SHALL BE PLACED MONOLITHICALLY. VERTICAL CONSTRUCTION JOINTS NECESSARY MAY BE MADE AT CENTER OF BEAM OR SLAB USING APPROVED BULKHEADS AND ADDITIONAL REINFORCING AS SHOWN ON DETAILS.
8. NO CONCRETE FLOOR SYSTEM IS TO BE INSTALLED UNTIL AT LEAST TWO HOURS HAVE PASSED AFTER THE SUPPORTING COLUMNS AND WALLS ARE PLACED.
9. WHEN PLACING CONCRETE AGAINST AN ADJACENT BUILDING OR AT EXPANSION JOINT, AT LEAST 1" (U.O.N.) OF HIGH DENSITY STYROFOAM SHALL BE PLACED AT THE INTERFACE BETWEEN THE EXISTING AND NEW CONCRETE. IN ADDITION, THE CONTRACTOR MUST TAKE ALL THE NECESSARY MEASURES SO AS NOT TO CREATE ANY DAMAGE TO THE EXISTING CONSTRUCTION WHILE PLACING THE NEW CONCRETE.
10. TEMPORARY SHORING AND RESHORING SHALL REMAIN IN PLACE AT LEAST 28 DAYS AFTER PLACEMENT OF CONCRETE.
11. NO DEVIATION FROM THE STRUCTURAL PLANS SHALL BE PERMITTED WITHOUT THE EXPRESS WRITTEN CONSENT OF THE STRUCTURAL ENGINEER.

B. REINFORCEMENT

1. ALL STEEL REINFORCEMENT (STIRRUPS AND TIES INCLUSIVE) SHALL HAVE AN ULTIMATE TENSILE STRENGTH OF 90,000 PSI AS PER A.S.T.M. A615 GRADE 60. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL THE CHAIRS, REBARS, TIES, SPACERS, ETC., TO SECURE AND SUPPORT THE REINFORCING WHILE PLACING THE CONCRETE.

2. CONCRETE SLABS MINIMUM BOTTOM MAT REINFORCEMENT TO BE AS FOLLOWS, U.O.N. ON PLANS:

6" TO 9"	#4@12 CONT. E.W.
10" TO 14"	#5@12 CONT. E.W.
15" TO 20"	#6@12 CONT. E.W.
21" TO 26"	#7@12 CONT. E.W.
27" TO 36"	#8@12 CONT. E.W.

3. THE CONTRACTOR MUST SUBMIT REINFORCING SHOP DRAWINGS TO THE STRUCTURAL ENGINEER FOR REVIEW. NO CONSTRUCTION IS TO BE STARTED UNTIL THE SHOP DRAWINGS ARE REVIEWED BY THE ENGINEER.

4. THE STRUCTURAL ENGINEER OR HIS FIELD QUALIFIED REPRESENTATIVE MUST CHECK AND APPROVE ALL STEEL REINFORCEMENT PRIOR TO CONCRETE PLACEMENT.

5. ALL REINFORCING BARS MARKED CONTINUOUS SHALL BE LAPPED AT SPLICES AND CORNERS IN CONFORMANCE WITH LAP SPLICE TABLES IN TYPICAL DETAILS UNLESS OTHERWISE NOTED. LAP CONTINUOUS TOP BARS AT CENTER BETWEEN SUPPORTS AS REQUIRED. TERMINATE CONTINUOUS BARS AT END SUPPORTS WITH STANDARD HOOKS, U.O.N.

6. MINIMUM COVER FOR REINFORCING STEEL SHALL BE ¾" FOR INTERIOR SLABS AND INTERIOR WALL SURFACES; 1½" FOR BEAMS, GIRDERS AND COLUMNS (TIES, STIRRUPS OR PRIMARY REINFORCEMENT). FOR ALL CONCRETE EXPOSED TO WEATHER AND EARTH FILL, COVER SHALL BE 2" (1½" FOR STIRRUPS). FOR CONCRETE PLACED AGAINST EARTH, MINIMUM COVER SHALL BE 3".

C. CODES AND TESTS

1. THIS STRUCTURE HAS BEEN DESIGNED UNDER THE PROVISIONS OF THE NEW YORK CITY BUILDING CODE AS AMENDED AND A.C.I. 318.
2. ALL CONTROLLED CONCRETE SHALL COMPLY WITH THE A.C.I. 318 BUILDING CODE AND THE NEW YORK CITY BUILDING CODE. A SPECIAL AMENDMENT FORM FOR CONTROLLED CONCRETE WITH CONCRETE TESTS AND CURVES OF TESTS FOR THE PRELIMINARY DESIGN MIX PREPARED BY AN APPROVED LABORATORY MUST BE SUBMITTED TO THE ENGINEER FOR FILING WITH THE BUILDING DEPARTMENT. NO CONCRETE IS TO BE PLACED BEFORE SUCH AN AMENDMENT IS APPROVED BY THE BUILDING DEPARTMENT.
3. DESIGN AND CONSTRUCTION OF FORMWORK IS TO COMPLY WITH THE A.C.I. 318 BUILDING CODE AND THE NEW YORK CITY BUILDING CODE AS AMENDED.
4. TRANSPORTING, PLACING, CURING AND DEPOSITING OF CONCRETE SHALL COMPLY WITH THE A.C.I. BUILDING CODE.
5. ALL REINFORCING BARS SHALL BE DEFORMED BARS CONFORMING TO "SPECIFICATIONS FOR DEFORMED BILLET-STEEL BARS FOR CONCRETE REINFORCEMENT" A.S.T.M. A615 GRADE 60. THE STEEL SUPPLIER SHALL PROVIDE THE ENGINEER WITH AN AFFIDAVIT OF THE PRODUCER OF STEEL CERTIFYING THAT THE STEEL MEETS THE REQUIREMENTS OF THE A.S.T.M.
6. ALL STRUCTURAL STEEL (LINTELS, DUNNAGE BEAMS, ETC.) SHALL CONFORM TO A.S.T.M. A-36, U.O.N.

SUPERSTRUCTURE CONCRETE NOTES (CONT.)

D. SEISMIC AND WIND CRITERIA

1. THE STRUCTURE HAS BEEN DESIGNED IN ACCORDANCE WITH THE LATEST NEW YORK CITY BUILDING CODE (NYCBC 2014).

2. WIND DESIGN DATA:

   - BASIC WIND SPEED (3 SECOND GUST) = 98 mph
   - WIND IMPORTANCE FACTOR = 1
   - WIND EXPOSURE = B
   - INTERNAL PRESSURE COEFFICIENT = ±0.18

3. EARTHQUAKE DESIGN DATA:

   AS PER GEOTECHNICAL REPORT DATED FEBRUARY/2015

   - SEISMIC IMPORTANCE FACTOR = 1
   - S_S = 0.281g, S_1 = 0.073g
   - S_{DS}= 0.187g, S_{D1}= 0.049g

   - SITE CLASS = B
   - SEISMIC DESIGN CATEGORY = B
   - SEISMIC FORCE RESISTING SYSTEM = ORDINARY REINFORCED CONCRETE SHEAR WALLS
   - DESIGN BASE SHEAR (V): E/W = 350 kips; N/S = 350 kips
   - SEISMIC RESPONSE COEFFICIENT (C_S): E/W = 0.01; N/S = 0.01
   - RESPONSE MODIFICATION FACTORS: R = 5
   - ANALYSIS PROCEDURE USED = EQUIVALENT LATERAL FORCE PROCEDURE

4. STRUCTURAL SEPARATIONS, (NYCBC-1613.7): ALL STRUCTURES SHALL BE SEPARATED FROM ADJACENT STRUCTURES. WHEN A STRUCTURE ADJOINS A PROPERTY LINE NOT COMMON TO A PUBLIC WAY (TYPICALLY SIDE OR REAR LOT LINES), THAT STRUCTURE SHALL ALSO BE SET BACK FROM THE PROPERTY LINE BY AT LEAST 1 INCH FOR EACH 50 FEET OF HEIGHT AND A MINIMUM OF 1 INCH FOR STRUCTURES WITH HEIGHTS LESS THAN 50 FEET. SMALLER SEPARATIONS OR PROPERTY LINE SETBACKS SHALL BE PERMITTED WHEN JUSTIFIED BY RATIONAL ANALYSIS BASED ON MAXIMUM EXPECTED GROUND MOTIONS WITH A MINIMUM SEPARATION OF 1 INCH ALONG THE FULL HEIGHT OF THE STRUCTURE.

STRUCTURAL STEEL NOTES:

1. STRUCTURAL STEEL HAS BEEN DESIGNED IN ACCORDANCE WITH THE NEW YORK CITY BUILDING CODE. ALL STEEL TO BE ASTM A572 / ASTM A992 HAVING A MINIMUM YIELD OF 50,000 PSI U.O.N. ON PLANS OR SECTIONS.
2. ALL CONNECTIONS SHALL BE IN ACCORDANCE WITH AISC SPECIFICATIONS.
3. ALL WELDED CONNECTIONS SHALL CONFORM TO THE NEW YORK CITY BUILDING CODE. PROVISIONS SHALL BE MADE FOR FIELD INSPECTION AND TESTING OF WELDS. ALL SHOP WELDS SHALL BE TESTED BY ANY OF APPROVED METHODS AND SHALL BE CERTIFIED.
4. ALL BOLT STEEL SHALL CONFORM TO THE FOLLOWING ASTM DESIGNATIONS, LATEST EDITION: HIGH STRENGTH BOLTS A-325 AND A-490, U.O.N.
5. ALL BOLTS SHALL BE ¾" ø MINIMUM ON HOLES 13/16"ø UNLESS OTHERWISE SHOWN ON THE DRAWINGS.
6. ALL SHOP CONNECTIONS SHALL BE HIGH STRENGTH BOLTED OR WELDED.
7. ALL ENDS OF COLUMNS AT SPLICES AND ALL OTHER BEARING CONNECTIONS SHALL BE MILLED TO COMPLETE TRUE BEARING.
8. THE USE OF A CUTTING TORCH IN THE FIELD WILL NOT BE PERMITTED.
9. WELDING ELECTRODES SHALL CONFORM TO E70XX ELECTRODES.
10. CONTRACTOR SHALL PROVIDE STIFFENERS PER CHAPTER K OF AISC SPECIFICATION (LRFD) REGARDING THE NEED FOR COLUMN STIFFENERS.
11. ALL WELDERS TO BE LICENSED BY THE CITY OF NEW YORK.
12. STRUCTURAL STEEL SHALL RECEIVE ONE COAT OF PAINT, ZINC OR BITUMINOUS COATING OR EQUIVALENT METAL PROTECTION BEFORE ERECTION AS SPECIFIED. FOR SPECIAL MINIMUM REQUIREMENTS IN SPECIFIC AREAS SEE NOTES THIS DRAWING. PARTS OF STRUCTURAL STEEL LEFT UNPAINTED BECAUSE OF WELDING, OR BOLTING SHALL RECEIVE A FIELD APPLICATION OF METAL PROTECTION.
13. STRUCTURAL STEEL THAT WILL REMAIN EXPOSED TO VIEW SHALL RECEIVE AN ADDITIONAL COAT OF METAL PROTECTION OF ANOTHER COLOR AFTER ERECTION.

UNDER THE PROVISIONS OF SECTION BC 1627 OF THE NEW YORK CITY BUILDING CODE A PEER REVIEW IS NOT REQUIRED FOR THIS PROJECT.

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

REVISIONS:

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04	05-13-15	ISSUE TO OER
03	04-17-15	SUPERSTRUCTURE BID SET
02	04-07-15	ISSUED TO DOB
01	03-25-15	FOUNDATION BID SET

ISSUED DRAWINGS:

GENE KAUFMAN ARCHITECT PC

525 BROADWAY, NEW YORK, N.Y., 10012
TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

GENE□□L NOTES□
□BB□E□□TIONS □ND LEGEND □

SEAL & SIGNATURE:

STATE OF NEW YORK · SUSAN L. MARCUS · 057539 · LICENSED PROFESSIONAL ENGINEER

DATE: MARCH 25, 2015
SCALE: N.T.S.
DRAWING NUMBER:

FO-001.00

PAGE#: 01 OF XX

ABBREVIATIONS:

AB	ANCHOR BOLT
ABV	ABOVE
AC	AIR CONDITIONER
ACI	AMERICAN CONCRETE INSTITUTE
ADD'L	ADDITIONAL
ADJ	ADJACENT
AFF	ABOVE FINISHED FLOOR
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ALT	ALTERNATE ALUM ALUMINUM
ANCH	ANCHOR
ANG	ANGLE
APPD	APPROVED
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AVG	AVERAGE
AWS	AMERICAN WELDING SOCIETY
B	BASE
BETW	BETWEEN
BF	BRACE FRAME
BKT	BRACKET
BL	BUILDING LINE
BLDG	BUILDING
BM	BEAM
BOTT	BOTTOM
BRK	BRICK
B/STL	BOTTOM OF STEEL
BS	BOTH SIDES
CANT	CANTILEVER
CF	CUBIC FOOT
CG	CENTER OF GRAVITY
CIP	CAST IN PLACE
C.JT	CONCRETE JOINT
CL	CENTER LINE
CLG	CEILING
CLR	CLEAR
CM	CONSTRUCTION MANAGER
CMU	CONCRETE MASONRY UNITS
COL	COLUMN
CONC	CONCRETE
COND	CONDITIONS
CONN	CONNECTION
CONST	CONSTRUCTIONS
CONT	CONTINUOUS
CONTR	CONTRACTOR
COORD	COORDINATE
CORR	CORRUGATED
CY	CUBIC YARD
DEMO	DEMOLITION
DEPT	DEPARTMENT
DET	DETAIL
DIA	DIAMETER
DIM	DIMENSION
DIR	DIRECTION
DN	DOWN
DWL	DOWEL
DWG	DRAWING
E	EAST
EA	EACH
EF	EACH FACE
EL	ELEVATION
ELEC	ELECTRIC
ELEV	ELEVATOR
EMBD	EMBEDMENT
ENCL	ENCLOSURE
EOR	ENGINEER OF RECORD
EOS	EDGE OF SLAB
EP	EMBEDDED PLATE
EQ	EQUAL
EQUIP	EQUIPMENT
ETC	ETCETERA
EW	EACH WAY
E-W	EAST WEST
EXIST	EXISTING
EXP	EXPANSION
EXP JT	EXPANSION JOINT
EXT	EXTENSION
EXTR	EXTERIOR
FL	FLOOR
FND	FOUNDATION
FOB	FACE OF BUILDING
FP	FIRE PROOFING
FT	FOOT
FTG	FOOTING
GA	GAUGE
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GB	GRADE BEAM
GRTG	GRATING
GYP. BD	GYPSUM BOARD
H	HIGH
HDR	HEADER
HGT	HEIGHT
HORIZ	HORIZONTAL
HP	HIGH POINT
HR	HOUR
HS	HIGH STRENGTH
HVAC	HEAT, VENTILATION & AIR CONDITIONING
ID	INSIDE DIAMETER
IF	INTERIOR FACE
IN	INCH
INCL	INCLUDING
INFO	INFORMATION
INSUL	INSULATION
JT	JOINT
K	KIP (1000 POUNDS)
KSF	KIPS PER SQUARE FOOT
KSI	KIPS PER SQUARE INCH
L	LOW
LB	LINK BEAM
LBS	POUNDS
LB/FT	POUNDS PER FOOT
Ld	DEVELOPMENT LENGTH
LG	LONG
LL	LIVE LOAD
LLRS	LATERAL LOAD RESISTING SYSTEM
LLV	LONG LEG VERTICAL
LP	LOW POINT
LRFD	LOAD RESISTANCE FACTOR DESIGN
LT	LIGHT
LW	LIGHT WEIGHT
MAX	MAXIMUM
MAS	MASONRY
MATER	MATERIAL
MAX	MAXIMUM
MC	MOMENT CONNECTION
MD	METAL DECK
MECH	MECHANICAL
MEP	MECHANICAL ELECTRICAL AND PLUMBING
MEZZ	MEZZANINE
MF	MOMENT FRAME
MFG	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
N	NORTH
NA	NOT APPLICABLE
NIC	NOT IN CONTRACT
NO	NUMBER
N-S	NORTH-SOUTH
NTS	NOT TO SCALE
NW	NORMAL WEIGHT
O/C	ON CENTER
OPNG	OPENING
OPP	OPPOSITE
PC	PILE CAP
PCF	POUNDS PER CUBIC FEET
PL	PLATE
PLF	POUNDS PER LINEAR FOOT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	POST TENSION
RC	REINFORCED CONCRETE
RD	ROOF DRAIN
REF	REFERENCE
REINF	REINFORCEMENT
REQ'D	REQUIRED
RFI	REQUEST FOR INFORMATION
S	SOUTH
SB	SPANDREL BEAM
SCHED	SCHEDULE
SECT	SECTION
SF	SQUARE FOOT
SHT	SHEET
SL	SLAB
SPA	SPACING
SPEC	SPECIFICATIONS
SQ	SQUARE
STD	STANDARD
STIFF	STIFFENER
STL	STEEL
STRUCT	STRUCTURAL
SW	SHEARWALL
SIM	SIMILAR
T&B	TOP AND BOTTOM
THK	THICK
T/	TOP OF
TBD	TO BE DETERMINED
TEMP	TEMPORARY
TSF	TONS PER SQUARE FOOT
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
U	UPTURNED BEAM
VERT	VERTICAL
VIF	VERIFY IN FIELD
W	WEST
W/	WITH
W/O	WITH OUT
WF	WIDE FLANGE
WP	WORKING POINT
WPG	WATER PROOFING
WS	WATER STOP
WT	WIND TRUSS
WWF	WELDED WIRE FABRIC
℄	CENTERLINE
ℙ	PLATE
∠	ANGLE
&	AND
ø	DIAMETER
@	AT

LEGEND:

a.	[...]	INDICATES THE BOTTOM OF FOUNDATION WALL ELEVATION
b.	<...>	INDICATES THE TOP OF FOUNDATION WALL ELEVATION
c.	{...}	INDICATES TOP OF SHELF ELEVATION
d.	(...)	INDICATES TOP OF PILE CAP/FOOTING ELEVATION
e.	CXX	INDICATES CAISSON CAP MARK
f.	XXxXX	INDICATES SIZE OF PIER IN INCHES, FIRST DIMENSION SHOWN IS IN THE EAST-WEST DIRECTION.
g.		INDICATES ROCK ANCHOR.
h.		INDICATES DRAIN DIRECTION
i.		INDICATES CLEANOUT
j.		INDICATES ADDITIONAL TOP REINFORCEMENT AT SUPPORTS
k.		INDICATES ADD'L BOTTOM REINFORCING AT SUPPORTS
l.		INDICATES ADDITIONAL TOP REINFORCEMENT CONTINUOUS BETWEEN SUPPORTS
m.		INDICATES ADDITIONAL BOTTOM REINFORCEMENT CONTINUOUS BETWEEN SUPPORTS
n.	1ST & 4TH LAYERS; 2ND & 3RD LAYERS	INDICATES ORDER OF BAR PLACEMENT AS SHOWN ON PLAN.
o.		INDICATES CHANGE IN ELEVATION
p.		INDICATES CONCRETE COLUMN/SHEARWALL/FOUNDATION WALL
q.		INDICATES CONCRETE COLUMN/SHEARWALL BELOW
r.		INDICATES CONCRETE WALL
s.		INDICATES SLAB OPENING (FIRST DIMENSION IS IN EAST-WEST DIRECTION)
t.		INDICATES COLUMN ABOVE OR BELOW
u.		INDICATES SLOPING COLUMN
v.	XX	INDICATES COLUMN DESIGNATION
w.	SW-X	INDICATES SHEARWALL DESIGNATION
x.	?	INDICATES DIMENSIONAL INFORMATION TO BE PROVIDED BY THE ARCHITECT.
y.	*	INDICATES DIMENSIONAL INFORMATION TO BE REVIEWED BY THE ARCHITECT.

POST SCHEDULE

1. P1 — INDICATES POST 12x12 CONCRETE POST REINF. W/4-#11 & #4□@14 TIES
1. P2 — INDICATES POST 20x12 CONCRETE POST REINF. W/4-#11 & #4□@14 TIES

LOADING SCHEDULE

OCCUPANCY	PARTITION/FILL &/OR FINISHES (PSF)	CEIL. & MECH. (PSF)	LIVE LOAD (PSF)
ROOF	40	5	30
ACCESSIBLE ROOF/TERRACES	35	5	60
LOBBIES/STAIRS/ CORRIDORS	30	5	100
RESIDENTIAL	12	3	40
MECHANICAL ROOMS	20	5	150
GYM	20	5	100
RETAIL	30	5	100
FACADE / ENCLOSURE (IMPOSED AT THE SLAB PERIMETER: SDL = 40 PSF (PER FT OF HEIGHT)			

NOTES:
1. LOADS ARE AS SHOWN ABOVE U.O.N. ON PLAN.

CONTROLLED INSPECTIONS

(TERMINOLOGY PER CURRENT TR-1) SPECIAL INSPECTION	CURRENT CODE REFERENCES	(PREVIOUS TERMINOLOGY) "CONTROLLED INSPECTION"
STRUCTURAL STEEL - WELDING	1704.3.1	WELDING
STRUCTURAL STEEL - ERECTION & BOLTING	1704.3.3	HIGH - STRENGTH BOLTING
STRUCTURAL COLD - FORMED STEEL	1704.3.4	(NONE)
CONCRETE - CAST IN PLACE	1704.4	CONCRETE
CONCRETE - PRECAST	1704.4	CONCRETE - PRECAST
CONCRETE - PRESTRESSED	1704.4	CONCRETE - PRESTRESSED
CONCRETE TEST CYLINDERS* (TR2)	1905.6	CONCRETE TEST CYLINDERS
CONCRETE DESIGN MIX* (TR3)	1905.3	CONCRETE MIX DESIGN
MASONRY	1704.5	MASONRY
SOILS - SITE PREPARATION	1704.7.1	SUBGRADE
SOILS - FILL PLACEMENT & IN-PLACE DENSITY	1704.7.2 1704.7.3	CONTROLLED FILL -
SOILS - INVESTIGATIONS (BORINGS/TEST PITS) (TR4)	1704.7.4	BORINGS / TEST PITS
PILE FOUNDATIONS & DRILLED PIER INSTALLATION (TR5)	1704.8	PILING
PIER FOUNDATIONS	1704.9	(NONE)
UNDERPINNING	1704.9.1	UNDERPINNING
WALL PANELS, CURTAIN WALLS AND VENEERS (ATTACHMENT TO BUILDING)	1704.10	(NONE)
SPRAYED FIRE RESISTANT MATERIALS	1704.11	SPRAY - ON FIREPROOFING
STRUCTURAL SAFETY - STRUCTURAL STABILITY	1704.19	STRUCTURAL STABILITY
EXCAVATION - SHEETING, SHORING AND BRACING	1704.19 & 3304.4.1	SHORING & SHEETING
FIRESTOP, DRAFTSTOP AND FIREBLOCK SYSTEMS	1704.25	(NONE)
PROGRESS INSPECTION		
FOOTING AND FOUNDATION	109.3.1	SOIL BEARING PRESSURE
FINAL	28-116.2.4.2 & 109.5 AND DIRECTIVE 14-(1975)	FINAL INSPECTION

* THESE TEST MUST BE PERFORMED BY A LICENSED CONCRETE TESTING LAB.

NOTES:

1. REFER TO THE PROJECT SPECIFICATIONS FOR ADDITIONAL INFORMATION ON SCOPE AND DETAILED REQUIREMENTS FOR INSPECTIONS.
2. ALL SPECIAL INSPECTIONS SHALL BE PERFORMED UNDER THE SUPERVISION OF A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF NEW YORK.
3. REPORTS OF RESULTS SHALL BE SUBMITTED TO THE OWNER AND ARCHITECT FOR REVIEW. SIGNED COPIES OF ALL TESTS AND INSPECTION REPORTS SHALL BE FILED WITH THE BUILDING DEPARTMENT (THROUGH THE APPLICANT).
4. REPORTS SHALL STATE WHETHER RESULTS COMPLY WITH CONTRACT REQUIREMENTS, SUMMARIZE THE TYPE OF TEST, THE LOCATION OR COMPONENT TESTED, AND RECOMMEND ANY REMEDIAL MEASURES REQUIRED. REPORT SHOULD NOTE ANY OTHER DEVIATIONS FROM THE CONTRACT DOCUMENTS.
5. FOR ITEMS OF WORK OF OTHER TRADES WHICH ARE SUBJECT TO SPECIAL INSPECTION, SEE THE CITY OF NEW YORK BUILDING CODE, AS WELL AS ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING, ETC. DRAWINGS AND SPECIFICATIONS.
6. IN ADDITION TO THE ABOVE REQUIREMENTS, ALL COLUMN SPLICE, BEAM MOMENT CONNECTIONS AT BEAMS DESIGNATED AS "LLRS" AND BRACE FRAME OR WIND TRUSS CONNECTIONS (PER S-940 SERIES OF DWGS.) SHALL COMPLY WITH THE INSPECTION REQUIREMENTS OF AWS D1.8 "STRUCTURAL WELDING CODE-SEISMIC SUPPLEMENT", IF WELDING IS PRESENT IN CONNECTION.

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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FAIRFIELD INN & SUITES SM Marriott

SPRINGHILL SUITES ® Marriott

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03	04-17-15	SUPERSTRUCTURE BID SET
02	04-07-15	ISSUED TO DOB
01	03-25-15	FOUNDATION BID SET

#	DATE	DESCRIPTION

ISSUED DRAWINGS:

GENE KAUFMAN ARCHITECT PC
525 BROADWAY, NEW YORK, N.Y. 10012
TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

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SEAL & SIGNATURE:

STATE OF NEW YORK · SUSAN L. MARCUS · 057539 · LICENSED PROFESSIONAL ENGINEER

DATE: MARCH 25, 2015
SCALE: N.T.S.
DRAWING NUMBER:
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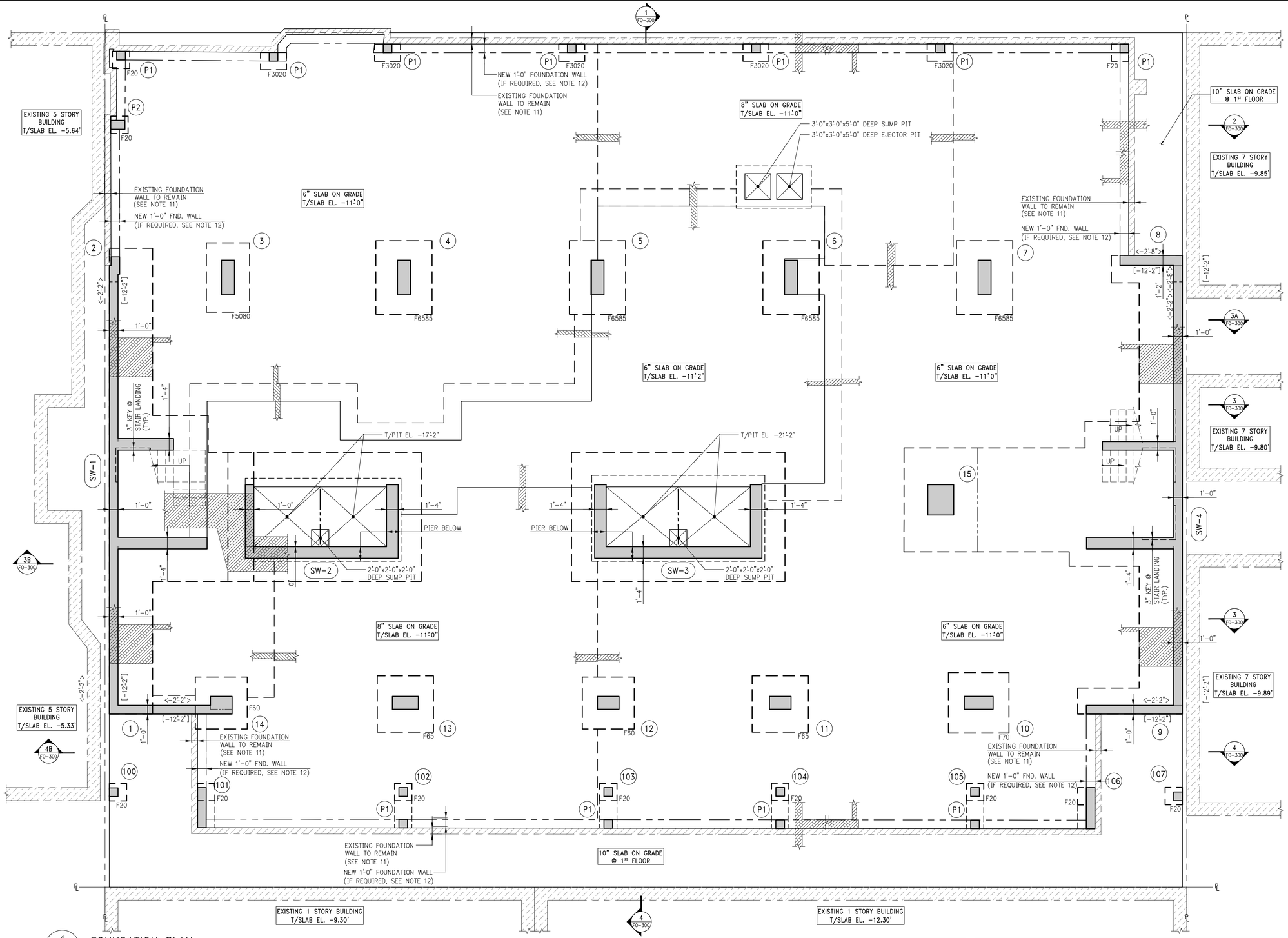
PAGE#: 02 OF XX



1 FO-100 FOUNDATION PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. T/SLAB ELEVATION TO BE -11'-0" U.O.N. THUS [.....] ON PLAN.
2. SLAB ON GRADE TO BE 6" THICK U.O.N. THUS [.....] ON PLAN.
3. SEE TYPICAL SLAB ON GRADE DETAIL FOR REINFORCEMENT.
4. FOOTINGS TO BE CENTERED ON COLUMN'S OR WALLS U.O.N. TOP OF FOOTINGS TO BE 1'-0" BELOW TOP OF SLAB ON GRADE U.O.N.
5. FOR GENERAL NOTES, ABBREVIATIONS AND LEGEND SEE DRAWINGS FO-001 & FO-002
6. FOR SHEARWALL MAT DETAILS SEE DRAWING FO-110
7. FOR FOUNDATION TYPICAL DETAILS SEE FO-200 SERIES DRAWINGS.
8. FOR FOUNDATION SECTIONS SEE FO-300 SERIES DRAWINGS.
9. FOR SHEARWALL DETAILS SEE S-940 SERIES DRAWINGS.
10. FOR COLUMN SIZES, REINFORCEMENT AND DETAILS SEE S-950 SERIES DRAWINGS.

NOTES (CONT.):

11. EXISTING FOUNDATION WALL TO REMAIN (IN AREAS INDICATED ON PLAN) TO BE USED AS TEMPORARY SOE. DEMOLITION/FOUNDATION CONTRACTOR RESPONSIBLE TO SHORE AS REQUIRED.
12. UPON COMPLETION OF DEMOLITION, EOR TO INSPECT STRUCTURAL INTEGRITY OF EXISTING WALL TO DETERMINE WHAT PORTIONS IF ANY CAN BE REUSED AS PERMANENT RETAINING WALLS/SUPPORT OF STRUCTURE ABOVE. IN AREAS WHERE EXISTING WALL IS NOT SUFFICIENT, NEW FOUNDATION WALL TO BE POURED INBOARD OF EXISTING WALL IN LIEU OF POST/BEAM SYSTEM CURRENTLY SHOWN.

20 TSF RECTANGULAR FOOTING SCHEDULE

MARK	SIZE	DEPTH	BOTTOM REINF. LONG BARS	BOTTOM REINF. SHORT BARS	REMARKS
F3020	3'-0" x 2'-0"	2'-0"	6-#5	8-#5	
F5080	5'-6" x 8'-0"	2'-9"	15-#9	9-#8	
F6585	6'-6" x 8'-6"	3'-3"	13-#10	12-#8	

20 TSF SQUARE FOOTING SCHEDULE

MARK	SIZE	DEPTH	BOTT. REINF. E.W.	REMARKS
F20	2'-0" x 2'-0"	2'-0"	6-#5	
F60	6'-0" x 6'-0"	2'-3"	10-#8	
F65	6'-6" x 6'-6"	2'-6"	12-#8	
F70	7'-0" x 7'-0"	2'-6"	12-#9	

NORTH

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ISSUED DRAWINGS:

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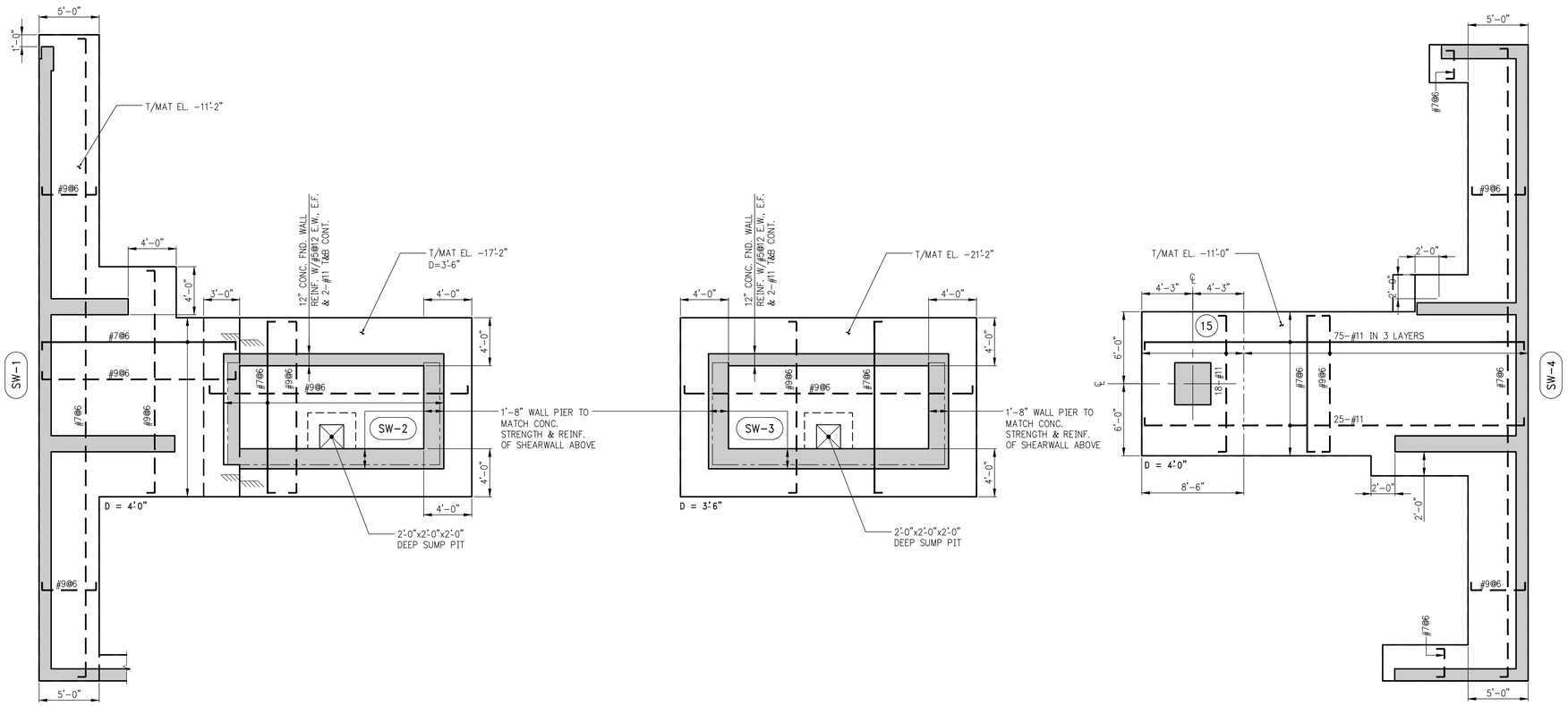
FOUNDATION PLAN

SEAL & SIGNATURE:

DATE: MARCH 25, 2015
SCALE: 3/16" = 1'-0"
DRAWING NUMBER:
FO-100.00

PAGE#: 03 OF XX



1 / FO-110 SHEARWALL MAT DETAILS

SCALE: 3/16"=1'-0"

NOTES:

1. FOR ADDITIONAL INFO SEE DRAWING FO-100.

NORTH

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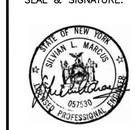
SCHEDULE AND MAT DETAILS

SEAL & SIGNATURE:



DATE: MARCH 23, 2015

SCALE: 3/16" = 1'-0"

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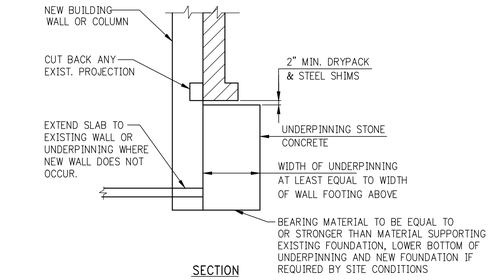
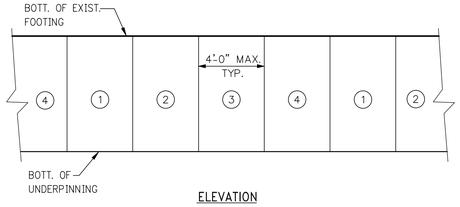


SECTION

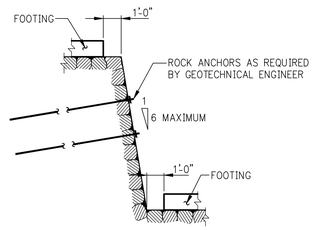


ELEVATION

NOTES:
1. EXCAVATE & PLACE PANELS IN ORDER SHOWN
2. MINIMUM CLEAR DISTANCE BETWEEN SIMULT. CUTS TO BE 12'-0"
3. CONCRETE FOR UNDERPINNING TO BE CONTROLLED STONE CONCRETE 3000 P.S.I.

SUGGESTED UNDERPINNING DETAIL

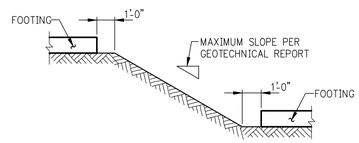
NOTES:
1. THIS DETAIL IS REPRESENTATIVE OF ONE METHOD OF UNDERPINNING UNDER PARTICULAR CIRCUMSTANCES. THE CONTRACTOR MUST EVALUATE THIS PROJECT AND DETERMINE EXACT METHODS AND PROCEDURES TO BE FOLLOWED.
2. CONTRACTOR'S UNDERPINNING DESIGN ENGINEER SHALL BE A REGISTERED PROFESSIONAL ENGINEER IN THE STATE OF NEW YORK AND SHALL REVIEW ALL AVAILABLE BORING DATA AND EXISTING CONDITIONS TO DETERMINE THE NECESSITY OF PRELOADING AND/OR JACKPILING TO PROTECT ADJACENT STRUCTURES PRIOR TO COMMENCEMENT OF UNDERPINNING OPERATIONS.
3. THE CONTRACTOR'S PROFESSIONAL ENGINEER SHALL FILE WITH THE BUILDING DEPARTMENT THE SELECTED PROCEDURE.



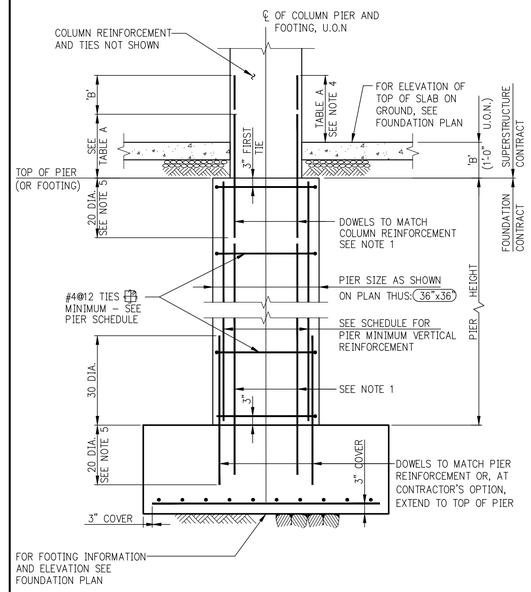
ADJACENT FOOTINGS ON ROCK AT DIFFERENT ELEVATIONS

FOR ROCK CAPACITY = 20 TONS PER SQ. FT. OR HIGHER.

NOTE:
THIS DETAIL IS SUBJECT TO THE INTEGRITY OF THE ROCK AND PITCH OF ROCK SEAMS AND MAY BE MODIFIED DUE TO SITE CONDITIONS. MAXIMUM HEIGHT DIFFERENTIAL TO BE DETERMINED BY GEOTECHNICAL ENGINEER WHEN ACTUAL ROCK CONDITION IS OBSERVED.



ADJACENT FOOTINGS ON SOIL



PIER: MINIMUM VERTICAL REINFORCEMENT	
PIER SIZE (OR EQUIVALENT)	VERTICAL REINF.
UP TO 36x36	8–#6
37x37 TO 48x48	12–#6
49x49 TO 54x54	12–#7
55x55 TO 66x66	16–#7
67x67 TO 84x84	16–#8
OVER 84 TO BE SUPPLIED IN PIER SCHEDULE	

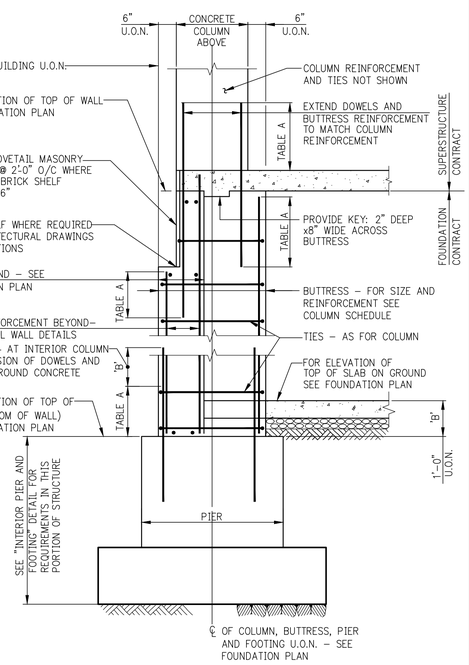
NOTE:
THE PIER SCHEDULE MAY REQUIRE A GREATER AMOUNT OF REINFORCEMENT, BUT NOT LESS.

TABLE A		
COMPRESSION LAP SPLICE LENGTH		
BAR SIZE	fy=60 KSI	fy=75 KSI
#5 TO #11	30 DIA.	44 DIA.
#14 & #18	45"–#11 DOWELS	60"–#11 DOWELS

NOTES:
1. WHERE PIER HEIGHT IS LESS THAN EMBEDMENT LENGTH OF COLUMN DOWELS, EMBED DOWELS IN FOOTING AND EXTEND THROUGH PIER INTO COLUMN ABOVE.
2. AT CONTRACTOR'S OPTION, A SHORT PIER MAY BE ELIMINATED BY THICKENING THE COLUMN FOOTING TO THE TOP OF PIER ELEVATION.
3. MAXIMUM PIER HEIGHT TO BE EIGHT TIMES THE LEAST PIER DIMENSION. INCREASE PIER SIZE AS REQUIRED TO MAINTAIN THIS RATIO.
4. WHEN SLAB ON GROUND IS POURED BEFORE COLUMN, INCREASE LENGTH OF DOWELS BY DIMENSION 'B' (FROM TOP OF PIER TO TOP OF SLAB.) IN ADDITION, IF COLUMN CONCRETE STRENGTH IS GREATER THAN 1.4 TIMES SLAB CONCRETE STRENGTH, THE SLAB CONCRETE STRENGTH MUST BE INCREASED LOCALLY TO MATCH COLUMN CONCRETE STRENGTH FOR A DISTANCE OF 2 FEET IN ALL DIRECTIONS FROM COLUMN FACES.
5. IF GRADE 75 COLUMN REINFORCEMENT IS USED, INCREASE DOWEL EMBEDMENT LENGTH TO 24 DIAMETERS.
6. MINIMUM CONCRETE STRENGTH OF f'c=4,000 PSI IS REQUIRED FOR PIER AND FOOTING. SEE PLANS AND NOTES FOR GREATER STRENGTH REQUIREMENTS.

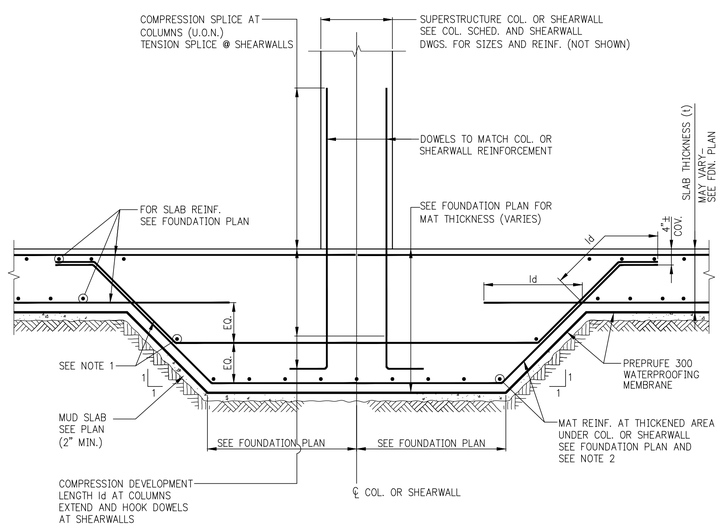
INTERIOR FOOTING AND PIER AT CONCRETE COLUMN

THIS DETAIL DOES NOT APPLY WHERE COLUMN REINFORCEMENT IS IN TENSION.



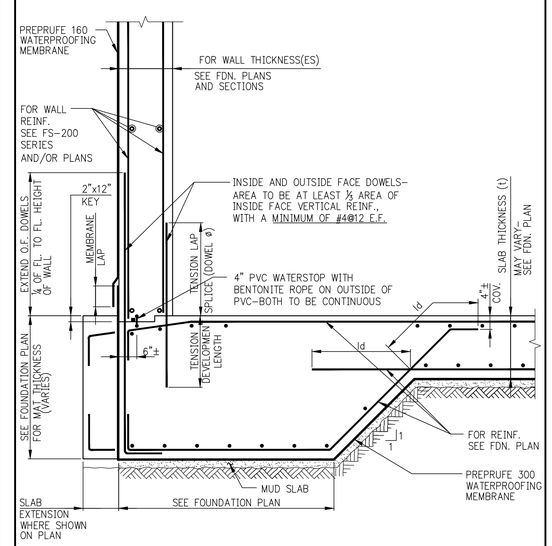
BUTTRESS AT CONCRETE COLUMN

THIS DETAIL DOES NOT APPLY WHERE COLUMN REINFORCEMENT IS IN TENSION.



MAT FOUNDATION HAUNCH AT COLUMN OR SHEARWALL FOOTING

NOTES:
1. WHERE HAUNCH DROP BELOW BOTTOM OF SLAB IS GREATER THAN 18", PLACE ONE SLAB BOTTOM BAR AT EACH SIDE OF HAUNCH. (SEE SECTION FOR LOCATIONS)
2. PLACE BOTTOM COLUMN STRIP BARS IN THE THICKENED MAT, UNIFORMLY SPACED. SEE FOUNDATION PLAN FOR REINFORCEMENT REQUIRED AND APPROXIMATE SPACING.
3. TYPICAL DETAILS SHOWN HERE (SUCH AS REINFORCEMENT PLACEMENT, LAPS, EXTENSIONS, EMBEDMENT, ETC., HAUNCHES, MEMBRANE, MUD SLAB, ETC.) APPLY TO ALL OTHER TYPICAL MAT DETAILS, WHETHER REPEATED THERE OR NOT.



MAT FOUNDATION AT EXTERIOR WALL

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SEAL & SIGNATURE:

STATE OF NEW YORK · SULIMAN L. MALOUF · 057530 · LICENSED PROFESSIONAL ENGINEER

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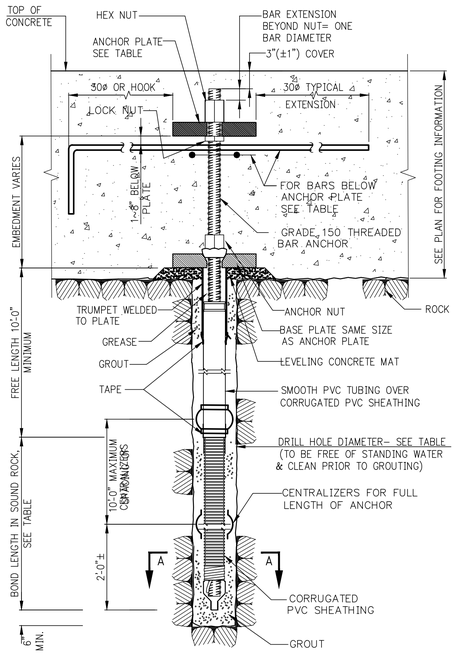


ROCK ANCHOR DETAIL

ROCK ANCHOR GENERAL NOTES

1. ROCK ANCHORS SHALL BE IN CONFORMANCE WITH LATEST PTI (POST – TENSIONING INSTITUTE) "RECOMMENDATIONS FOR PRESTRESSED ROCK AND SOIL ANCHORS". FOR SIZES AND LOCATIONS SEE FOUNDATION DRAWINGS.
2. ALL ROCK ANCHORS SHALL BE GRADE 150 THREADED BARS CONFORMING TO ASTM A–722. THREADED BARS SHALL BE PROVIDED WITH SHOP FABRICATED DOUBLE CORROSION PROTECTION. THREADED BARS, ANCHORAGE'S, CENTRALIZERS, ACCESSORIES, CORROSION PROTECTION SYSTEM, ETC. SHALL BE PROVIDED BY SAS STRESSTEEL OR APPROVED EQUAL.
3. THREADED BARS SHALL BE ENCAPSULATED WITH HIGH STRENGTH PVC CORRUGATED SHEATHING (COMPRESSIVE STRENGTH = 7,000 PSI) AND SHALL BE PRE–GROUTED BY THE MANUFACTURER.
4. PLATES SHALL CONFORM TO ASTM A–36, UNLESS GRADE 50 IS CALLED FOR IN THE DETAILS.
5. ANCHOR NUTS AND COUPLERS SHALL BE CAPABLE OF DEVELOPING 100% OF THE ULTIMATE STRENGTH OF THE THREADED BAR.
6. CARE MUST BE TAKEN NOT TO DAMAGE THE TENDONS. KEEP ALL COMPONENTS OF THE SYSTEM FREE OF DIRT OR OTHER DELETERIOUS SUBSTANCES.
7. DO NOT WELD IN THE VICINITY OF THE THREADED BARS.
8. DO NOT USE ANCHORS AS A GROUND FOR WELDING.
9. THE FIRST THREE ANCHORS INSTALLED, AND TEN PER CENT OF REMAINING ANCHORS, SHALL BE PERFORMANCE TESTED. ALL OTHER ANCHORS SHALL BE PROOF TESTED. ALL TESTS SHALL BE PERFORMED USING A CALIBRATED CENTER HOLE JACK.
10. PERFORMANCE TESTS SHALL BE MADE BY CYCLICALLY AND INCREMENTALLY LOADING AND UNLOADING THE ANCHOR IN ACCORDANCE WITH THE FOLLOWING SCHEDULE, WHERE AL= ALIGNMENT LOAD AND P= DESIGN LOAD:

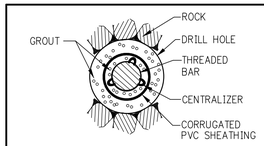
    10.1 AL, 25P
    10.2 AL, .25P, .50P
    10.3 AL, .25P, .50P, .75P
    10.4 AL, .25P, .50P, .75P, 1.00P
    10.5 AL, .25P, .50P, .75P, 1.00P, 1.20P
    10.6 AL, .25P, .50P, .75P, 1.00P, 1.20P, 1.33P (TEST LOAD)

    HOLD 1.33P FOR CREEP TEST. RECORD MOVEMENTS AT EACH INCREMENT USING A DIAL INDICATOR CAPABLE OF READING INCREMENTS OF .001 INCH, ALL IN CONFORMANCE WITH PTI RECOMMENDATIONS.

    REDUCE LOAD TO "TRANSFER LOAD" (1.00 P) AND LOCK OFF ANCHOR NUT AT "TRANSFER LOAD"
11. PROOF TESTS SHALL BE MADE BY INCREMENTALLY LOADING THE ANCHOR:
    AL, .25P, .50P, .75P, 1.00P, 1.20P, 1.33P (TEST LOAD, TEN MINUTE HOLD)

    RECORD MOVEMENTS AT EACH INCREMENT IN CONFORMANCE WITH PTI RECOMMENDATIONS.

    REDUCE LOAD TO "TRANSFER LOAD" (1.00 P) AND LOCK OFF ANCHOR NUT AT "TRANSFER LOAD"
12. CONTRACTOR SHALL SUBMIT ANCHOR SHOP DRAWING(S) FOR APPROVAL PRIOR TO COMMENCING ANCHOR INSTALLATION. SHOP DRAWING(S) SHALL CONTAIN ANCHOR DETAILS, AND INSTALLATION AND TESTING PROCEDURES.

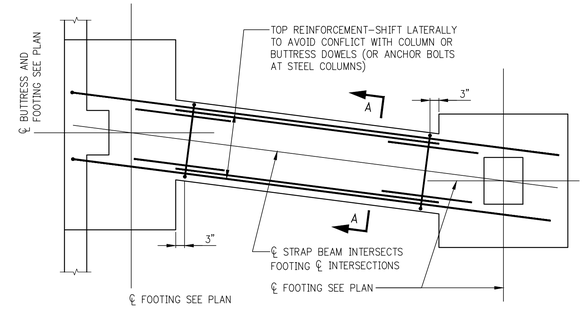


SECTION A–A

RECOMMENDED GROUT MIX
1 BAG – PORTLAND CEMENT TYPE III
5 GALLONS – POTABLE WATER
1/2 LB. SIKA ENTRAPLAST "N"

TABLE OF REINFORCEMENT ADDED BELOW ANCHOR PLATES	
ROCK ANCHOR BAR DIA.	ADD'L REINF. PROVIDED
UP TO 1⅞"	2–#7 E.W.
2¼"	2–#9 E.W.
2½"	2–#10 E.W.
3"	2–#11 E.W.

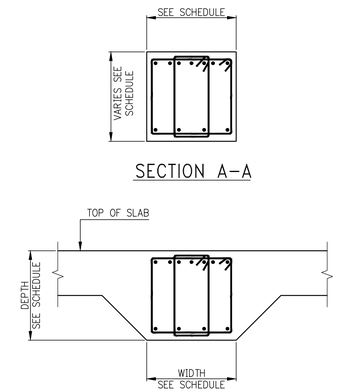
ROCK ANCHOR DETAILS INCLUDED FOR REFERENCE ONLY AS SUCH ANCHORS MAY BE REQUIRED FOLLOWING EXCAVATION AND EVALUATION OF EXISTING CONDITIONS



PLAN

STRAP BEAM FOR FOOTINGS ON SOIL OR ROCK

NOTE:
STRAP BEAM MUST FRAME DIRECTLY TO FOOTINGS.
STRAP BEAMS MAY NOT FRAME TO PIERS OR BUTTRESSES.

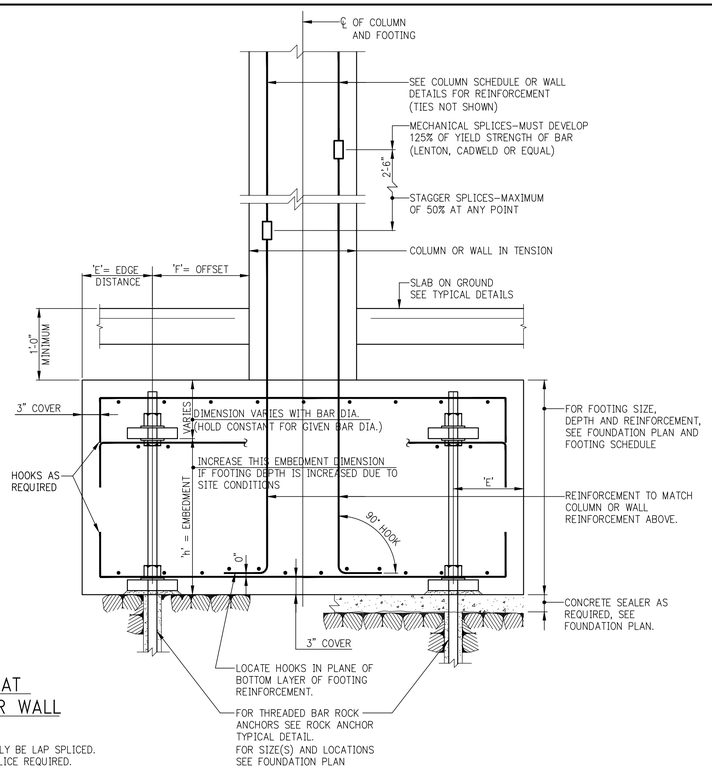


SECTION A–A

NOTE:
FOR SLAB DETAILS AND WATERPROOFING REQUIREMENTS SEE FOUNDATION PLANS AND DETAILS

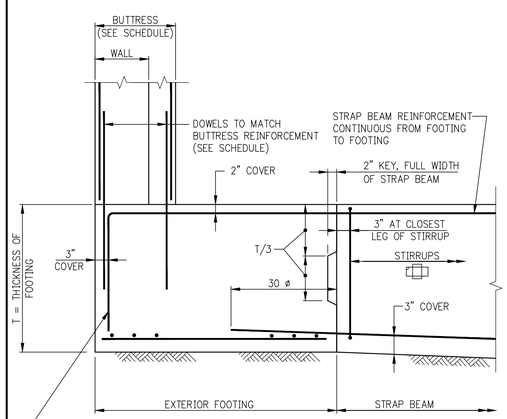
ALTERNATIVE SECTION A–A

(AT STRAP BEAM MONOLITHIC WITH SLAB)



ROCK ANCHORAGE AT CONCRETE COLUMN OR WALL

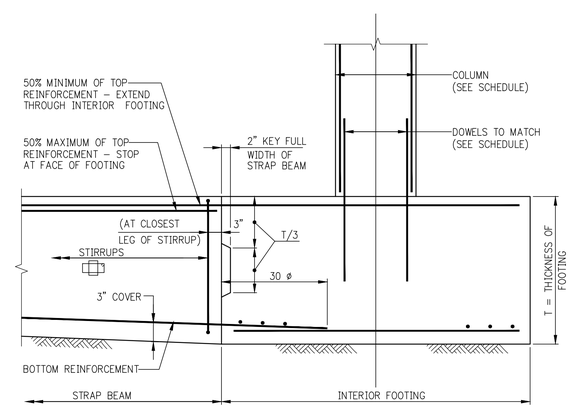
NOTE:
SHEARWALL REINFORCEMENT WILL GENERALLY BE LAP SPLICED.
SEE SHEARWALL DETAILS FOR TYPE OF SPLICE REQUIRED.



BEND TOP REINFORCEMENT 90°, EXTEND TO FOOTING REINFORCEMENT.

ELEVATION – EXTERIOR FOOTING

NOTE:
SEE FOUNDATION DRAWINGS FOR STRAP BEAM SIZE, REINFORCEMENT, AND STIRRUPS.



ELEVATION – INTERIOR FOOTING

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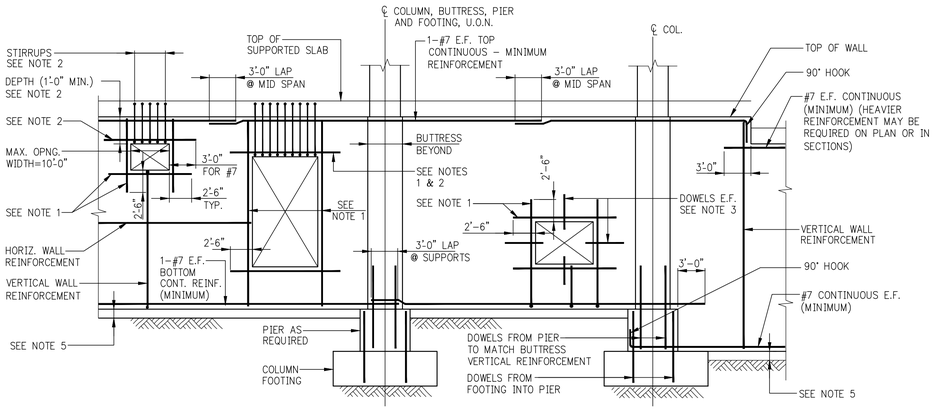
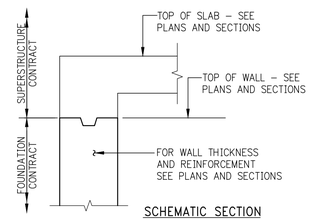


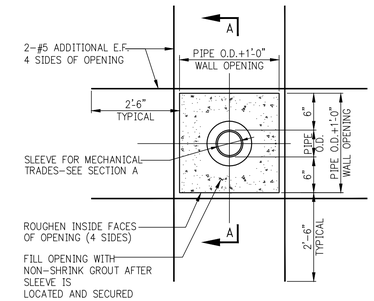
FOUNDATION WALL ELEVATION SHOWING REINFORCEMENT AT OPENINGS AND MISCELLANEOUS DETAILS



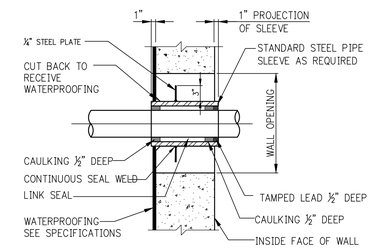
SCHEMATIC SECTION AT TOP OF WALL

NOTES:

1. ADD #5 BARS (HORIZ. & VERT.) AT ALL FOUR EDGES OF OPENINGS. AREA OF ADDED BARS AT EACH EDGE TO BE EQUAL TO ONE HALF OF AREA OF INTERRUPTED BARS IN THE CORRESPONDING DIRECTION. PROVIDE A MINIMUM OF 1-#5 E.F.
2. WHERE TOP EDGE OF OPENING IS LESS THEN 2'-6" FROM TOP OF WALL ADD 1-#7 E.F. (IN LIEU OF #5) OVER OPENING. PROVIDE #4 [] STIRRUPS @ 8" - EXTEND INTO SLAB WITH 2" COVER AT TOP OF STIRRUPS.
3. AT UTILITY ACCESS OPENINGS WHICH ARE TO BE FILLED IN WITH CONCRETE, PROVIDE DOWELS PROJECTING 1'-0" INTO OPENING. EITHER EXTEND HORIZONTAL AND VERTICAL WALL REINFORCEMENT, OR ADD # 4@12± E.F. DOWELS x2'-6" LONG.
4. FOR ACTUAL OPENING SIZES AND LOCATIONS, SEE PLANS, SECTIONS, ARCHITECTURAL DWGS., AND MEP DWGS. SUBMIT SHOP DRAWINGS WITH WALL ELEVATIONS SHOWING ALL OPENINGS AND REINFORCEMENT.
5. PROVIDE FOOTING OR CONCRETE MUD SLAB TO SUPPORT WALL FORMS AND WET CONCRETE. SEE FOUNDATION SECTIONS ON FS-300 SERIES DRAWINGS FOR ADDITIONAL DETAILS.

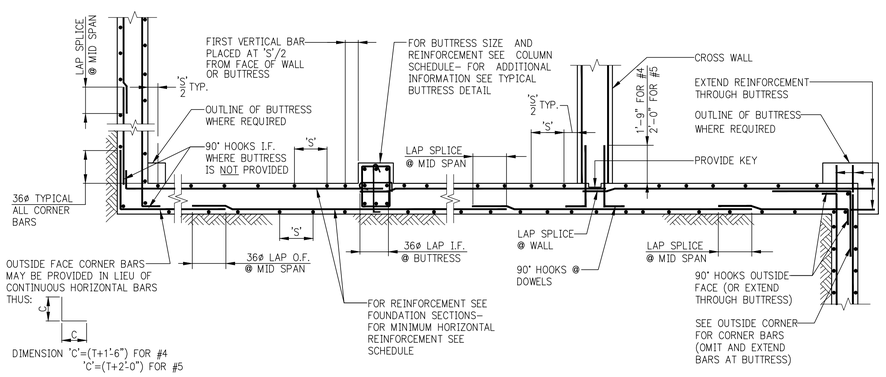


BOX-OUT OPENING THROUGH FOUNDATION WALL



SECTION A-A

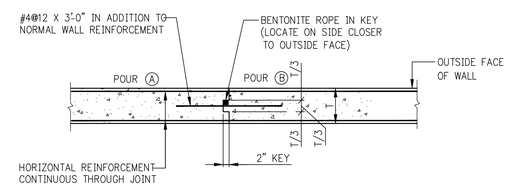
WATERPROOFED SLEEVE THROUGH WALL WITH WATERPROOFING



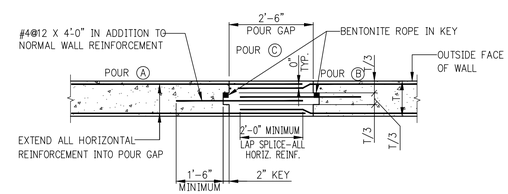
HORIZONTAL SECTION SHOWING PLACEMENT OF FOUNDATION WALL REINFORCEMENT

NOTE:
VERTICAL CONSTRUCTION JOINT IN WALL IS NOT SHOWN HERE - SEE TYPICAL CONSTRUCTION JOINT DETAIL.

MINIMUM HORIZONTAL WALL REINFORCEMENT REQUIRED AT EACH FACE	
T = WALL THICKNESS	HORIZONTAL REINFORCEMENT
UP TO 10"	#4@18 E.F.
11" TO 12"	#4@16 E.F.
13" TO 16"	#4@12 E.F.
17" TO 20"	#4@10 OR #5@15 E.F.
21" TO 22"	#4@9 OR #5@12 E.F.
23" TO 24"	#4@8 OR #5@12 E.F.
OVER 24"	SEE PLANS AND SECTIONS



PLAN VIEW OF JOINT



ALTERNATIVE-POUR GAP

VERTICAL CONSTRUCTION JOINT IN FOUNDATION WALL

NOTES:

1. CONSTRUCTION JOINTS IN WALLS SHALL BE LOCATED AT LEAST FOUR FEET FROM FACE OF SUPPORTING PIER, FOOTING, PILE CAP, ETC, OR FROM WALL OPENING.
2. MAXIMUM SPACING BETWEEN JOINTS SHALL BE FORTY FEET UNLESS NOTED OTHERWISE ON THE FOUNDATION DRAWINGS.
3. CONCRETE SHALL NOT BE PLACED IN THE POUR GAP UNTIL 24 HOURS AFTER PLACEMENT OF THE MOST RECENT ADJACENT SECTION.
4. FOR JOINTS IN SHEARWALLS SEE DETAILS IN FS-400 OR S-400 SERIES.

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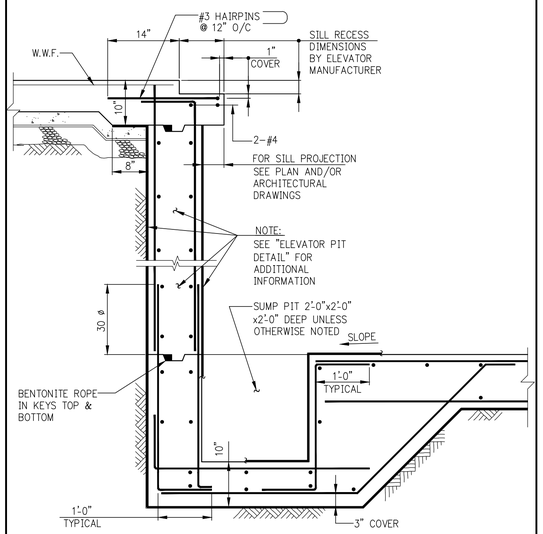
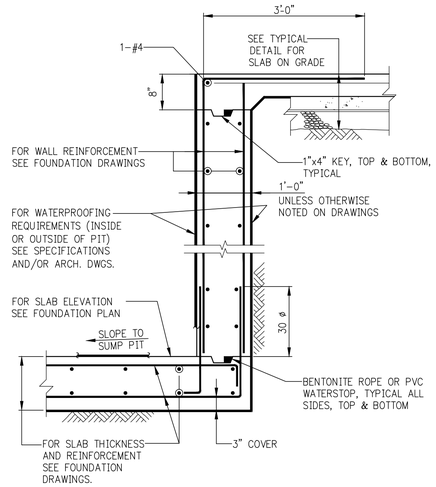
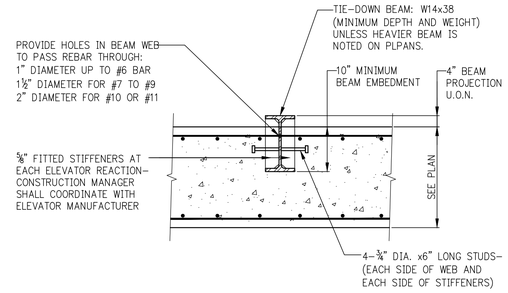


ELEVATOR PIT SILL AND SUMP PIT

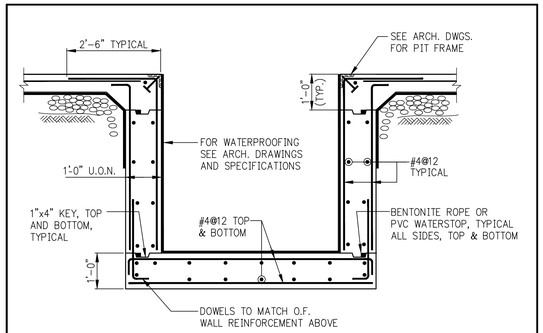


ELEVATOR PIT

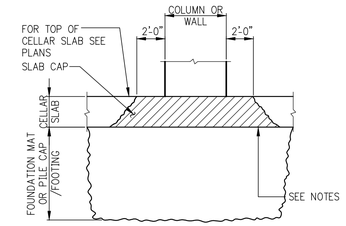
NOTE:
PROVIDE ELEVATOR TIE-DOWN BEAM AS REQUIRED. SEE PLAN AND "ELEVATOR TIE-DOWN BEAM" DETAIL.



ELEVATOR TIE-DOWN BEAM



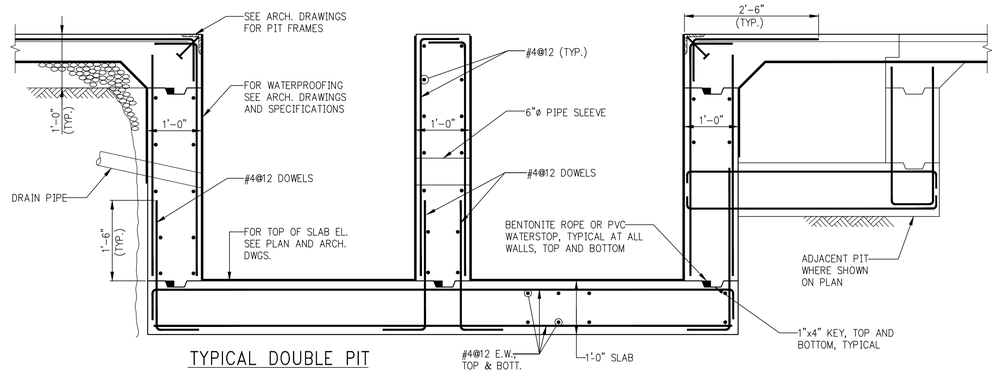
TYPICAL PIT



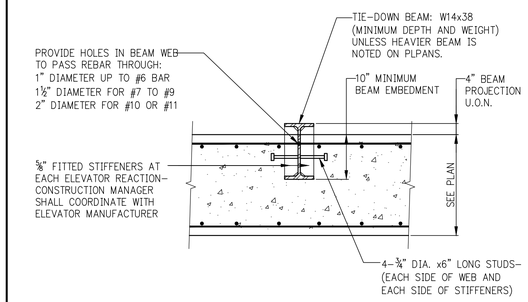
BEAM AND SLAB CONCRETE PLACEMENT AT HIGH STRENGTH CONCRETE COLUMN OR WALL

NOTES:

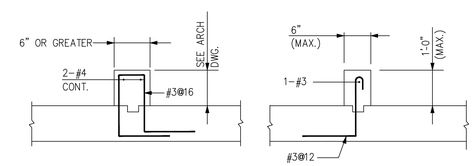
1. IN CONFORMANCE WITH 10.13 OF ACI 318-89. USE THIS DETAIL WHEN THE SPECIFIED CONCRETE STRENGTH IN COLUMN/WALL IS GREATER THAN 1.4 TIMES THAT SPECIFIED FOR THE FLOOR SYSTEM.
2. CAP SHALL BE NORMAL-WEIGHT STONE CONCRETE, EQUAL IN STRENGTH TO THAT SPECIFIED FOR THE COLUMN/WALL. CAP SHALL EXTEND BEYOND COLUMN/WALL IN ALL DIRECTIONS AS SHOWN ABOVE.
3. THE BALANCE OF CONCRETE IN SLAB AND BEAMS SHALL BE PLACED WHILE CAP CONCRETE IS STILL IN A WORKABLE PLASTIC CONDITION, BEFORE INITIAL SET. RETEMPERING OF CONCRETE WILL NOT BE PERMITTED.
4. IN LIEU OF PLACING TWO DIFFERENT STRENGTHS OF CONCRETE WITHIN THE SAME FLOOR SYSTEM, THE CONTRACTOR MAY ELECT (AT NO ADDITIONAL COST TO THE OWNER) TO PLACE ONE STRENGTH THROUGHOUT THE ENTIRE FLOOR. THE MINIMUM FLOOR CONCRETE STRENGTH REQUIRED BY ACI CODE WOULD BE 0.72 TIMES THE SPECIFIED STRENGTH OF CONCRETE IN THE COLUMNS/WALLS, UP TO 10,000 PSI COLUMN/WALL CONCRETE.
5. WHEN COLUMN/WALL CONCRETE STRENGTH EXCEEDS 10,000 PSI, THE CAP DETAILS SHOWN ABOVE MUST BE FOLLOWED, USING CAPS OF SAME CONCRETE STRENGTH AS IN COLUMNS/WALLS, AND THE STRENGTH SPECIFIED ON THE DRAWINGS FOR THE BALANCE OF THE FLOOR SYSTEM.



TYPICAL DOUBLE PIT

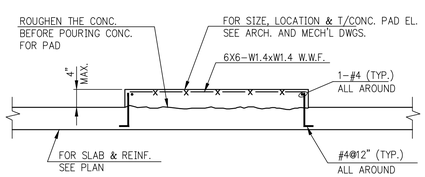


ELEVATOR TIE-DOWN BEAM



TYPICAL CONCRETE CURB DETAILS

NOTE:
FOR LOCATION SEE ARCH./MECH'L DWGS.



TYP. CONC. PAD DETAIL

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FAIRFIELD INN & SUITES SM Marriott

SPRINGHILL SUITES ® Marriott

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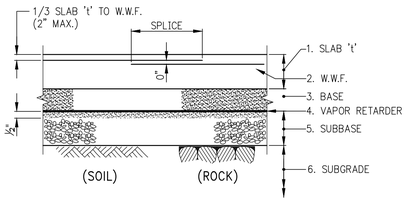


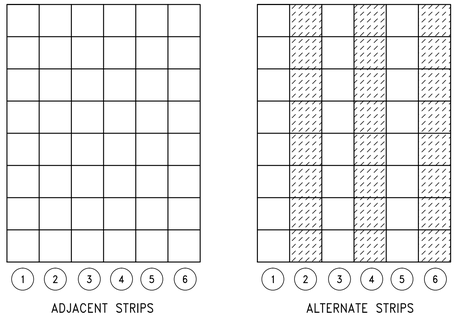
TYPICAL DETAIL – SLAB ON GROUND

NOTES:

1. SLAB THICKNESS 't'=5" UNLESS OTHERWISE NOTED ON PLANS.
2. W.W.F REINFORCEMENT: SEE TABLE
3. BASE = 3" LAYER OF PROCESSED AGGREGATE, SIZE NO. 10 PER ASTM D448. (SAND OF UNIFORM PARTICLE SIZE OR CONCRETE FINE AGGREGATE IS NOT ACCEPTABLE).
4. VAPOR RETARDER (VAPOR "BARRIER"): 10 MILS THICK POLYETHYLENE.
5. SLAB BASE: 4" LAYER OVER SOIL, 5" MIN. OVER ROCK SUBGRADE, COMPACTABLE GRANULAR FILL. COVER ROUGH FILL WITH ½" OF BASE AGGREGATE AND COMPACT IT ONTO SUBBASE.
6. SUBGRADE: COMPACTED FILL, BACKFILL OR UNDISTURBED SOIL, OR LEVELED ROCK SURFACE.

SUBGRADE DESIGN TO BE CONFIRMED WITH FINAL GEOTECHNICAL REPORT WHICH SHOULD PREVAIL

SLAB 't'	SLAB REINFORCEMENT (UNLESS OTHERWISE NOTED) W.W.F
5"	6 x 6 – W2.1 x W2.1
6"–7"	6 x 6 – W2.9 x W2.9
8"–9"	6 x 6 – W4.0 x W4.0
10" OR MORE	REBAR PER DRAWINGS



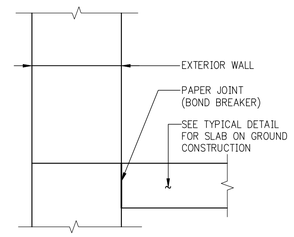
SUGGESTED SEQUENCE OF CASTING STRIPS

SLAB ON GROUND NOTES:

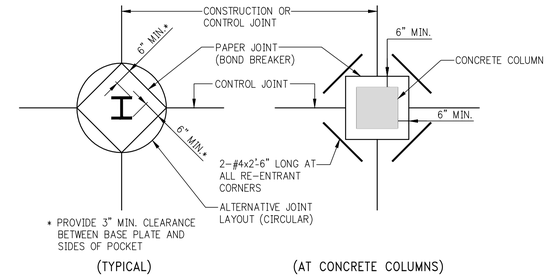
1. SLAB ON GROUND SHALL BE PLACED IN STRIPS, AS SHOWN IN "SUGGESTED SEQUENCE OF CASTING STRIPS".
2. CONTROL JOINTS SHALL BE SAWCUT AS SOON AS CONCRETE IS HARD ENOUGH NOT TO BE TORN OR DAMAGED BY THE BLADE, AND BEFORE THE CONCRETE STARTS TO COOL. TYPICALLY JOINTS SHOULD BE CUT 4 TO 12 HOURS AFTER THE SLAB HAS BEEN FINISHED, DEPENDING UPON WEATHER AND JOB CONDITIONS.
3. SPACING OF SAWCUT CONTROL JOINTS (IN FEET) TO BE APPROXIMATELY THREE TIMES THE SLAB THICKNESS IN INCHES, WITH A MAXIMUM OF TWENTY (20) FEET.
4. A MAXIMUM RATIO OF 1.5 SHALL BE MAINTAINED BETWEEN LONG AND SHORT DIMENSIONS OF PANELS FORMED BY CONSTRUCTION AND CONTROL JOINTS.

LEGEND:

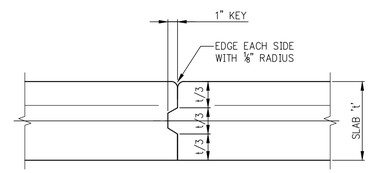
- STRIPS CAST FIRST
- INFILL STRIPS
- FORMED JOINTS
- SAWCUT JOINTS



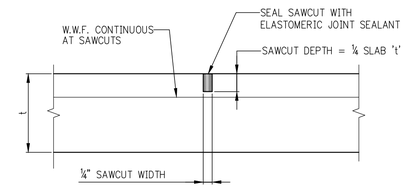
ISOLATION JOINT AT PERIMETER WALL



CONTROL JOINT LAYOUT AT COLUMNS

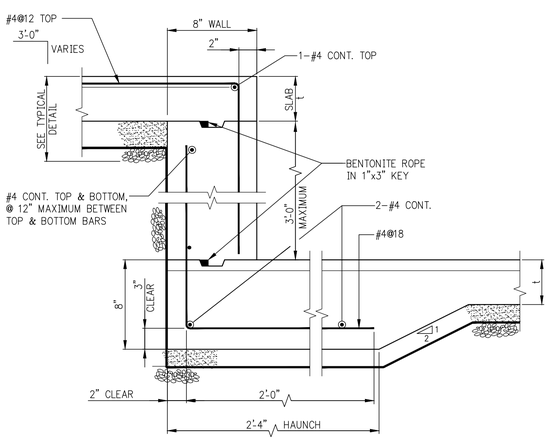


CONSTRUCTION JOINT

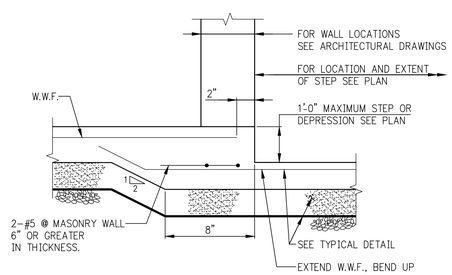


SAWCUT CONTROL JOINT

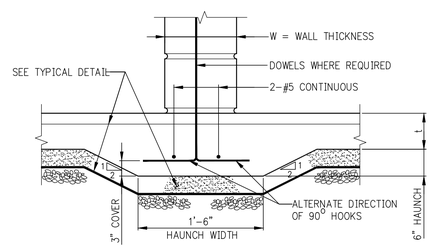
SLAB ON GROUND JOINT DETAILS



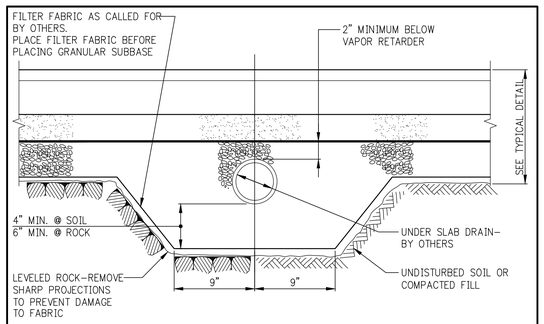
SLAB ON GROUND STEP OR DEPRESSION
GREATER THAN 1'-0"



SLAB ON GROUND STEP OR DEPRESSION
1'-0" OR LESS



THICKENED SLAB AT MASONRY
WALLS 6" THICK OR GREATER



UNDER SLAB DRAIN

NOTE:
THIS DETAIL IS INTENDED SOLELY TO SHOW TRENCHING IN SUBGRADE WHERE DRAINS ARE CALLED FOR BY OTHERS.

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TABLE #1:

TENSION LAP SPLICE LENGTHS (CLASS B MINIMUM)

TABLE 1.A: ¾" COVER TO OUTER LAYER BARS
OUTER LAYER LAP LENGTHS (IN INCHES)

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	16	16	16	16	16	16	16	16
#4	21	20	20	20	20	20	20	20
#5	31	27	24	24	24	24	24	24
#6	43	37	33	30	29	29	29	29
#7	69	60	53	49	45	42	40	38
#8	85	74	66	60	56	52	49	47
#9	103	89	80	73	67	63	59	56
#10	121	105	94	86	79	74	70	66
#11	140	122	109	99	92	86	81	77

TABLE 1.B: ¾" COVER TO OUTER LAYER BARS
INNER LAYER LAP LENGTHS (IN INCHES)

NOTE: USE TABLE 1.A IF BAR SPACING IS LESS THAN 4" O/C UP TO #8, 5" O/C FOR #9, #10, #11

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	16	16	16	16	16	16	16	16
#4	20	20	20	20	20	20	20	20
#5	24	24	24	24	24	24	24	24
#6	30	29	29	29	29	29	29	29
#7	48	42	38	34	34	34	34	34
#8	61	53	47	43	40	39	39	39
#9	75	65	58	53	49	46	44	44
#10	89	77	69	63	58	55	51	49
#11	104	90	81	74	68	64	60	57

TABLE 1.C: 1½" COVER TO OUTER LAYER BARS
OUTER LAYER LAP LENGTHS (IN INCHES)

NOTE: USE TABLE 1.A IF BAR SPACING IS LESS THAN 4" O/C UP TO #8, 5" O/C FOR #9, #10, #11

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	16	16	16	16	16	16	16	16
#4	20	20	20	20	20	20	20	20
#5	24	24	24	24	24	24	24	24
#6	29	29	29	29	29	29	29	29
#7	42	37	34	34	34	34	34	34
#8	53	46	41	39	39	39	39	39
#9	66	57	51	46	44	44	44	44
#10	79	68	61	56	51	49	49	49
#11	92	80	72	65	60	57	54	54

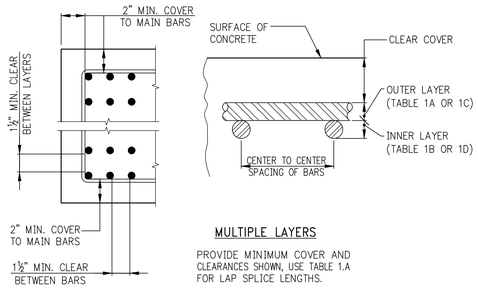
TABLE 1.D: 1½" COVER TO OUTER LAYER BARS
INNER LAYER LAP LENGTHS (IN INCHES)

NOTE: USE TABLE 1.A IF BAR SPACING IS LESS THAN 5" O/C UP TO #8, 6" O/C FOR #9, #10, #11

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	16	16	16	16	16	16	16	16
#4	20	20	20	20	20	20	20	20
#5	24	24	24	24	24	24	24	24
#6	29	29	29	29	29	29	29	29
#7	37	34	34	34	34	34	34	34
#8	43	39	39	39	39	39	39	39
#9	53	46	44	44	44	44	44	44
#10	64	55	49	49	49	49	49	49
#11	75	65	58	54	54	54	54	54

NOTES FOR TENSION LAP SPLICES

1. REINFORCEMENT IS UNCOATED, WITH Fy=60,000 PSI.
2. CONCRETE IS NORMAL WEIGHT (144–150#/C.F.).
3. FOR "TOP"' BAR SPLICE LENGTHS ("TOP" IS DEFINED BY ACI 318 AS HAVING MORE THAN 12 INCHES OF FRESH CONCRETE CAST BELOW THE BAR), TABULATED LENGTHS MUST BE MULTIPLIED BY 1.3.
4. LENGTHS TABULATED MUST BE MULTIPLIED BY THE FOLLOWING MODIFICATION FACTORS:
   a. LIGHTWEIGHT CONCRETE 1.3
   b. EPOXY–COATED BARS:
      1.) BARS WITH COVER < 3db, OR WITH CLEAR SPACING < 6db ...1.5 FOR BOTTOM & VERTICAL BARS, 1.3 FOR 'TOP' BARS *
      2.) ALL OTHER CONDITIONS 1.2
   * FOR EPOXY–COATED 'TOP' BARS THE MAXIMUM FOR COMBINED FACTORS = 1.7
5. WHERE TENSION DEVELOPMENT LENGTH (Ld) IS REQUIRED ON PLANS OR IN DETAILS, SEE TENSION DEVELOPMENT LENGTH TABLES.
6. CLASS A LAP SPLICE LENGTHS ARE EQUAL TO TENSION DEVELOPMENT LENGTHS. SEE TABLES FOR TENSION DEVELOPMENT LENGTHS (Ld). APPLY APPROPRIATE MODIFICATION FACTORS TO CLASS A SPLICE LENGTHS.



MULTIPLE LAYERS

PROVIDE MINIMUM COVER AND CLEARANCES SHOWN, USE TABLE 1.A FOR LAP SPLICE LENGTHS.

TABLE #2:

TENSION DEVELOPMENT LENGTHS (Ld) (IN INCHES)

TABLE 2.A: ¾" COVER TO OUTER LAYER BARS
OUTER LAYER DEVELOPMENT LENGTHS

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	12	12	12	12	12	12	12	12
#4	16	14	13	12	12	12	12	12
#5	24	21	19	17	16	15	14	13
#6	33	28	25	23	22	20	19	18
#7	53	46	41	37	35	32	31	29
#8	66	57	51	46	43	40	38	36
#9	79	69	61	56	52	49	46	43
#10	93	81	72	66	61	57	54	51
#11	108	94	84	76	71	66	62	59

TABLE 2.B: ¾" COVER TO OUTER LAYER BARS
INNER LAYER DEVELOPMENT LENGTHS

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	12	12	12	12	12	12	12	12
#4	13	12	12	12	12	12	12	12
#5	16	14	13	13	13	13	13	13
#6	23	20	18	16	15	15	15	15
#7	37	32	29	26	24	23	22	20
#8	47	41	36	33	31	29	27	26
#9	57	50	44	41	38	35	33	31
#10	68	59	53	48	45	42	40	38
#11	80	69	62	57	52	49	46	44

TABLE 2.C: 1½" COVER TO OUTER LAYER BARS
OUTER LAYER DEVELOPMENT LENGTHS)

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	12	12	12	12	12	12	12	12
#4	13	12	12	12	12	12	12	12
#5	16	14	13	13	13	13	13	13
#6	20	17	15	15	15	15	15	15
#7	32	28	25	23	21	20	19	18
#8	41	36	32	29	27	25	24	23
#9	50	44	39	36	33	31	29	28
#10	60	52	47	43	40	37	35	33
#11	71	61	55	50	46	43	41	39

TABLE 2.D: 1½" COVER TO OUTER LAYER BARS
INNER LAYER DEVELOPMENT LENGTHS

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	12	12	12	12	12	12	12	12
#4	13	12	12	12	12	12	12	12
#5	16	14	13	13	13	13	13	13
#6	20	17	15	15	15	15	15	15
#7	29	25	22	20	19	18	18	18
#8	33	28	25	23	22	20	20	20
#9	41	35	31	29	27	25	23	23
#10	49	42	38	35	32	30	28	27
#11	58	50	45	41	38	35	33	32

NOTES FOR TENSION DEVELOPMENT LENGTHS (Ld)

1. REINFORCEMENT IS UNCOATED, WITH Fy=60,000 PSI.
2. CONCRETE IS NORMAL WEIGHT (144–150#/C.F.).
3. FOR "TOP"' BAR DEVELOPMENT LENGTHS ("TOP" IS DEFINED BY ACI 318 AS HAVING MORE THAN 12 INCHES OF FRESH CONCRETE CAST BELOW THE BAR), TABULATED LENGTHS MUST BE MULTIPLIED BY 1.3.
4. LENGTHS TABULATED MUST BE MULTIPLIED BY THE FOLLOWING MODIFICATION FACTORS:
   a. LIGHTWEIGHT CONCRETE 1.3
   b. EPOXY–COATED BARS:
      1.) BARS WITH COVER < 3db, OR WITH CLEAR SPACING < 6db ...1.5 FOR BOTTOM & VERTICAL BARS, 1.3 FOR 'TOP' BARS *
      2.) ALL OTHER CONDITIONS 1.2
   * FOR EPOXY–COATED 'TOP' BARS THE MAXIMUM FOR COMBINED FACTORS = 1.7
5. WHERE TENSION DEVELOPMENT LENGTH (Ld) IS REQUIRED ON PLANS OR IN DETAILS, SEE TENSION DEVELOPMENT LENGTH TABLES.
6. CLASS A LAP SPLICE LENGTHS ARE EQUAL TO TENSION DEVELOPMENT LENGTHS. SEE TABLES FOR TENSION DEVELOPMENT LENGTHS (Ld). APPLY APPROPRIATE MODIFICATION FACTORS TO CLASS A SPLICE LENGTHS.

TABLE #3

TENSION DEVELOPMENT LENGTHS FOR STANDARD END HOOKS (ldh)

(LENGTHS IN INCHES)

BAR SIZE	CONCRETE STRENGTH (PSI)							
	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	9	7	7	6	6	6	6	6
#4	11	10	9	8	7	7	7	6
#5	14	12	11	10	9	9	8	8
#6	17	15	13	12	11	10	10	9
#7	19	17	15	14	13	12	11	11
#8	22	19	17	16	15	14	13	12
#9	25	22	19	18	16	15	15	14
#10	28	24	22	20	19	17	16	16
#11	31	27	24	22	21	19	18	17
#14	37	32	29	27	25	23	22	21
#18	50	43	39	35	33	31	29	27

NOTES:

1. TABLE 3 CONFORMS TO ACI 318–2002 (AND 2005). TABULATED VALUES ARE BASED UPON ACI 12.5.2 , ASSUMING GRADE 60 REINFORCEMENT AND NORMALWEIGHT CONCRETE.
2. PER ACI 12.5.3 a), FOR #11 AND SMALLER BARS, IF COVER TO BAR IS 2½ INCHES OR MORE, AND FOR 90 DEGREE HOOK WITH COVER ON BAR EXTENSION BEYOND HOOK NOT LESS THAN 2 INCHES, A MODIFICATION FACTOR OF 0.7 MAY BE APPLIED. MINIMUM ldh SHALL NOT BE LESS THAN 8db NOR 6 INCHES.

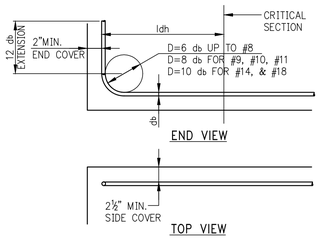


TABLE #5

DEVELOPMENT LENGTHS FOR BARS IN COMPRESSION

(LENGTHS IN INCHES)

BAR SIZE	fy = 60,000 PSI			fy = 75,000 PSI			fy = 80,000 PSI		
	CONC. f'c (IN PSI)			CONC. f'c (IN PSI)			CONC. f'c (IN PSI)		
	3,000	4,000	5,000 OR MORE	3,000	4,000	5,000 OR MORE	3,000	4,000	5,000 OR MORE
#3	12	12	12	12	12	12	12	12	12
#4	12	12	12	14	12	12	15	13	12
#5	14	12	12	17	15	14	18	16	15
#6	17	15	14	21	18	17	22	19	18
#7	19	17	16	24	21	20	26	22	21
#8	22	19	18	28	24	23	29	25	24
#9	25	22	21	31	27	25	33	28	27
#10	28	24	23	34	30	28	36	31	30
#11	31	27	26	38	33	31	40	34	33
#14	37	32	31	48	42	39	51	44	42
#18	50	43	41	62	54	51	65	56	54

TABLE #4

COMPRESSION LAP SPLICES

(LENGTHS IN INCHES)

BAR SIZE	GRADE OF REINFORCEMENT		
	60 KSI (30 DIA.)	75 KSI (44 DIA.)	80 KSI (48 DIA.)
#3	12	17	18
#4	15	22	24
#5	19	28	30
#6	23	33	36
#7	27	39	42
#8	30	44	48
#9	34	50	54
#10	38	56	61
#11	43	62	68
#14 AND #18	1. LAP SPLICES ARE NOT PERMITTED. USE MECHANICAL CONNECTIONS OR WELDED SPLICES FOR #14 AND #18, PER ACI 318 (12.14.3). 2. LAP SPLICES OF #14 AND #18 BARS TO #11 AND SMALLER BARS ARE PERMITTED PER ACI 318 (12.16.2).		
3. FOR BARS OF DIFFERENT SIZE, USE LARGER OF: SPLICE LENGTH OF SMALLER BAR (TABLE #4) OR DEVELOPMENT LENGTH OF LARGER BAR (FROM TABLE #5) PER ACI 318 (12.16.2).			

NOTE:

TABLE #4 APPLIES FOR NORMALWEIGHT CONCRETE WITH f'c = 3,000 PSI OR GREATER.

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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01	03–25–15	FOUNDATION BID SET
#	DATE	DESCRIPTION

ISSUED DRAWINGS:

GENE KAUFMAN ARCHITECT PC

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TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

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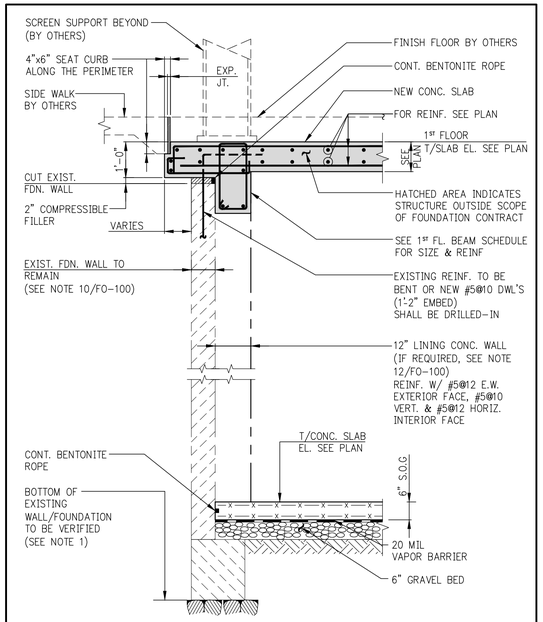
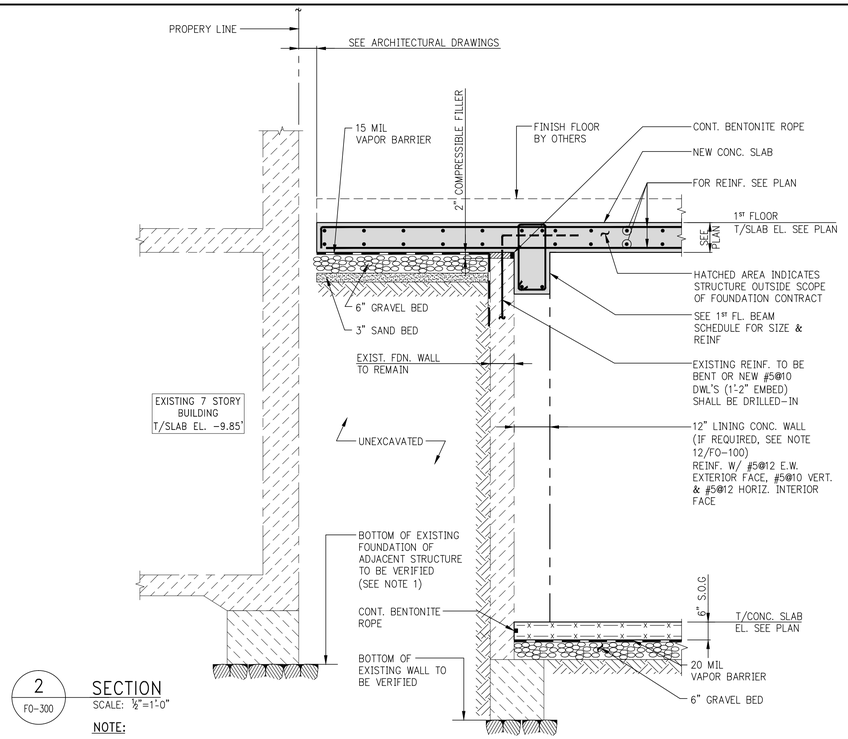


1 FO-300 **SECTION**
SCALE: ½"=1'-0"

NOTE:

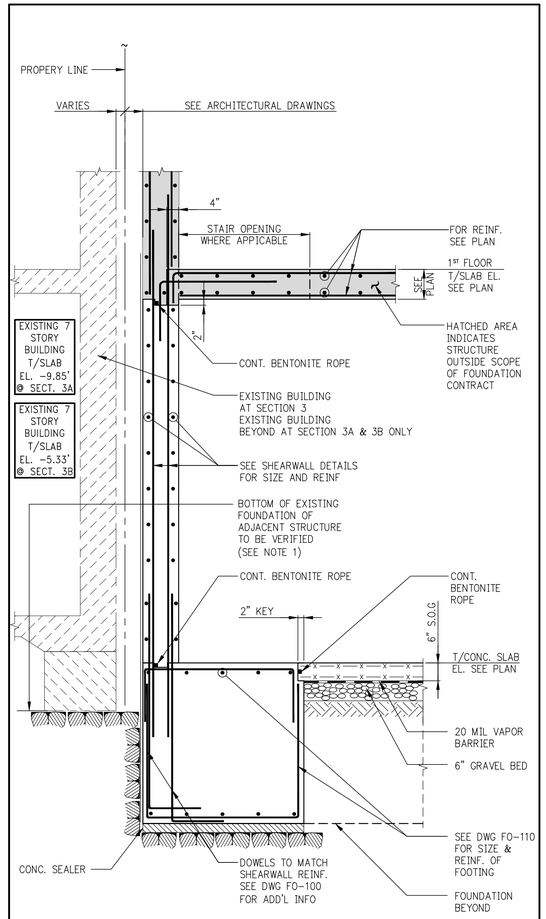
1. BOTTOM OF FOUNDATION OF ADJACTENT STRUCTURE TO BE VERIFIED VIA TEST PITS PRIOR TO EXCAVATION OF NEW STRUCTURE. FOUNDATION DESIGN TO BE MODIFIED AS REQUIRED.



2 FO-300 **SECTION**
SCALE: ½"=1'-0"

NOTE:

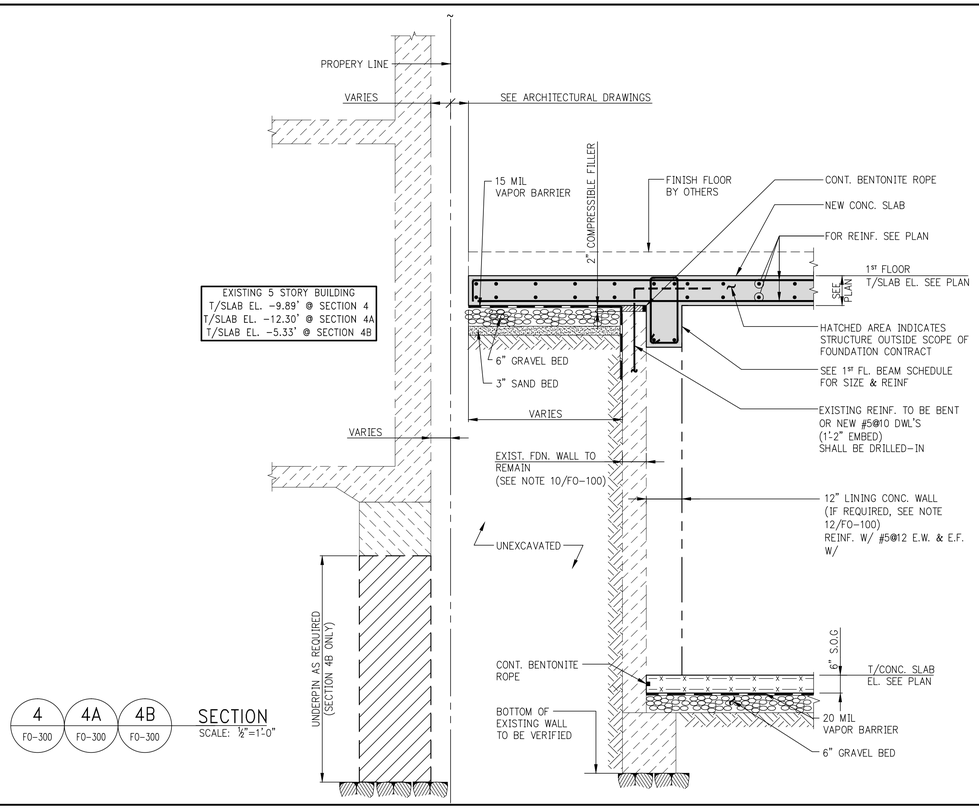
1. BOTTOM OF FOUNDATION OF ADJACTENT STRUCTURE TO BE VERIFIED VIA TEST PITS PRIOR TO EXCAVATION OF NEW STRUCTURE. FOUNDATION DESIGN TO BE MODIFIED AS REQUIRED.



3 FO-300 3A FO-300 3B FO-300 **SECTION**
SCALE: ½"=1'-0"

NOTE:

1. BOTTOM OF FOUNDATION OF ADJACTENT STRUCTURE TO BE VERIFIED VIA TEST PITS PRIOR TO EXCAVATION OF NEW STRUCTURE. IF ADJACENT STRUCTURE IS NOT BEARING ON ROCK FOUNDATION DESIGN WILL NEED TO BE MODIFIED AS REQUIRED.



4 FO-300 4A FO-300 4B FO-300 **SECTION**
SCALE: ½"=1'-0"

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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02	04-07-15	ISSUED TO DOB
01	03-25-15	FOUNDATION BID SET
#	DATE	DESCRIPTION

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338 WEST 36TH STREET
NEW YORK, NY

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DATE: MARCH 25, 2015
SCALE: AS NOTED
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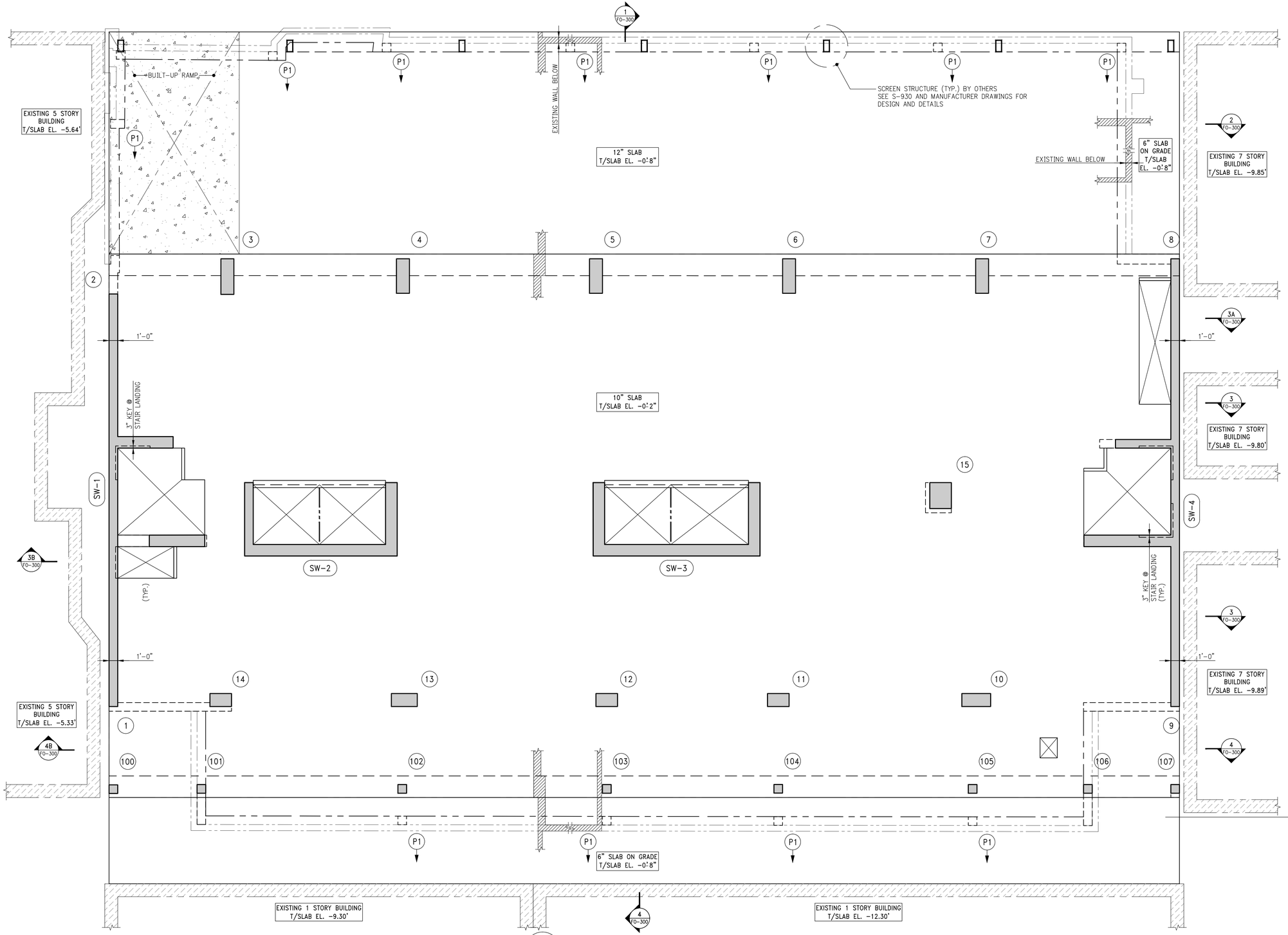

1 S-010 1ST FLOOR FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. T/SLAB ELEVATION TO BE 0'-0" U.O.N. THUS [ ] ON PLAN.
2. SLAB TO BE 10" THICK U.O.N. THUS [ ] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #4@10 CONT. E.W. FOR 10" SLAB U.O.N.
   #5@12 CONT. E.W. FOR 12" SLAB U.O.N.
4. FOR GENERAL NOTES, ABBREVIATIONS AND LEGEND SEE DRAWING FO-001.
5. FOR LINK BEAM SCHEDULE AND SHEARWALL DETAILS SEE S-940 SERIES DRAWINGS.
6. FOR COLUMN SIZES, REINFORCEMENT AND DETAILS SEE S-950 SERIES DRAWINGS.
7. FOR TYPICAL SUPERSTRUCTURE DETAILS SEE S-960 SERIES DRAWINGS.
8. FOR SUPERSTRUCTURE SECTIONS SEE S-970 SERIES DRAWINGS.
9. FOR STAIR DETAILS AND SECTIONS SEE S-980 SERIES DRAWINGS.

NORTH

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DATE: APRIL 07, 2015
SCALE: 3/16" = 1'-0"
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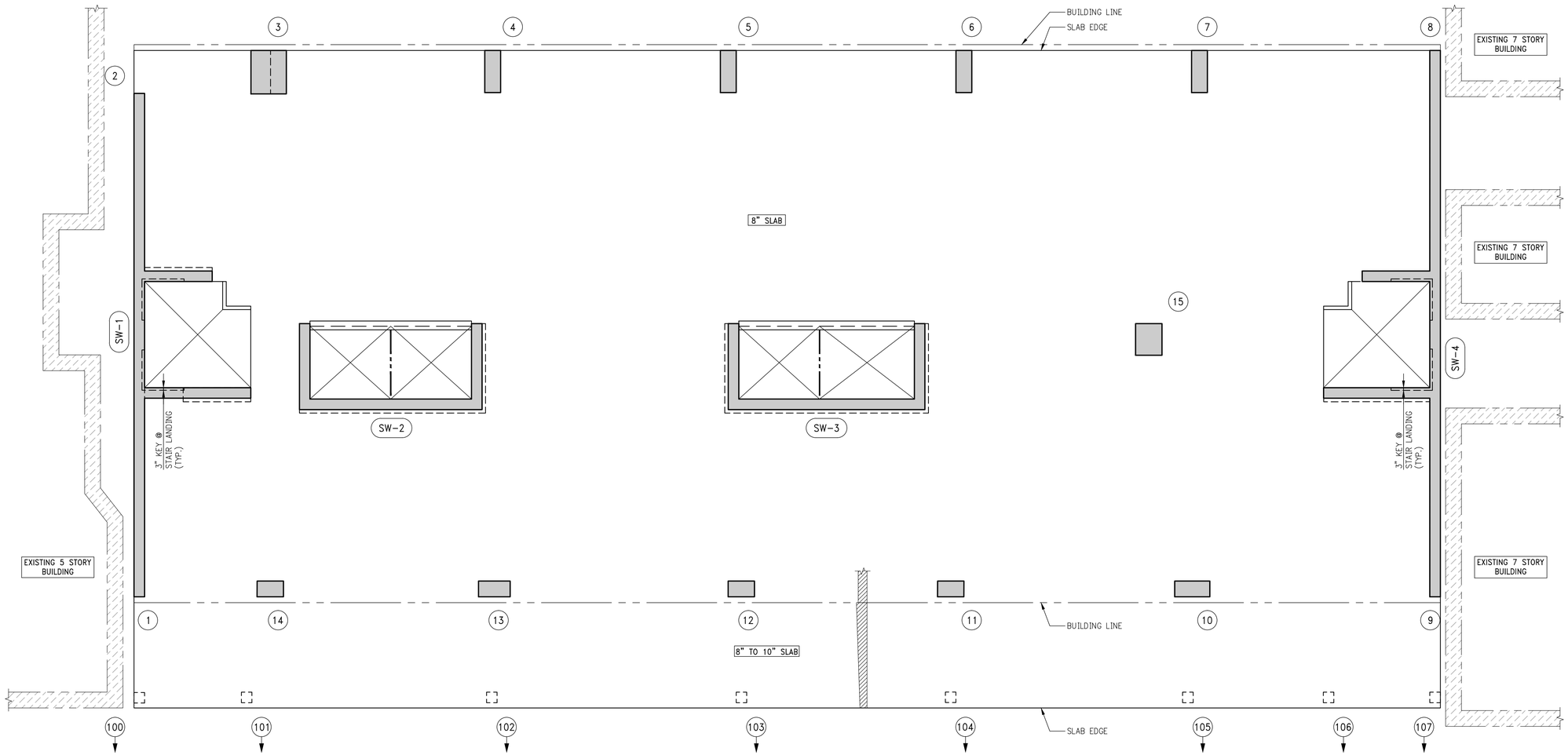

1 S-020

2ND FLOOR FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. TOP OF SLAB ELEVATION TO BE 14'-0" U.O.N. THUS [.....] ON PLAN.
2. SLAB TO BE 8" THICK U.O.N. THUS [.....] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #4@12 CONT. E.W. FOR 8" SLAB U.O.N.
4. FOR BALANCE OF NOTES SEE DRAWING S-010.

NORTH

REINFORCEMENT SIMILAR TO S-030

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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2ND FLOOR FRAMING PLAN

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DATE: APRIL 07, 2015

SCALE: 3/16" = 1'-0"

DRAWING NUMBER:

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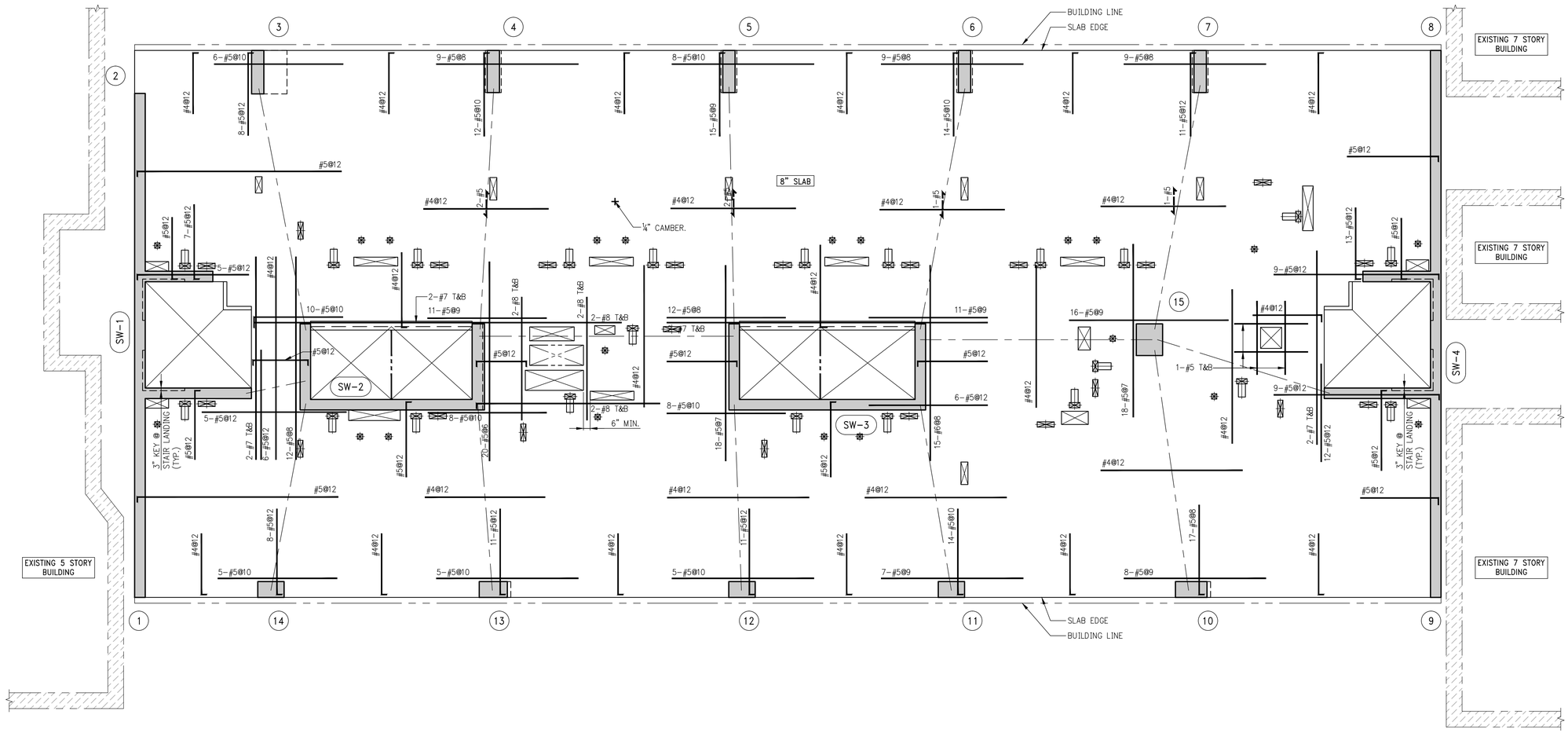
PAGE#: 13 OF XX



1 / S-030

3RD – 13TH FLOOR FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. TOP OF SLAB ELEVATION TO BE:
   22'-8" @ 3RD FL.
   31'-4" @ 4TH FL.
   40'-0" @ 5TH FL.
   48'-8" @ 6TH FL.
   57'-4" @ 7TH FL.
   66'-0" @ 8TH FL.
   74'-8" @ 9TH FL.
   83'-4" @ 10TH FL.
   92'-0" @ 11TH FL.
   100'-8" @ 12TH FL.
   109'-4" @ 13TH FL.
2. SLAB TO BE 8" THICK U.O.N. THUS [illegible] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #4@12 CONT. E.W. FOR 8" SLAB U.O.N.
4. FOR BALANCE OF NOTES SEE DRAWING S-010.

NORTH

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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ISSUED DRAWINGS:

GENE KAUFMAN ARCHITECT PC
525 BROADWAY, NEW YORK, N.Y. 10012
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338 WEST 36TH STREET
NEW YORK, NY

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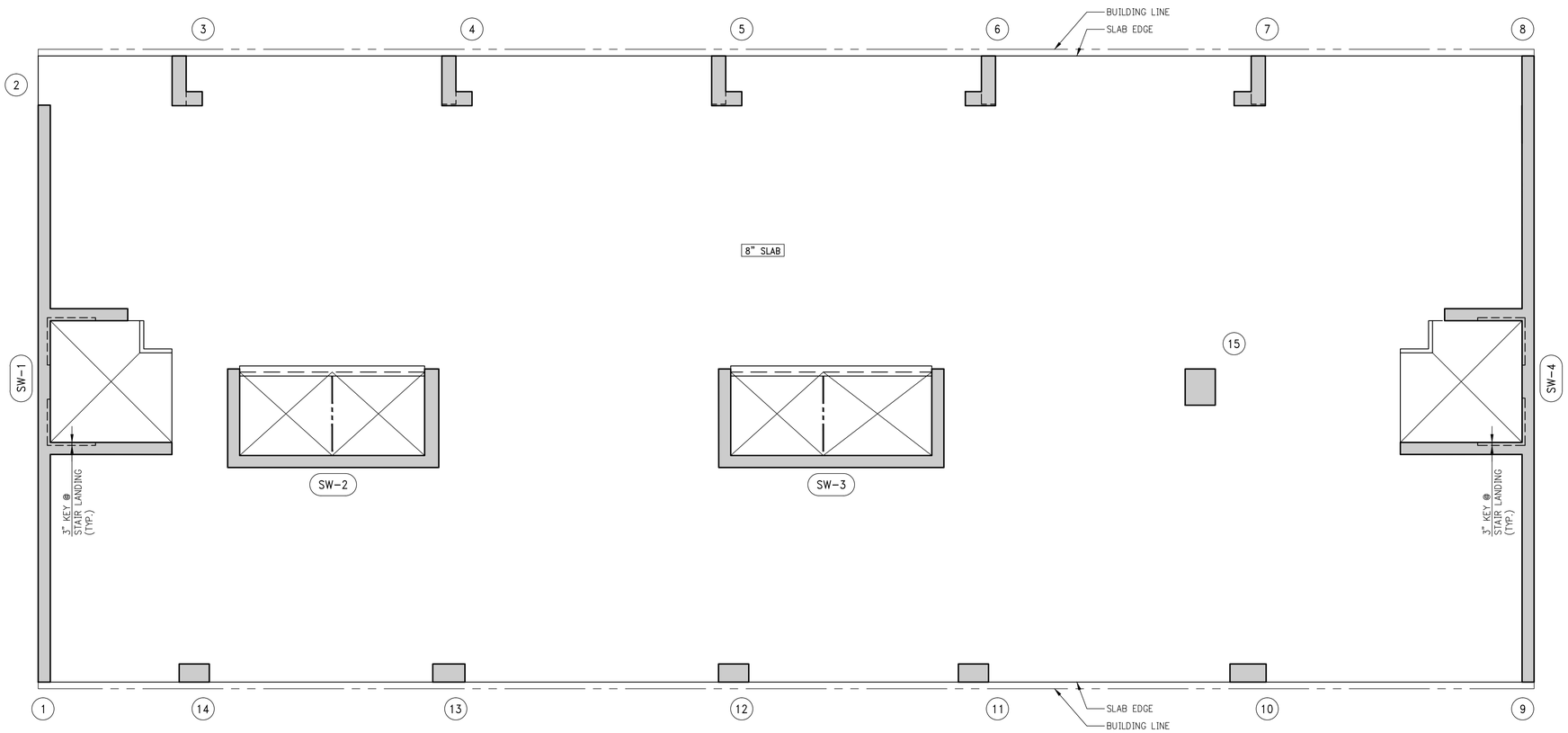
DATE: APRIL 07, 2015
SCALE: 3/16" = 1'-0"
DRAWING NUMBER:
S-030.00

PAGE#: 14 OF XX



1 / S-140

14TH FLOOR FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. TOP OF SLAB ELEVATION TO BE 118'-0" U.O.N. THUS [.....] ON PLAN
2. SLAB TO BE 8" THICK U.O.N. THUS [.....] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #4@12 CONT. E.W. FOR 8" SLAB U.O.N.
4. FOR BALANCE OF NOTES SEE DRAWING S-010.

REINFORCEMENT SIMILAR TO S-030

NORTH

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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FAIRFIELD INN & SUITES SM Marriott

SPRINGHILL SUITES ® Marriott

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SEAL & SIGNATURE:

STATE OF NEW YORK · SUSAN L. MARCUS · 057539 · LICENSED PROFESSIONAL ENGINEER

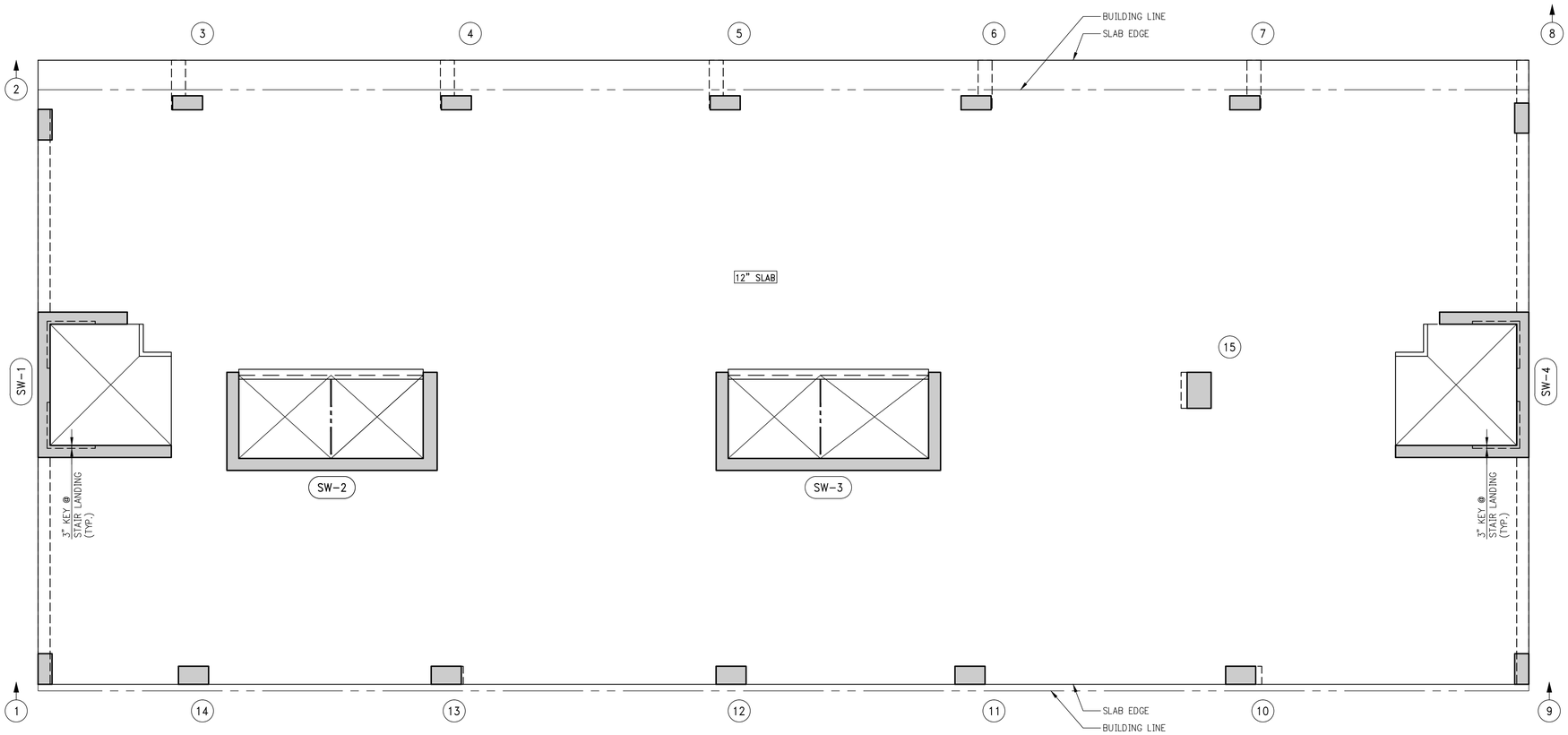
DATE: APRIL 07, 2015

SCALE: 3/16" = 1'-0"

DRAWING NUMBER:

S-140.00

PAGE#: 15 OF XX



1 / S-150

15TH FLOOR FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. TOP OF SLAB ELEVATION TO BE 127'-4" U.O.N. THUS [.....] ON PLAN
2. SLAB TO BE 12" THICK U.O.N. THUS [.....] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #5@12 CONT. E.W. FOR 12" SLAB U.O.N.
4. FOR BALANCE OF NOTES SEE DRAWING S-010.

REINFORCEMENT SIMILAR TO S-030

NORTH

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FAIRFIELD INN & SUITES SM Marriott

SPRINGHILL SUITES ® Marriott

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DATE: APRIL 07, 2015

SCALE: 3/16" = 1'-0"

DRAWING NUMBER:

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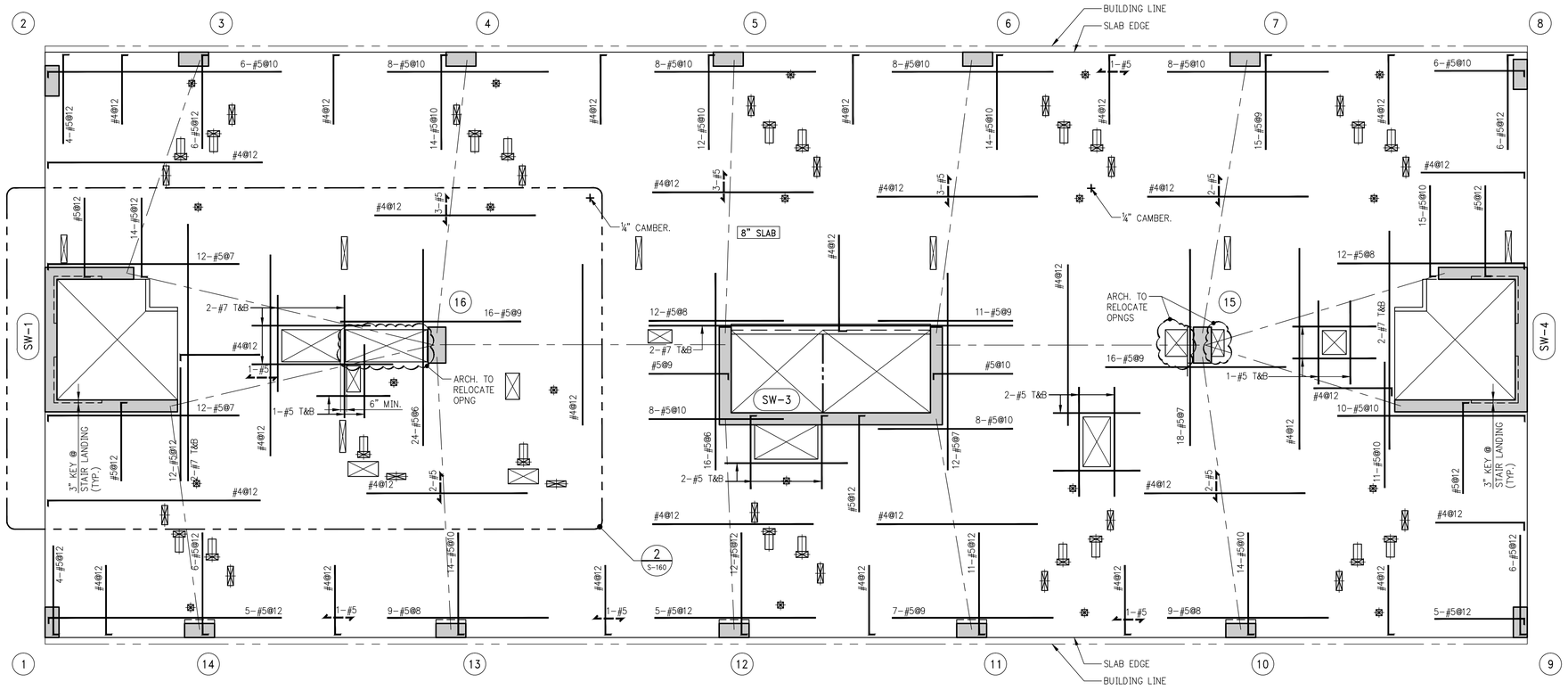
PAGE#: 16 OF XX

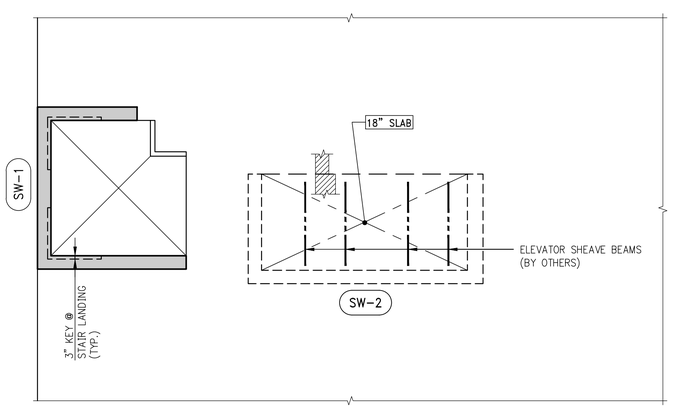


1 / S-160 — 16TH – 28TH FLOOR FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. TOP OF SLAB ELEVATION TO BE:
   - 136'-0" @ 16TH FL.
   - 144'-8" @ 17TH FL.
   - 153'-4" @ 18TH FL.
   - 162'-0" @ 19TH FL.
   - 170'-8" @ 20TH FL.
   - 179'-4" @ 21ST FL.
   - 188'-0" @ 22ND FL.
   - 196'-8" @ 23RD FL.
   - 205'-4" @ 24TH FL.
   - 214'-0" @ 25TH FL.
   - 222'-8" @ 26TH FL.
   - 231'-4" @ 27TH FL.
   - 240'-0" @ 28TH FL.
2. SLAB TO BE 8" THICK U.O.N. THUS [.....] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #4@12 CONT. E.W. FOR 8" SLAB U.O.N.
4. FOR BALANCE OF NOTES SEE DRAWING



1 / S-160 — 16TH FLOOR PART FRAMING PLAN

SCALE: 3/16"=1'-0"

NORTH

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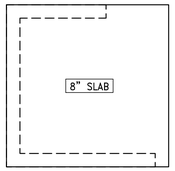
DATE: APRIL 07, 2015
SCALE: 3/16" = 1'-0"
DRAWING NUMBER:
S-160.00

PAGE#: 17 OF XX

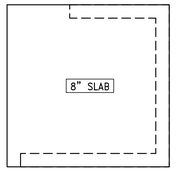


2 / S-290 STAIR ROOF FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. TOP OF SLAB ELEVATION TO BE 258'-8" U.O.N. THUS [.....] ON PLAN.
2. SLAB TO BE 8" THICK U.O.N. THUS [.....] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #4@12 CONT. E.W. FOR 8" SLAB U.O.N.
4. FOR BALANCE OF NOTES SEE DRAWING S-010.

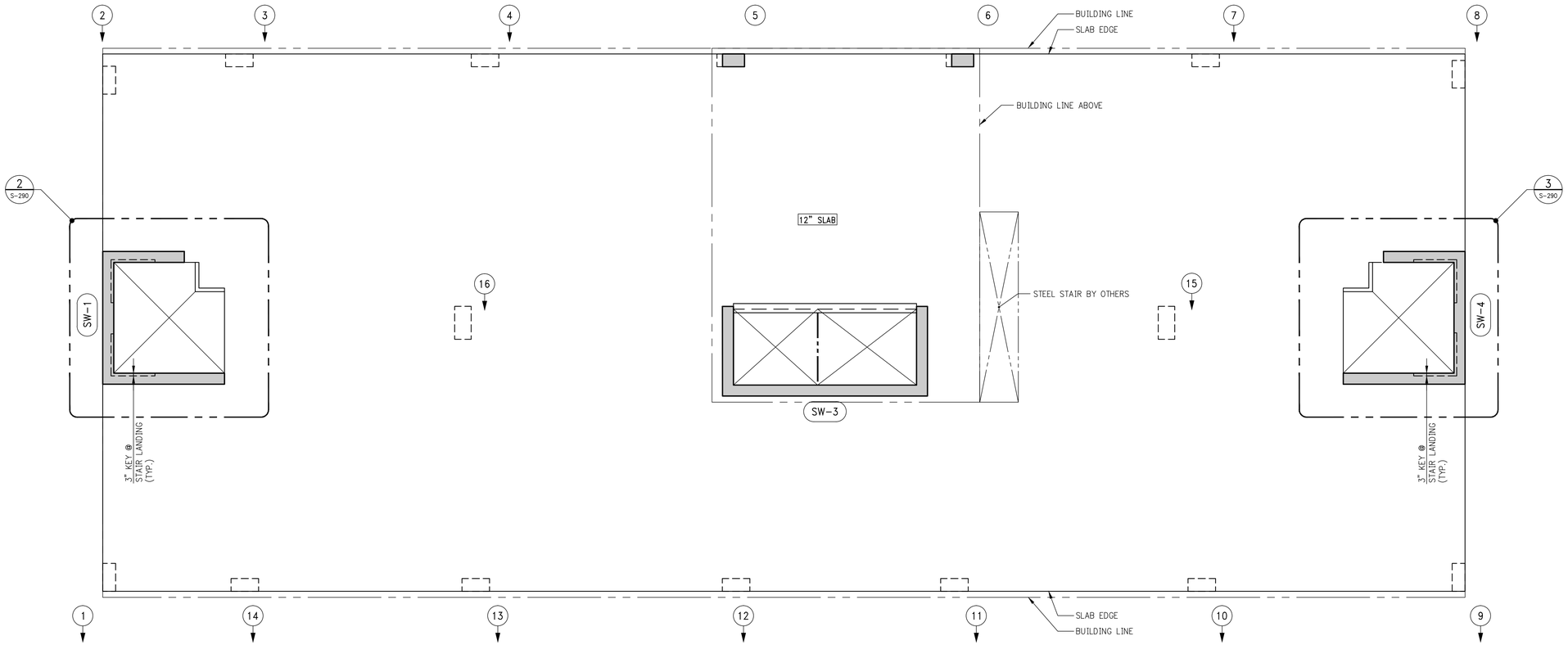


3 / S-290 STAIR ROOF FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. TOP OF SLAB ELEVATION TO BE 258'-8" U.O.N. THUS [.....] ON PLAN.
2. SLAB TO BE 8" THICK U.O.N. THUS [.....] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #4@12 CONT. E.W. FOR 8" SLAB U.O.N.
4. FOR BALANCE OF NOTES SEE DRAWING S-010.



1 / S-290 MAIN ROOF FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. TOP OF SLAB ELEVATION TO BE 250'-0" U.O.N. ON THUS [.....] ON PLAN.
2. SLAB TO BE 10" THICK U.O.N. THUS [.....] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #4@10 CONT. E.W. FOR 10" SLAB U.O.N.
   #5@10 CONT. E.W. FOR 16" SLAB U.O.N.
4. FOR BALANCE OF NOTES SEE DRAWING S-010.

NORTH

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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FAIRFIELD INN & SUITES SM Marriott

SPRINGHILL SUITES ® Marriott

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ISSUED DRAWINGS:

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NEW YORK, NY

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SEAL & SIGNATURE:

STATE OF NEW YORK · SUTAR L. MARCUS · 057539 · LICENSED PROFESSIONAL ENGINEER

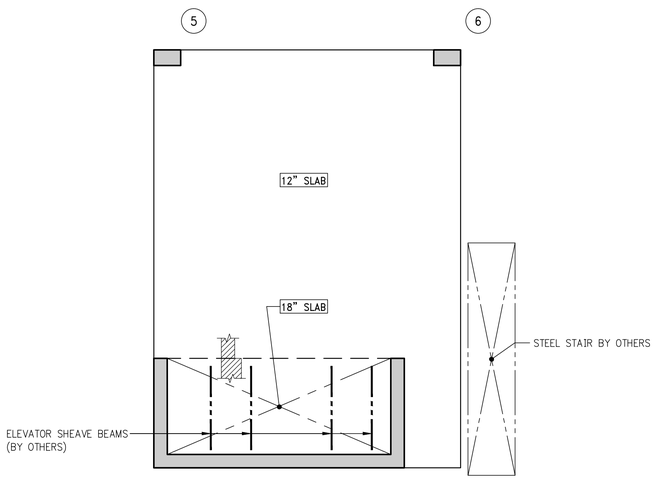
DATE: APRIL 17, 2015

SCALE: 3/16" = 1'-0"

DRAWING NUMBER:

S-290.00

PAGE#: XX OF XX

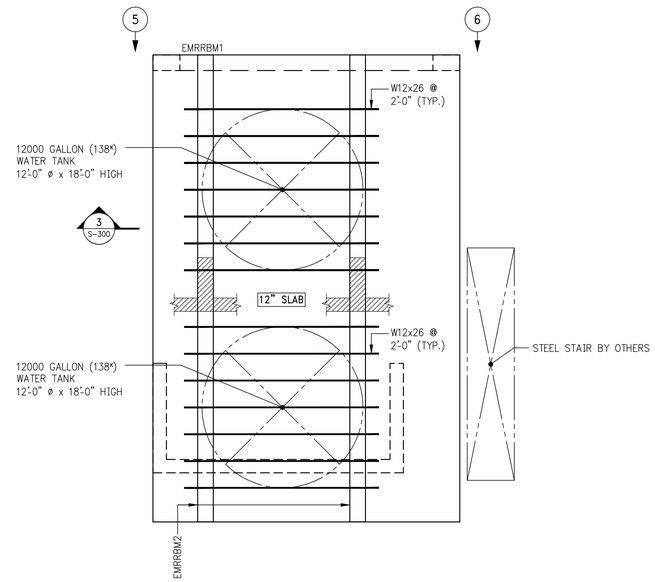


1 S-300 EMR FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. TOP OF SLAB ELEVATION TO BE 258'-8" U.O.N. THUS [.....] ON PLAN.
2. SLAB TO BE 10" THICK U.O.N. THUS [.....] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #4@10 CONT. E.W. FOR 10" SLAB U.O.N.
4. FOR BALANCE OF NOTES SEE DRAWING S-010.

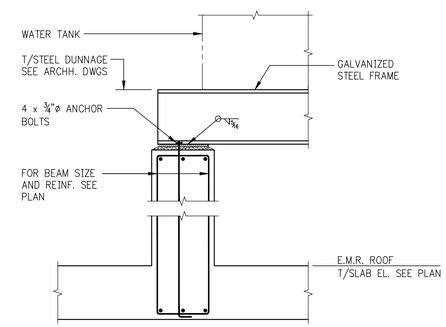


2 S-300 EMR ROOF/WATER TANK FRAMING PLAN

SCALE: 3/16"=1'-0"

NOTES:

1. TOP OF SLAB ELEVATION TO BE 258'-8" U.O.N. THUS [.....] ON PLAN.
2. SLAB TO BE 10" THICK U.O.N. THUS [.....] ON PLAN.
3. BOTTOM REINFORCEMENT TO BE #4@10 CONT. E.W. FOR 10" SLAB U.O.N.
4. FOR BALANCE OF NOTES SEE DRAWING S-010.



3 S-300 SECTION

SCALE: 3/4"=1'-0"

NORTH

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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ISSUED DRAWINGS:

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STATE OF NEW YORK · SUSAN L. MACKEY · 057139 · LICENSED PROFESSIONAL ENGINEER

DATE: APRIL 17, 2015

SCALE: 3/16" = 1'-0"

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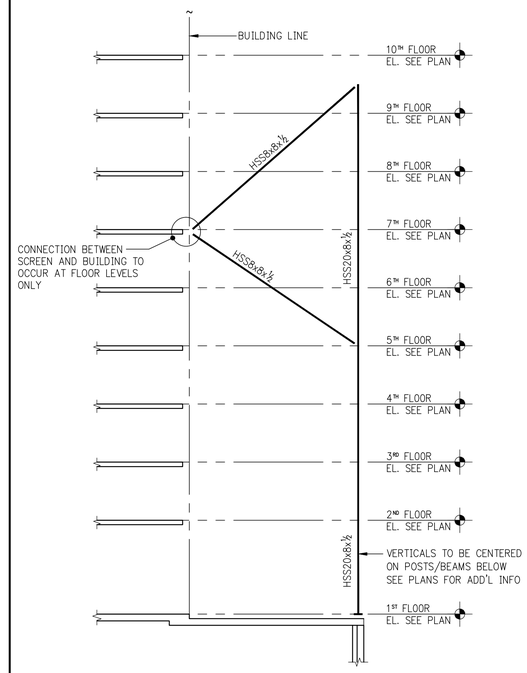
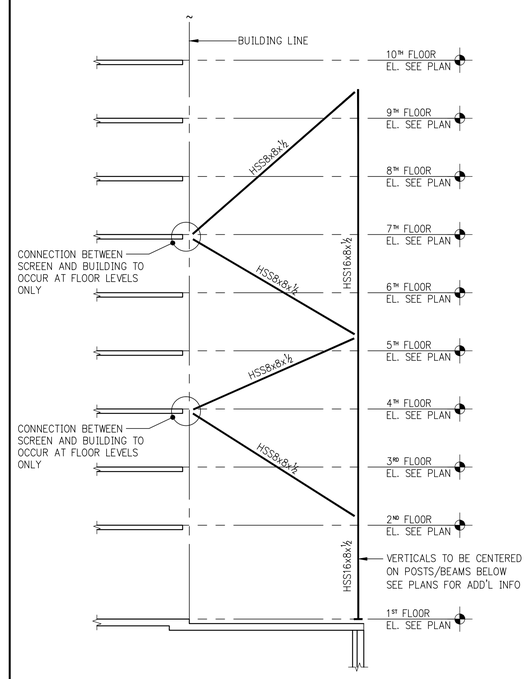
PAGE#: XX OF XX

1 S-930 SCHEMATIC SCREEN ELEVATION – ALT 1
SCALE: 3/32"=1'-0"



2 S-930 SCHEMATIC SCREEN SECTION – ALT 1
SCALE: 3/32"=1'-0"

1A S-930 SCHEMATIC SCREEN ELEVATION – ALT 2
SCALE: 3/32"=1'-0"



2A S-930 SCHEMATIC SCREEN SECTION – ALT 2
SCALE: 3/32"=1'-0"

FOR SCOPE PURPOSES ONLY
FINAL DESIGN & CONNECTION TO BASE
CONCRETE STRUCTURE TO BE
SUPPLIED BY SCREEN MANUFACTURER

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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NEW YORK, NY

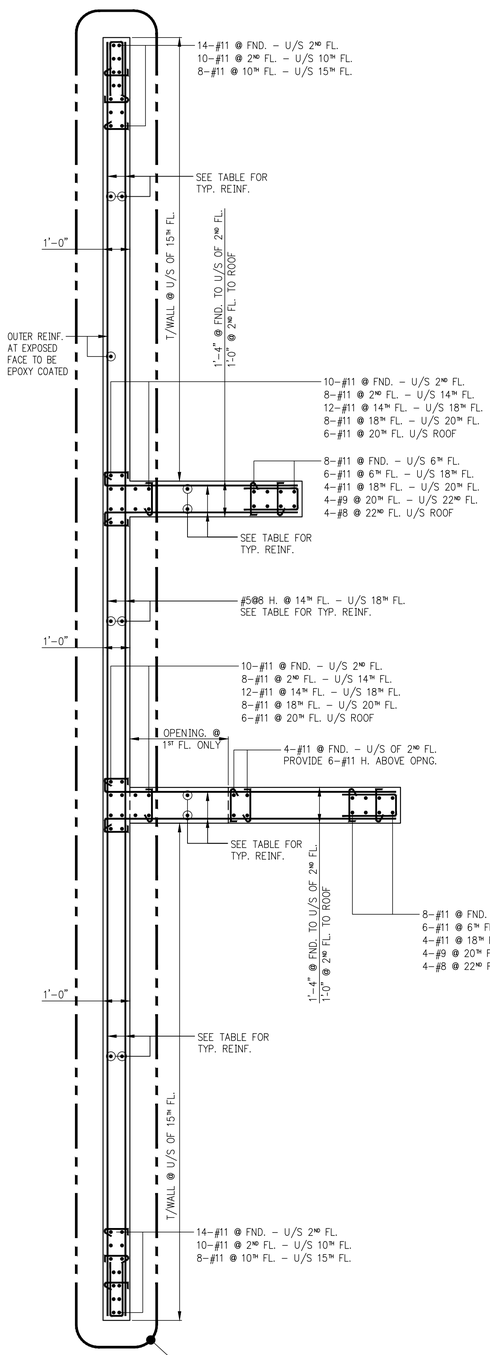
SCREEN DETAILS

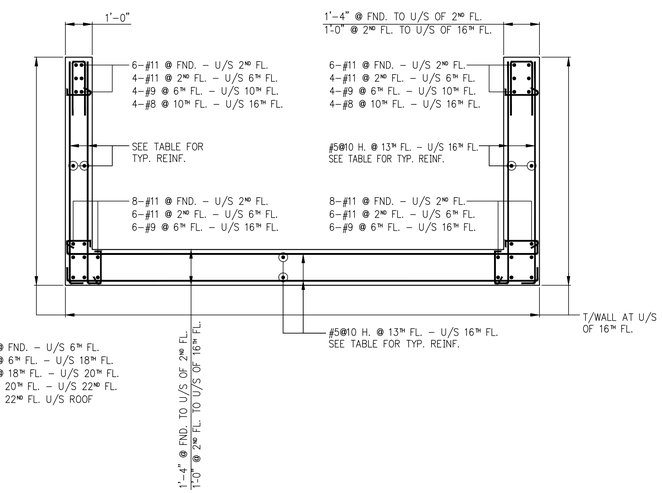
SEAL & SIGNATURE:

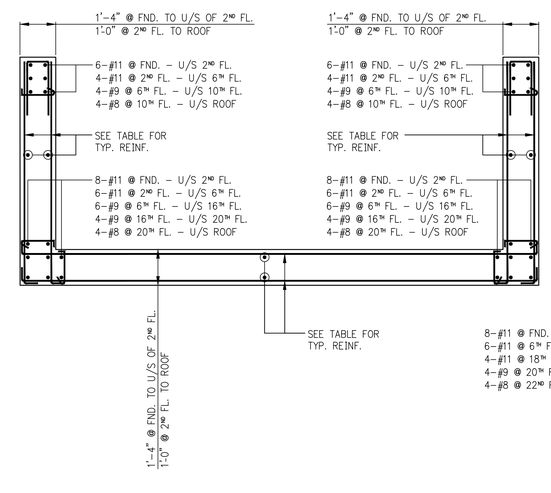
STATE OF NEW YORK · SULIMAN L. MALOUF · 057530 · LICENSED PROFESSIONAL ENGINEER

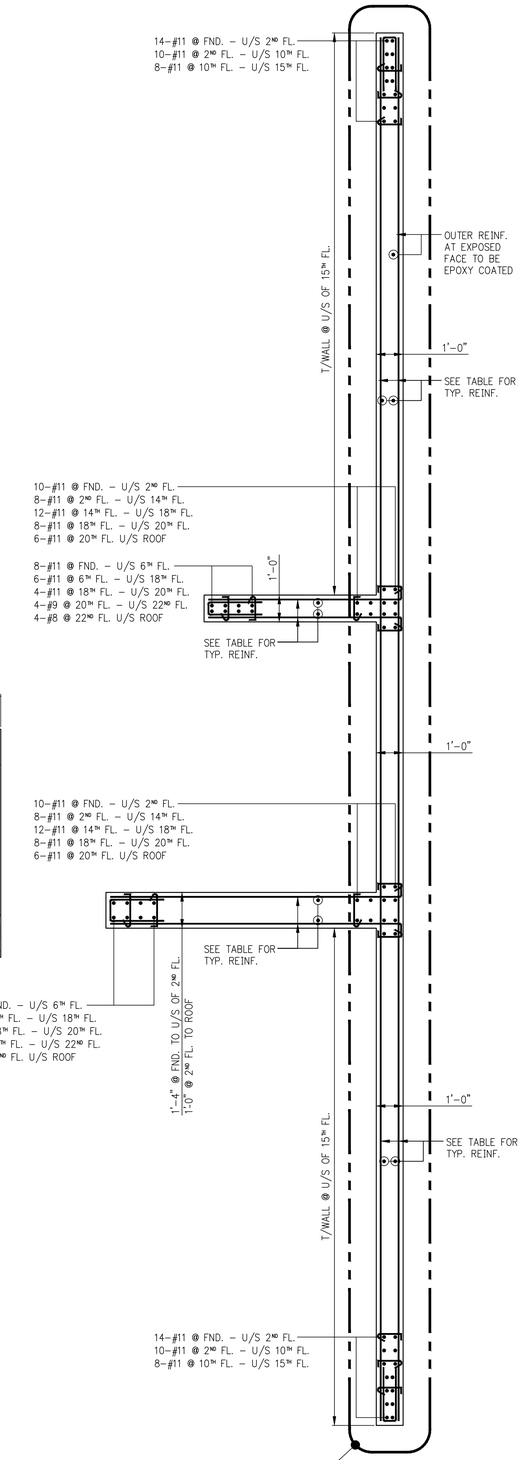
DATE: APRIL 17, 2015
SCALE: AS NOTED
DRAWING NUMBER:
S-930.00

PAGE#: XX OF XX









1 / S–940

SHEARWALL DETAILS

SCALE: ⅜"=1'–0"

NOTES:

1. FOR TYPICAL H & V REINF. SEE SCHEDULE ON S–945.
2. OUTER LAYERS OF REINFORCEMENT (VERTICAL, HORIZONTAL & TIES) AT EXPOSED CONCRETE FACES SHALL BE EPOXY COATED (ABOVE THE FIRST FLOOR SLAB ONLY).
3. FOR TYPICAL SHEARWALL DETAILS AND BALANCE OF NOTES SEE S–945.

NORTH

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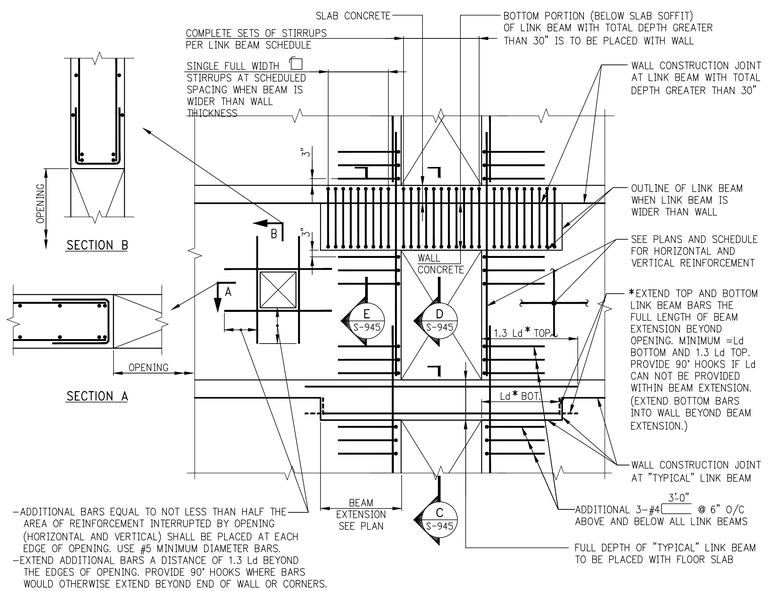
NEW YORK, NY

S□E□□□ □LL DET□ILS

SEAL & SIGNATURE:

STATE OF NEW YORK · SILVIA L. MANCIA · 051539 · LICENSED PROFESSIONAL ENGINEER

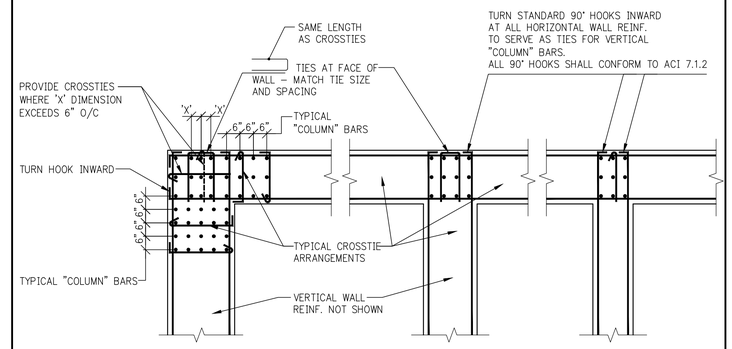
DATE: MARCH 25, 2015
SCALE: 3/8" = 1'-0"
DRAWING NUMBER:
S-940.00
PAGE#: 20 OF XX



SHEARWALL NOTES:

1. ALL SHEARWALL REINFORCEMENT (HORIZONTAL AND VERTICAL) IS TO BE TENSION LAP SPLICED. SEE LAP SPLICE IN S-960 SERIES DRAWINGS.
2. ALL NON-TYPICAL VERTICAL BARS UNSUPPORTED BY A LATERAL TIE SHALL BE SPACED NO MORE THAN 6" CLEAR ON BOTH SIDES FROM SUCH LATERALLY SUPPORTED BARS.
3. ALTERNATE 90° AND 135° ENDS ON CONSECUTIVE SINGLE LEG CROSSTIES THROUGHOUT HEIGHT OF WALL.
4. FOR MINIMUM TYPICAL REINFORCEMENT SEE SCHEDULE ON THIS DRAWING.
5. WHERE HEAVIER REINFORCEMENT IS SHOWN ON S-940 SERIES ELEVATIONS OR DETAILS, THE HEAVIER REINFORCEMENT SHALL BE USED IN LIEU OF REINFORCEMENT SHOWN ON SHEARWALL PLANS, UNLESS NOTED AS "ADDITIONAL". (AN ASTERISK (*) MAY BE SHOWN TO DENOTE SUCH SUBSTITUTIONS).
6. NO OPENING OTHER THAN THOSE SHOWN ON STRUCTURAL DRAWINGS MAY BE PLACED WITHOUT APPROVAL OF THE ENGINEER OF RECORD.
7. CONTRACTOR SHALL SUBMIT CONSOLIDATED SHOP DRAWINGS FOR ALL OPENINGS PROPOSED (SUCH AS STRUCTURAL, ARCHITECTURAL, MEP) TO THE ENGINEER OF RECORD FOR REVIEW AND APPROVAL.
8. NO VERTICAL CONSTRUCTION JOINTS ARE PERMITTED IN SHEARWALLS WITHOUT WRITTEN AUTHORIZATION FROM THE ENGINEER OF RECORD. KEYS AND DOWELS MUST BE AS DEFINED BY THE E.O.R.
9. SEE PLANS AND ELEVATIONS FOR SHEARWALL LOCATIONS, DIMENSIONS, REINFORCEMENT, OPENINGS, LINK BEAM LOCATIONS, ETC.
10. SEE COLUMN SCHEDULES ON S-950 SERIES DRAWINGS FOR CONCRETE STRENGTH REQUIRED AT EACH LEVEL.

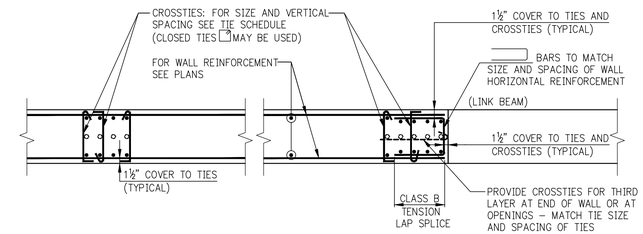
TYPICAL REINFORCEMENT AT LINK BEAMS AND AROUND SHEARWALL OPENINGS



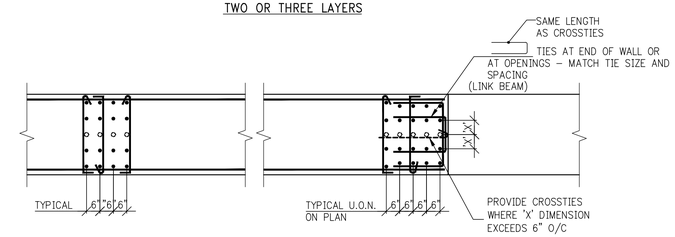
SEE S-400 SERIES PLANS FOR ACTUAL SIZE, NUMBER, AND ARRANGEMENT OF VERTICAL REINFORCEMENT AT EACH LEVEL

CORNER

'T' INTERSECTIONS



TWO OR THREE LAYERS



FOUR OR MORE LAYERS

TIE ARRANGEMENTS AT "COLUMN" VERTICAL REINFORCEMENT

*TYPICAL MINIMUM SHEARWALL REINFORCEMENT	
WALL THICKNESS (INCHES)	HORIZONTAL AND VERTICAL EACH FACE
UP TO 12	#4@12
12+ TO 16	#4@10

*THE REINFORCEMENT SHOWN IN THIS TABLE IS THE MINIMUM AMOUNT THAT MUST BE PROVIDED. HEAVIER REINFORCEMENT AND "ADDITIONAL" REINFORCEMENT MAY BE CALLED FOR ON PLANS, ELEVATIONS, OR IN SECTIONS AND DETAILS.

SHEARWALL TIE SCHEDULE	
NON-TYPICAL VERTICAL BAR SIZE	#4 TIES VERTICAL SPACING(S), BUT NOT TO EXCEED WALL THICKNESS (INCHES)
#6	12
#7	14
#8	16
#9	18
#10	20
#11	22

NOTES:
1. LOCATE LOWEST SET OF TIES S/2 ABOVE TOP OF SLAB.
2. LOCATE TOP SET OF TIES WITHIN S/2 OF BOTTOM REINFORCEMENT IN SLAB OR LINK BEAM.

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

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FAIRFIELD INN & SUITES SM Marriott

SPRINGHILL SUITES ® Marriott

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525 BROADWAY, NEW YORK, N.Y. 10012
TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

TYPICAL SCHEDULE DETAILS

SEAL & SIGNATURE:

STATE OF NEW YORK · SUSAN L. MACLIS · 057530 · LICENSED PROFESSIONAL ENGINEER

DATE: MARCH 25, 2015
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COLUMN SCHEDULE

FLOOR \ COL. NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	100	101	102	103	104	105	106
22ND FLOOR (f'c= 6000 psi, 8'-8")	345	352	561	699 4-#8	630 4-#7	673 4-#8	693 4-#8	426	436	696 4-#7	577	558	660 4-#8	546	1103	1147 6-#8							
21ST FLOOR (f'c= 6000 psi, 8'-8")	368	377	608 4-#7	759	683 4-#8	728	755	457	468	756 4-#8	624 4-#7	603	718	588	1190	1240 6-#9							
20TH FLOOR (f'c= 6000 psi, 8'-8")	392	401	654 4-#8	819 4-#8	737	784	817 4-#8	488	501	817 4-#8	671 4-#8	647 4-#7	777	631 4-#7	1277 6-#8	1334 6-#9							
19TH FLOOR (f'c= 6000 psi, 8'-8")	415	425	700	879 4-#9	791	839	880 4-#9	520	533	877 4-#9	718	692 4-#8	835	673 4-#8	1364 6-#9	1427 6-#10							
18TH FLOOR (f'c= 6000 psi, 8'-8")	438	448	747	939	844	894	942	551	565	937	765	737	893	715	1451	1520							
17TH FLOOR (f'c= 7000 psi, 8'-8")	460	471	793	999	898	950	1004	582	598	998	812	781	951 4-#8	757	1538	1613 6-#10							
16TH FLOOR (f'c= 7000 psi, 8'-8")	483	495	840	1058	952	1005	1066	613	630	1058	859	826	1010 4-#9	800	1625	1706 6-#11							
15TH FLOOR (8'-8")	505 14 x 24 4-#6	518 14 x 24 4-#6	886 24 x 14 4-#8	1118 24 x 14 4-#9	1006 24 x 14 4-#8	1060 24 x 14 4-#8	1129 24 x 14 4-#9	644 24 x 14 4-#7	662 14 x 24 4-#7	1119 24 x 14 4-#9	907 24 x 14 4-#8	871 24 x 14 4-#8	1068 24 x 14 4-#9	842 24 x 14 4-#8	1712 18 x 28	1800 18 x 28 6-#11							
14TH FLOOR (9'-4")			DET. C	1209 DET. C 10-#9	1091 DET. C 10-#8	1150 DET. C 10-#8	1230 DET. C 10-#9			1199 28 x 18 6-#9	969 28 x 18 6-#8	930 28 x 18 6-#8	1131 28 x 18 6-#9	892 28 x 18 6-#8	1836 24 x 36								
13TH FLOOR (8'-8")			1011 14 x 48 8-#8	1277 14 x 48 10-#9	1158 14 x 48 8-#8	1217 14 x 48 8-#8	1304 14 x 48 8-#9			1261	1018	976	1180	932	1930 6-#9								
12TH FLOOR			1064	1345 8-#9	1224	1284	1378			1324	1066	1022	1229	971	2024 6-#10								
11TH FLOOR			1117	1413	1290	1350	1452			1386	1115	1069	1278	1011	2117								
10TH FLOOR			1170	1482	1356	1417	1526			1448	1164	1115	1328	1051	2211								
9TH FLOOR (f'c= 7000 psi)	SHEARWALL	SHEARWALL	1223	1550	1422	1484	1600	SHEARWALL	SHEARWALL	1511	1213	1161	1377	1090	2305	SHEARWALL							
8TH FLOOR (f'c= 7000 psi)			1275	1618	1488	1551	1674			1573	1262	1208	1426	1130	2399								
7TH FLOOR (f'c= 8000 psi)			1328	1686	1554	1618	1749			1635	1311	1254	1475	1169	2493								
6TH FLOOR (f'c= 8000 psi)			1381	1754	1621	1685	1823			1697	1359	1300	1525	1209	2587								
5TH FLOOR			1434	1823	1687	1752	1897			1760	1408	1347	1574	1249	2680								
4TH FLOOR			1487	1891	1753	1819	1971			1822	1457	1393	1623	1288	2774								
3RD FLOOR			1539 14 x 48 8-#8	1959	1819	1886	2045			1884 6-#9	1506	1439	1672	1328	2868 6-#10								
2ND FLOOR (8'-8")			1602 29 x 48 10-#8	2028 14 x 48	1885 14 x 48	1953 14 x 48	2119 14 x 48			1947 28 x 18 6-#10	1555	1486	1721	1367	2962 6-#11								
T.O.S. EL. +14'-0" 1ST (14'-0")			1669 18 x 48 8-#8	2111 18 x 48 8-#8	1965 18 x 48	2033 18 x 48	2208 18 x 48			2053 32 x 18	1652	1584	1820	1442	3062		112 12 x 12 4-#6	157 12 x 12 4-#6	229 12 x 12 4-#6	141 12 x 12 4-#6	144 12 x 12 4-#6	155 12 x 12 4-#6	104 12 x 12 4-#6
CELLAR (f'c= 8000 psi, 11'-2 1/2")			1845 18 x 48 8-#8	2339 18 x 48 8-#9	2192 18 x 48	2263 18 x 48 8-#8	2437 18 x 48 8-#9			2186 32 x 18 6-#10	1772 28 x 18 6-#8	1699 28 x 18 6-#8	1939 28 x 18 6-#9	1511 28 x 18 6-#8	3266 24 x 36 6-#11			234 12 x 48 8-#6	296 12 x 48 8-#6	200 12 x 48 8-#6	207 12 x 48 8-#6	220 12 x 48 8-#6	
FOUNDATION LEVEL (SERVICE LOADS)			1565	2001	1888	1942	2081			1815	1478	1417	1612	1228	2709		74	369	248	179	188	199	68
FLOOR \ COL. NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	100	101	102	103	104	105	106

COLUMN SCHEDULE

FLOOR \ COL. NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	100	101	102	103	104	105	106
32ND FLOOR (T/WATER TANK) (f'c= 6000 psi, 34'-5")																							
31ST FLOOR (E.M.R. ROOF) (8'-8")																							
30TH FLOOR (E.M.R.) (8'-8")																							
29TH FLOOR (MAIN ROOF) (10'-0")	198 14 x 24 4-#6	200 14 x 24 4-#6	272 24 x 14 4-#7	325 24 x 14 4-#7	292 24 x 14 4-#7	326 24 x 14 4-#7	303 24 x 14 4-#7	226 24 x 14 4-#7	229 14 x 24 4-#7	325 24 x 14 4-#7	278 24 x 14 4-#7	274 24 x 14 4-#7	305 24 x 14 4-#7	281 24 x 14 4-#7	568 18 x 28 6-#6	578 18 x 28 6-#7							
28TH FLOOR (8'-8")	223	226	324	394	354	389	374	261	265	391	332	326	368	328	667 6-#6	681							
27TH FLOOR	248	252	374	459	413	450	442	295	301	454	385	375	427	374	754 6-#7	774							
26TH FLOOR	273	278	422	519	468	507	506	329	335	514	435	423	485	419	841	868							
25TH FLOOR	297	303	469	579	522	562	568	362	370	575	482	469	544	461	928 6-#7	961							
24TH FLOOR	321	328	515	639 4-#7	576	617 4-#7	631 4-#7	394	403	635	530	514	602 4-#7	504	1015 6-#8	1054 6-#7							
23RD FLOOR																							
FLOOR \ COL. NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	100	101	102	103	104	105	106

NOTES:

1. FIRST COLUMN DIMENSION SHOWN IN SCHEDULE IS IN THE EAST-WEST DIRECTION.
2. LOADS ON PILE CAPS ARE SERVICE LOADS IN KIPS.
3. LOADS ARE GIVEN IN KIPS, AND ARE ULTIMATE LOADS U.O.N.
4. FOR CONCRETE STRENGTH REQUIRED SEE COLUMN SCHEDULES.
5. COLUMN SIZES AND REINFORCEMENT ARE SHOWN ONLY WHERE SIZES START AND STOP. BLANK SPACES IN BETWEEN INDICATE SAME SIZE AS INDICATED ABOVE AND BELOW.
6. HEAVY LINE AT TOP INDICATES TOP OF COLUMN.
7. FOR GENERAL NOTES SEE DRAWINGS. FO-001 & FO-002
8. FOR SHEARWALL DETAILS SEE S-940 SERIES DRAWINGS.
9. FOR COLUMN AND REINFORCING DETAILS SEE S-950 SERIES DRAWINGS.
10. BUTTRESS INDICATED AS "B" IN COLUMN SCHEDULE
11. * INDICATES TENSION SPLICE REBARS.
12. INDICATE SHEARWALLS.
13. INDICATES COLUMN BEING PICKED UP BY BEAM OR SLAB.
14. INDICATES CHANGES IN HELD FACE OF COLUMN.
15. INDICATES ADDITIONAL LOAD FROM PICK-UP BEAM OR SLAB.

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TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

COLUMN SCHEDULE

SEAL & SIGNATURE:

STATE OF NEW YORK · SUSAN L. MARCUS · 057530 · LICENSED PROFESSIONAL ENGINEER

DATE: MARCH 25, 2015

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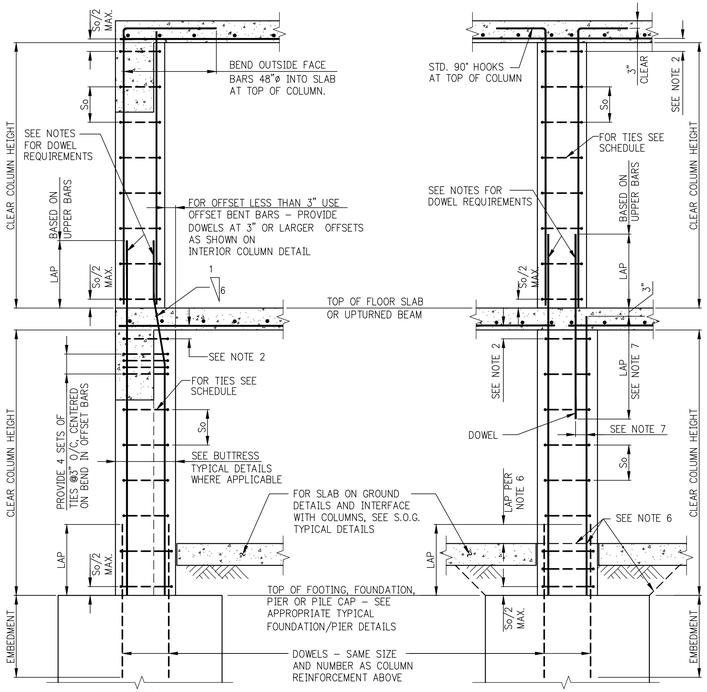
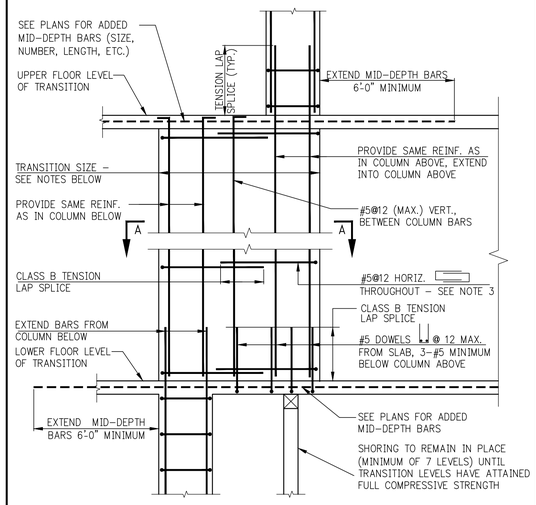


COLUMN DETAILS

COLUMN TIE SCHEDULE			
VERTICAL BAR SIZE	SIZE AND SPACING (So) OF TIES IN INCHES (MAX. SPACING NOT TO EXCEED LEAST COL. DIM.)		
	#3	#4	#5
#5	10	–	–
#6	12	–	–
#7	14	–	–
#8	16	16	–
#9	18	18	–
#10	18	20	–
#11	*	22	–
#14	*	24	27
#18	*	34	30

NOTES:

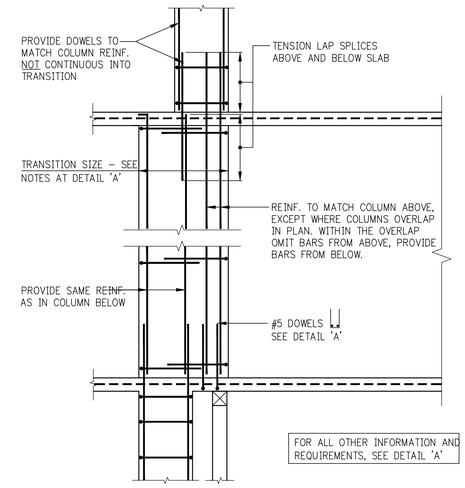
1. * #3 TIES NOT PERMITTED FOR #11, #14, #18 OR BUNDLED VERTICAL BARS.
2. LOCATE TOP SET OF TIES So/2 MAX. BELOW THE LOWEST HORIZONTAL REINFORCEMENT IN SLAB OR DROP PANEL. WHERE BEAMS FRAME FROM FOUR DIRECTIONS INTO COLUMN, TIES MAY TERMINATE NOT MORE THAN 3" BELOW LOWEST REINFORCEMENT IN SHALLOWEST OF SUCH BEAMS.
3. WHERE AREA OF VERTICAL REINFORCEMENT IN LOWER COLUMN IS GREATER THAN THAT OF UPPER COLUMN, EXTEND AREA OF REINFORCEMENT AT LEAST EQUAL TO THAT OF UPPER COLUMN.
4. WHERE AREA OF REINFORCEMENT IN LOWER COLUMN IS LESS THAN THAT OF UPPER COLUMN, PROVIDE ADDITIONAL DOWELS TO MAKE UP THE DIFFERENCE.
5. ALL LAP SPLICES AND EMBEDMENTS TO BE COMPRESSION UNLESS OTHERWISE NOTED IN COLUMN SCHEDULE.
6. WHERE SLAB IS POURED OVER FOUNDATION PRIOR TO COLUMN, VERTICAL REINFORCEMENT AND DOWEL LAP TO START AT TOP OF SLAB.
7. IF OFFSET OF DOWEL IS MORE THAN 6", LAP SHALL BE TWICE THE COMPRESSION DEVELOPMENT LENGTH OF THE SMALLER BAR.



DETAIL A – ELEVATION OF "WALKING" COLUMN TRANSITION

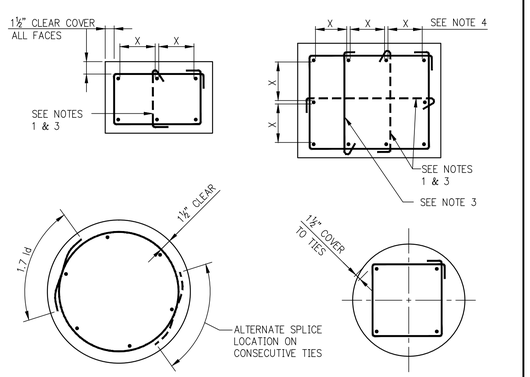
NOTES:

1. FOR DIMENSIONS AND LOCATION OF TRANSITION SEE COLUMN LOCATION PLANS AND/OR COLUMN SCHEDULE.
2. VERTICAL REINFORCEMENT IN TRANSITION TO BE AS SHOWN IN DETAILS 'A' AND 'B' UNLESS THE COLUMN SCHEDULE CALLS FOR SPECIFIC VERTICAL REINFORCEMENT WITHIN THE TRANSITION.
3. IN ADDITION TO #5@12 HORIZONTAL HOOPS, PROVIDE HOOPS AND CROSSTIES TO SATISFY TIEING REQUIREMENTS OF TYPICAL COLUMN DETAILS FOR ALL VERTICAL REINFORCEMENT.



DETAIL B

USE THIS DETAIL WHERE COLUMNS ABOVE AND BELOW TRANSITION OVERLAP IN PLAN



TIED CIRCULAR COLUMN

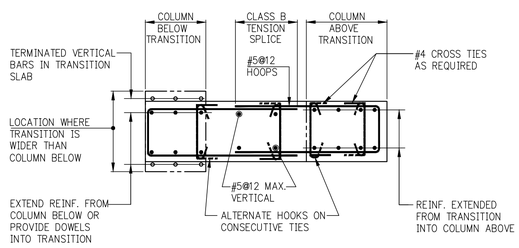
NOTE:
MINIMUM NUMBER OF VERTICAL BARS TO BE 5 FOR CIRCULAR TIES

CIRCULAR COLUMN WITH 4 BARS AND SQUARE TIES

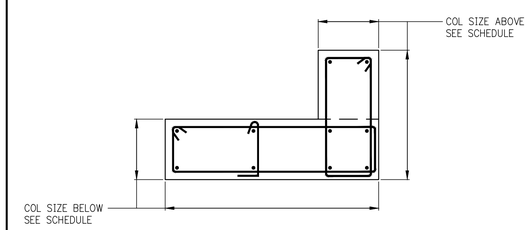
COLUMN REINFORCEMENT AND TIES ARRANGEMENT

NOTES:

1. SINGLE LEG CROSSTIES SHOWN DASHED MAY BE OMITTED WHEN THE VERTICAL BAR IS NO FARTHER THAN 6" CLEAR ON EACH SIDE FROM ADJACENT TIED BARS.
2. WHEN THERE IS A SERIES OF VERTICAL BARS (SUCH AS IN WALL-LIKE COLUMNS) AND BARS ARE SPACED NOMINALLY AT 6" O/C, EVERY OTHER VERTICAL BAR WILL REQUIRE A CROSSTIE.
3. ALTERNATE 90° AND 135° ENDS ON CONSECUTIVE SINGLE LEG CROSSTIES THROUGHOUT HEIGHT OF MEMBER.
4. DETAILER SHALL SPACE BARS EQUIDISTANT ON ALL FACES UNLESS OTHERWISE SHOWN IN DETAILS.



SECTION A–A – HORIZONTAL SECTION THROUGH "WALKING" COLUMN TRANSITION



DETAIL C

NOTES:

1. FOR REINF. SEE SCHEDULE
2. FOR TIES SEE DETAIL B

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525 BROADWAY, NEW YORK, N.Y. 10012
TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

T□□IC□L COLUMN DET□ILS

SEAL & SIGNATURE:

STATE OF NEW YORK · SULIMAN L. MALOUF · 057530 · LICENSED PROFESSIONAL ENGINEER

DATE: APRIL 07, 2015
SCALE: N.T.S.
DRAWING NUMBER:

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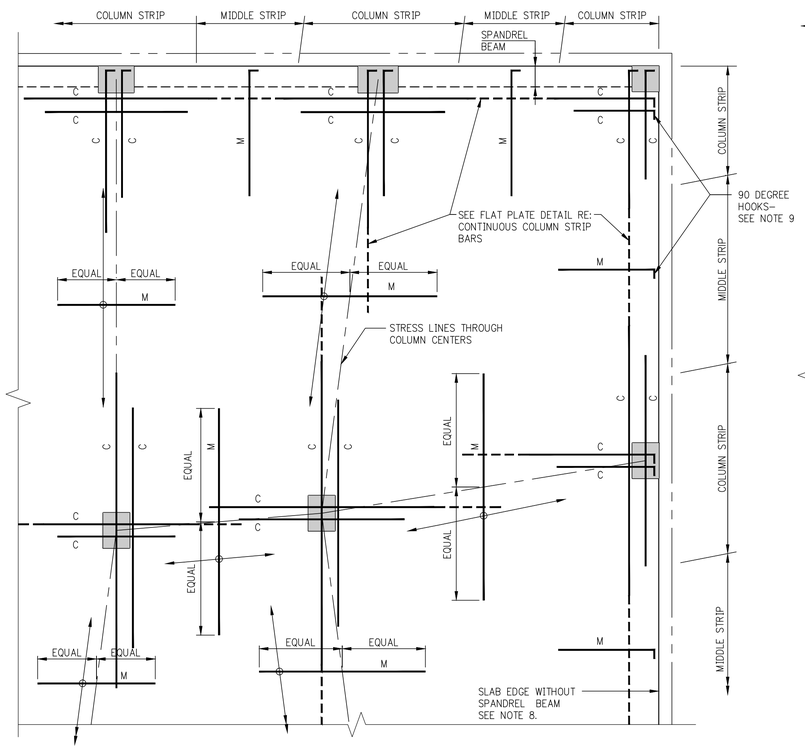
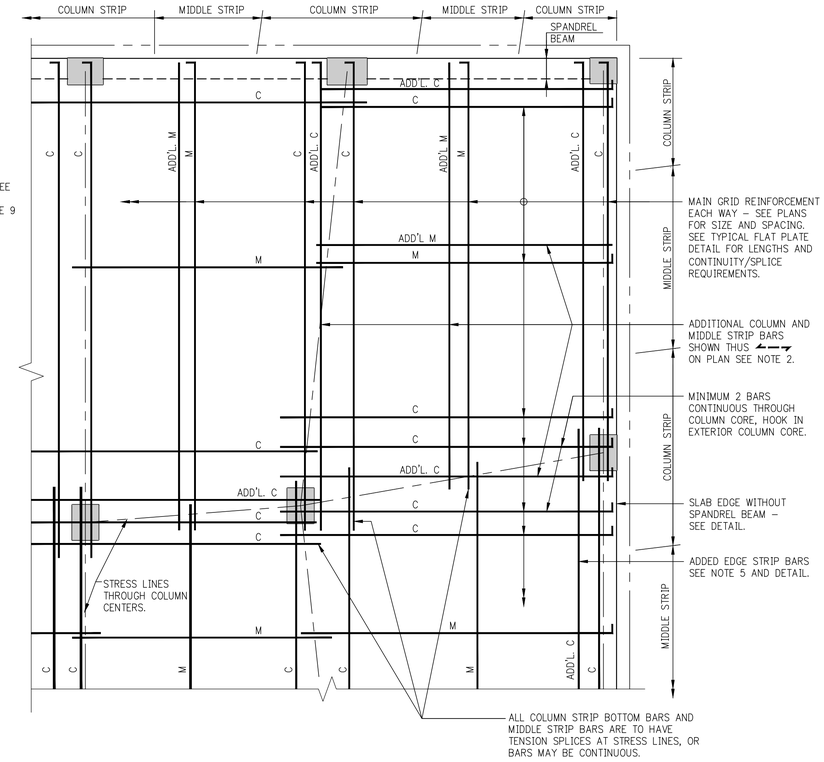


TOP REINFORCEMENT



BOTTOM REINFORCEMENT

NOTES FOR TOP REINFORCEMENT

1. 'C' DENOTES COLUMN STRIP BARS (LONG AND SHORT BARS ARE ALTERNATED). 'M' DENOTES MIDDLE STRIP BARS.
2. FOR SIZE, SPACING, NUMBER, ETC. OF REINFORCING BARS, SEE FRAMING PLANS.
3. WHERE COLUMN STRIP BAR LENGTHS ARE SHOWN ON FRAMING PLANS THEY ARE FOR LONGER BARS, WHICH ARE TO BE ALTERNATED WITH SHORTER BARS. SEE TYPICAL FLAT PLATE DETAIL.
4. COLUMN STRIP BARS ARE TO BE CENTERED OVER COLUMNS UNLESS OTHERWISE INDICATED ON PLANS.
5. MIDDLE STRIP BARS ARE TO BE CENTERED OVER STRESS LINES UNLESS OTHERWISE INDICATED ON PLANS.
6. MIDDLE STRIP BARS ARE TO BE SPACED AS SHOWN ON PLANS. FIRST BAR IS TO BE LOCATED A DISTANCE FROM LAST COLUMN STRIP BAR NOT TO EXCEED MIDDLE STRIP BAR SPACING.
7. COLUMN STRIP BARS PARALLEL TO SPANDREL BEAMS ARE TO HAVE FIRST BAR LOCATED AT ONE–HALF SCHEDULED SPACING FROM INSIDE FACE OF BEAM, SIX INCHES MAXIMUM.
8. AT SLAB EDGES WITHOUT SPANDREL BEAMS, SEE TYPICAL DETAIL FOR ADDITIONAL CONTINUOUS EDGE BARS AND FOR COLUMN STRIP BAR PLACEMENT PARALLEL TO SLAB EDGE.
9. PROVIDE 90 DEGREE HOOK AT EVERY DISCONTINUOUS TOP BAR, COLUMN AND MIDDLE STRIPS, AT EDGE OF SLAB, WITH OR WITHOUT SPANDREL BEAMS (2" CLEAR COVER TO HOOK)

BAR LENGTH EXTENSIONS REQUIRED AT EPOXY COATED REINFORCEMENT (WHERE SPECIFIED ON PLANS)
1. TO REINFORCING BAR LENGTHS SHOWN ON PLAN OR AS DETERMINED FROM TYPICAL DETAILS, ADD AN ADDITIONAL LENGTH AT EACH END (EXCEPT AT HOOKED BARS) EQUAL TO 50% OF BAR DEVELOPMENT LENGTH (SEE TABLE #2)
2. DEVELOPMENT LENGTHS AND LAP SPLICE LENGTHS SHOWN ARE TO BE INCREASED, IN CONFORMANCE WITH TABLES 1 & 2 IN TYPICAL DETAILS FOR REINFORCEMENT DEVELOPMENT AND SPLICE LENGTHS, OVER VALUES FOR UNCOATED BARS.

NOTES FOR BOTTOM REINFORCEMENT:

1. 'C' DENOTES A COLUMN STRIP BAR, PART OF MAIN GRID.
   'ADD'L. C' DENOTES COLUMN STRIP BARS ADDITIONAL TO MAIN GRID BARS.
   'M' DENOTES A MIDDLE STRIP BAR, PART OF MAIN GRID.
   'ADD'L M' DENOTES MIDDLE STRIP BARS ADDITIONAL TO MAIN GRID BARS.
2. PLACE ADDITIONAL BARS BETWEEN MAIN GRID BARS. IN COLUMN STRIPS GROUP ABOUT STRESS LINE. IN MIDDLE STRIPS DISTRIBUTE THROUGHOUT STRIP.
3. ALL COLUMN STRIP BOTTOM BARS ARE TO BE CONTINUOUS AND HOOKED 90° AT EDGES OF SLAB OR AT SLAB OPENINGS, OR AT OTHER DISCONTINUITIES.
4. ALL MIDDLE STRIP BOTTOM BARS ARE TO BE CONTINUOUS AND ARE TO EXTEND TO EDGE OF SLAB WHERE 50% OF BARS ARE TO BE HOOKED.
5. IN EDGE STRIP WITHOUT SPANDREL BEAMS START ADDITIONAL BARS TWO INCHES FROM CONTINUOUS EDGE BARS – SEE FLAT PLATE DETAIL AT EDGE OF SLAB.

FLAT SLAB REINFORCEMENT DETAILS

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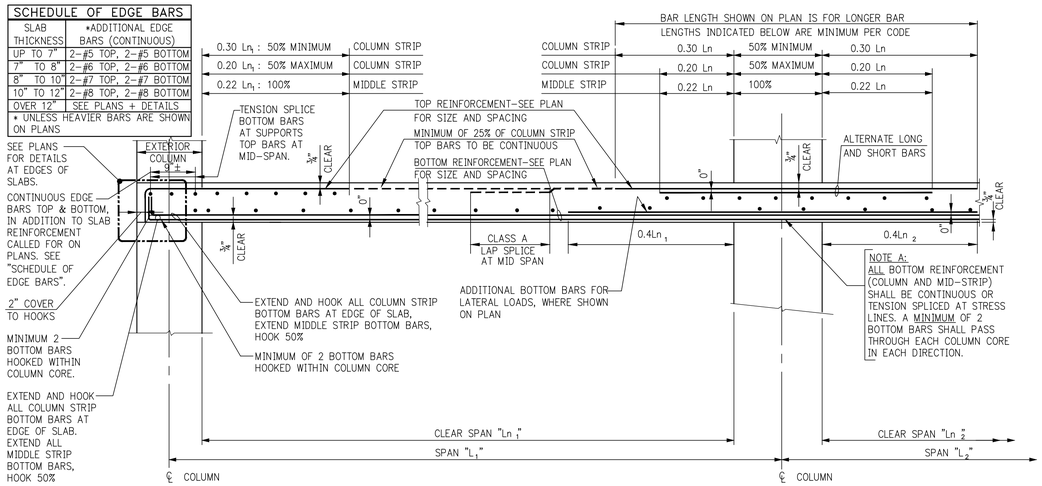
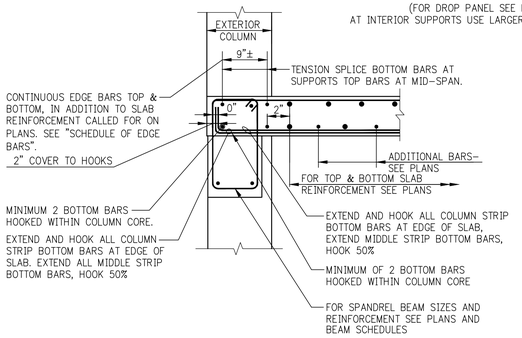
SCHEDULE OF EDGE BARS	
SLAB THICKNESS	*ADDITIONAL EDGE BARS (CONTINUOUS)
UP TO 7"	2–#5 TOP, 2–#5 BOTTOM
7" TO 8"	2–#6 TOP, 2–#6 BOTTOM
8" TO 10"	2–#7 TOP, 2–#7 BOTTOM
10" TO 12"	2–#8 TOP, 2–#8 BOTTOM
OVER 12"	SEE PLANS + DETAILS

* UNLESS HEAVIER BARS ARE SHOWN ON PLANS

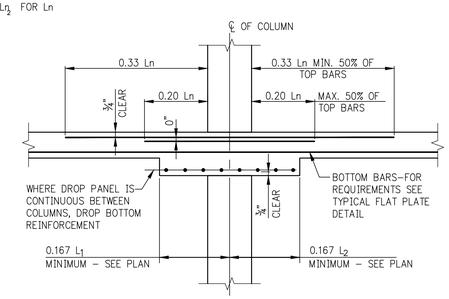


FLAT PLATE DETAIL

(FOR DROP PANEL SEE DETAIL)
AT INTERIOR SUPPORTS USE LARGER OF Ln_1 OR Ln_2 FOR Ln

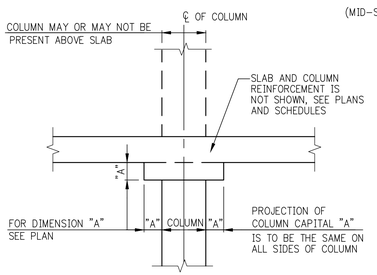


EDGE OF SLAB WITH SPANDREL BEAM

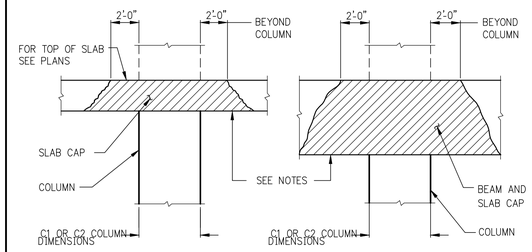


FLAT SLAB WITH DROP PANELS AT COLUMN STRIP

(MID–STRIP BARS SAME AS TYPICAL FLAT PLATE DETAIL)



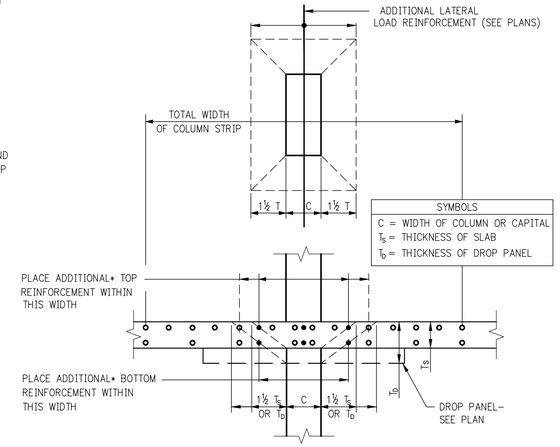
COLUMN WITH CAPITAL



BEAM AND SLAB CONCRETE PLACEMENT AT HIGH STRENGTH CONCRETE COLUMN OR WALL

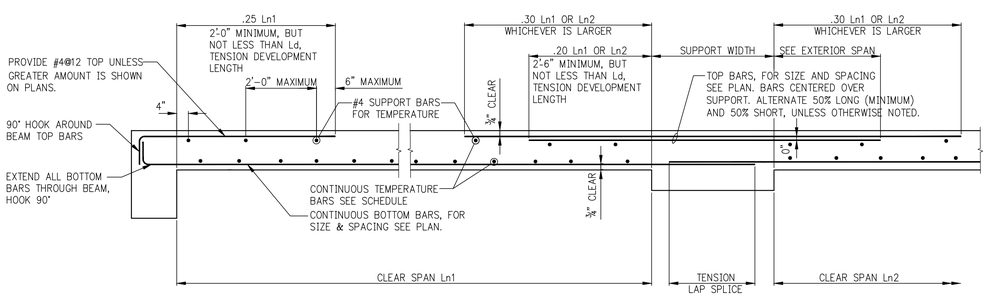
NOTES:

1. IN CONFORMANCE WITH 10.13 OF ACI 318–89 (10.15 in 2002 CODE), USE THIS DETAIL WHEN THE SPECIFIED CONCRETE STRENGTH IN COLUMN/WALL IS GREATER THAN 1.4 TIMES THAT SPECIFIED FOR THE FLOOR SYSTEM.
2. CAP SHALL BE NORMAL–WEIGHT STONE CONCRETE, EQUAL IN STRENGTH TO THAT SPECIFIED FOR THE COLUMN/WALL. CAP SHALL EXTEND BEYOND COLUMN/WALL IN ALL DIRECTIONS AS SHOWN ABOVE.
3. CAP CONCRETE SHALL NOT BE PLACED OVER THE COLUMN/WALL UNTIL COLUMN/WALL CONCRETE IS NO LONGER PLASTIC, BUT IN NO CASE LESS THAN TWO HOURS AFTER COLUMN/WALL CONCRETE PLACEMENT HAS BEEN COMPLETED.
4. THE BALANCE OF CONCRETE IN SLAB AND BEAMS SHALL BE PLACED WHILE CAP CONCRETE IS STILL IN A WORKABLE PLASTIC CONDITION, BEFORE INITIAL SET. RETEMPERING OF CONCRETE WILL NOT BE PERMITTED.
5. IN LIEU OF PLACING TWO DIFFERENT STRENGTHS OF CONCRETE WITHIN THE SAME FLOOR SYSTEM, THE CONTRACTOR MAY ELECT (AT NO ADDITIONAL COST TO THE OWNER) TO PLACE ONE STRENGTH THROUGHOUT THE ENTIRE FLOOR. THE MINIMUM FLOOR CONCRETE STRENGTH REQUIRED BY ACI CODE WOULD BE 0.72 TIMES THE SPECIFIED STRENGTH OF CONCRETE IN THE COLUMNS/WALLS, UP TO 10,000 PSI COLUMN/WALL CONCRETE.
6. WHEN COLUMN/WALL CONCRETE STRENGTH EXCEEDS 10,000 PSI, THE CAP DETAILS SHOWN ABOVE MUST BE FOLLOWED, USING CAPS OF SAME CONCRETE STRENGTH AS IN COLUMNS/WALLS, AND THE STRENGTH SPECIFIED ON THE DRAWINGS FOR THE BALANCE OF THE FLOOR SYSTEM.



ADDITIONAL COLUMN STRIP REINFORCEMENT DUE TO LATERAL LOAD (WIND OR SEISMIC)

NOTE:
ADDITIONAL TOP OR BOTTOM BARS ARE NOTED ON PLAN WITH AN ASTERISK *.



AT SUPPORT WHERE SLAB IS NON–CONTINUOUS

AT SUPPORT WHERE SLAB IS CONTINUOUS

ONE WAY CONCRETE SLAB

MINIMUM TEMPERATURE REINFORCEMENT (BOTTOM) ONE WAY SLABS	
SLAB THICKNESS	MIN. TEMPERATURE REINFORCEMENT
UP TO 6"	#4@18
6"+ TO 7"	#4@16
7"+ TO 8"	#4@14
8"+ TO 9"	#4@12
9"+ TO 10"	#4@10 OR #5@15
10"+ TO 12"	#4@9 OR #5@14
12"+ TO 14"	#4@8 OR #5@12
14"+ TO 16"	#5@10
OVER 16"	BY DESIGNER

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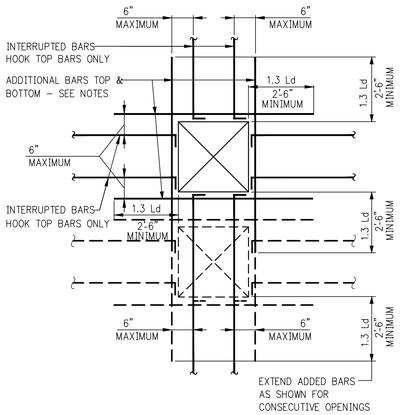
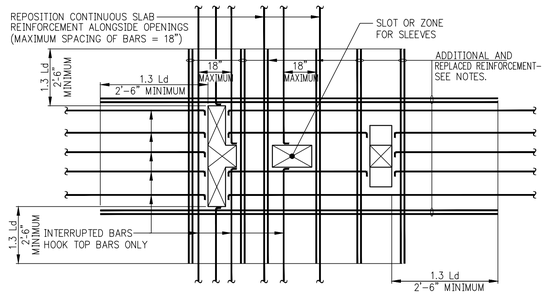


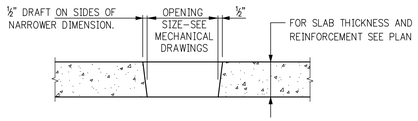
ADDED REINFORCEMENT AT OPENINGS IN FLOOR SLAB

NOTES:

1. ADDITIONAL BARS EQUAL IN AREA TO AREA OF REINFORCEMENT INTERRUPTED BY OPENING(S) SHALL BE PLACED ALONGSIDE OPENING(S), ONE HALF ON EACH SIDE (#5 MINIMUM DIAMETER), TOP AND BOTTOM.
2. ADD 1–#5 TOP AND BOTTOM EACH SIDE OF OPENING, ADDITIONAL TO REPLACEMENT BARS.
3. WHERE OPENINGS ARE NEAR OR AGAINST EXTERIOR BEAMS OR COLUMNS AND ADDED REINFORCEMENT CAN NOT BE EXTENDED AS SHOWN, HOOK EXTERIOR END.
4. AT OPENINGS SMALLER THAN THE SLAB THICKNESS (10" MAXIMUM), NO ADDITIONAL REINFORCEMENT IS REQUIRED, PLACE NORMAL REINFORCEMENT ALONGSIDE OPENING.
5. Ld = TENSION DEVELOPMMENT LENGTH, SEE TABLES.



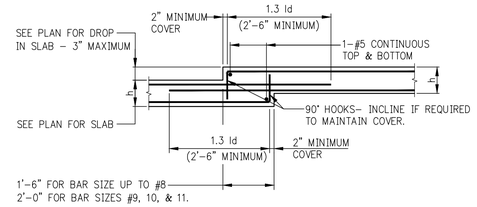
SLAB OPENINGS AT BATHROOM



PLUMBING OPENING (SLOT) IN SLAB

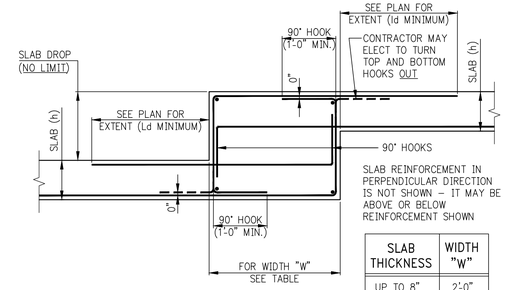
NOTES:

1. FOR LOCATIONS AND DIMENSIONS OF PLUMBING OPENINGS SEE MECHANICAL AND/OR ARCHITECTURAL DRAWINGS.
2. FILL ALL OPENINGS WITH CONCRETE AFTER PIPING HAS BEEN INSTALLED.
3. FOR SLAB REINFORCEMENT DETAILS ALONGSIDE OPENINGS SEE DETAIL OF "ADDED REINFORCEMENT AT OPENINGS IN FLOOR SLAB".
4. MINIMUM REQUIREMENTS ARE SHOWN IN THESE DETAILS. SEE PLAN FOR ADDITIONAL REQUIREMENTS.



DROP IN TOP AND BOTTOM OF SLAB

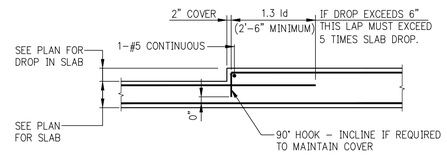
(MAXIMUM DROP = 3")



SLAB THICKNESS	WIDTH "W"
UP TO 8"	2'-0"
8"+ TO 10"	2'-6"
OVER 10"	3'-0"

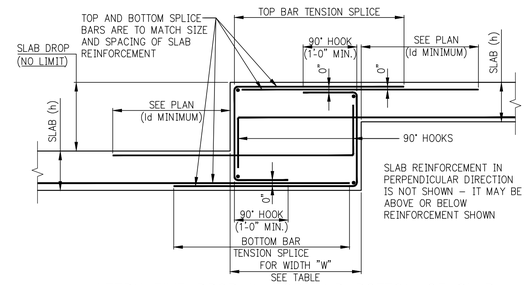
DROP IN TOP AND BOTTOM OF SLAB

(DROP GREATER THAN 3")



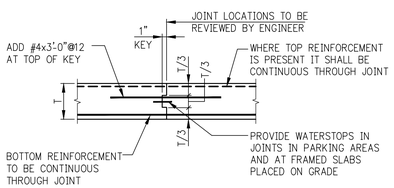
DROP IN TOP OF SLAB

NOTE:
BARS IN OTHER DIRECTION ARE NOT SHOWN – SEE PLANS.

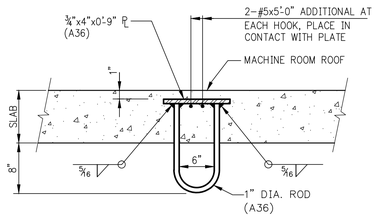


ALTERNATIVE DROP IN TOP AND BOTTOM OF SLAB USING SPLICE BARS

(DROP GREATER THAN 3")

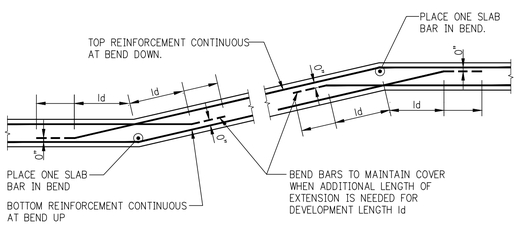


SLAB CONSTRUCTION JOINT



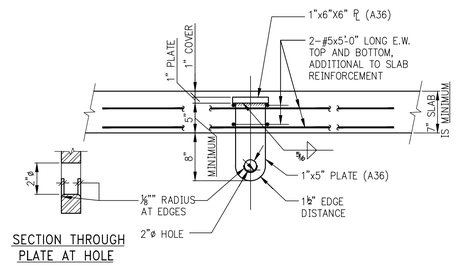
LIFTING HOOK AT ELEVATOR

MAXIMUM SERVICE LOAD LIFTING CAPACITY = 2,000 POUNDS.
FOR HEAVIER LOADS A SOLID PLATE WITH HOLE MUST BE PROVIDED.



BEND IN SLAB

NOTE:
BARS IN OTHER DIRECTION ARE NOT SHOWN– SEE PLANS.

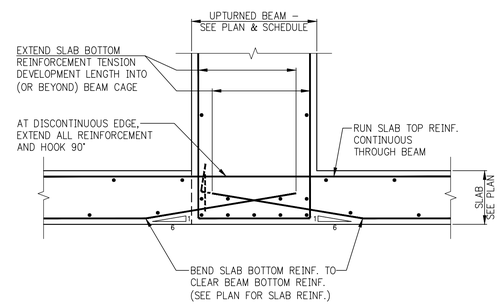


HEAVY LIFTING "PADEYE" PLATE AT ELEVATOR

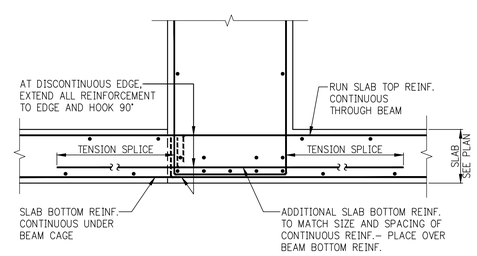
MAXIMUM SERVICE LOAD LIFTING CAPACITY = 10,000 POUNDS.

NOTES:

1. SLAB REINFORCEMENT IS NOT SHOWN.
2. PLACE ADDITIONAL #5 BOTTOM BARS IN THE SAME PLANE(S) AS SLAB BOTTOM REINFORCEMENT.



SLAB BOTTOM REINFORCEMENT AT A FULLY UPTURNED BEAM



ALTERNATIVE SLAB BOTTOM REINFORCEMENT AT A FULLY UPTURNED BEAM

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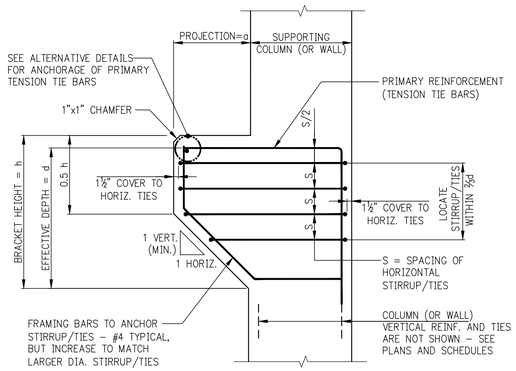
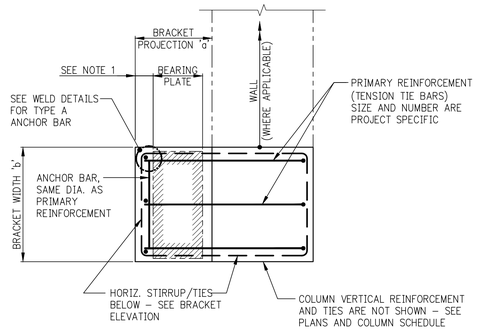
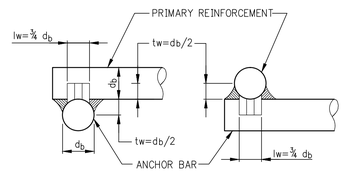


BRACKET

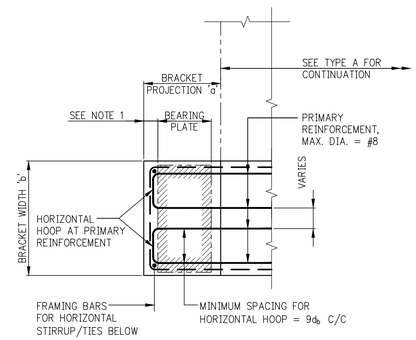


NOTES:
1. BEARING AREA SHALL NOT PROJECT BEYOND INTERIOR FACE OF ANCHOR BAR.
2. PROVIDE POSITIVE ANCHORAGE BETWEEN BEARING PLATE AND BRACKET, SUCH AS STUDS, REBAR WELDED TO PLATE, ETC.



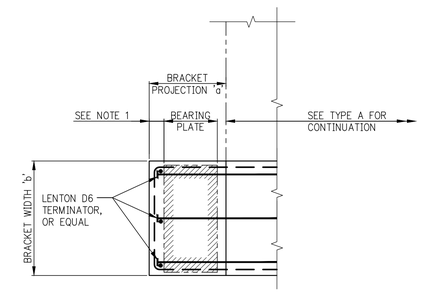
TYPE A: ANCHORAGE OF BRACKET PRIMARY REINFORCEMENT BY WELDED ANCHOR BAR (ACI 11.9.6a)

NOTE:
AT WELDED ANCHORAGE, BOTH PRIMARY REINFORCEMENT AND ANCHOR BAR SHALL CONFORM TO ASTM A706, GRADE 60. ELECTRODES SHALL BE E90XX, LOW HYDROGEN. CONFORM TO AWS D1.4.



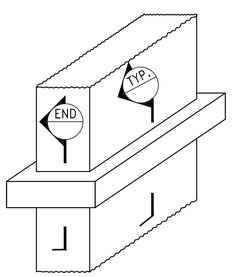
NOTES:
1. BEARING AREA SHALL NOT PROJECT BEYOND INTERIOR FACE OF HORIZONTAL HOOPS.
2. PROVIDE POSITIVE ANCHORAGE BETWEEN BEARING PLATE AND BRACKET, SUCH AS STUDS, REBAR WELDED TO PLATE, ETC.

TYPE B: ANCHORAGE OF BRACKET PRIMARY REINFORCEMENT BY USE OF HORIZONTAL HOOPS (ACI 11.9.6b)



NOTES:
1. BEARING AREA SHALL NOT PROJECT BEYOND INTERIOR FACE OF D6 TERMINATOR.
2. PROVIDE POSITIVE ANCHORAGE BETWEEN BEARING PLATE AND BRACKET, SUCH AS STUDS, REBAR WELDED TO PLATE, ETC.

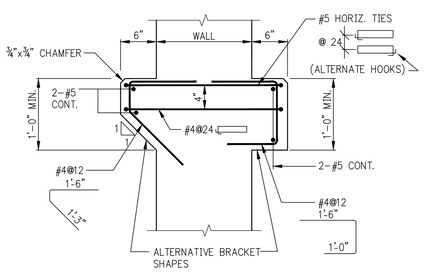
TYPE C: ANCHORAGE OF BRACKET PRIMARY REINFORCEMENT BY LENTON D6 TERMINATORS (OR EQUAL) (ACI 11.9.6c)



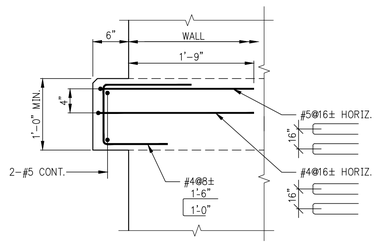
VIEW OF WALL/COLUMN BRACKET

BRACKET SCHEDULE

REQUIREMENT \ BRACKET NUMBER				
LOCATION OF BRACKET				
PROJECTION 'a'				
WIDTH 'b'				
TOTAL HEIGHT 'h'				
PRIMARY REINFORCEMENT TOP TENSION TIE BARS				
HORIZONTAL STIRRUP/TIES NUMBER, SIZE, SPACING				
EMBEDED STEEL BEARING PLATE SIZE				
DOWELS (WHERE REQUIRED)				
REMARKS				



TYPICAL SECTION



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SEAL & SIGNATURE:

DATE: APRIL 07, 2015
SCALE: AS NOTED
DRAWING NUMBER:
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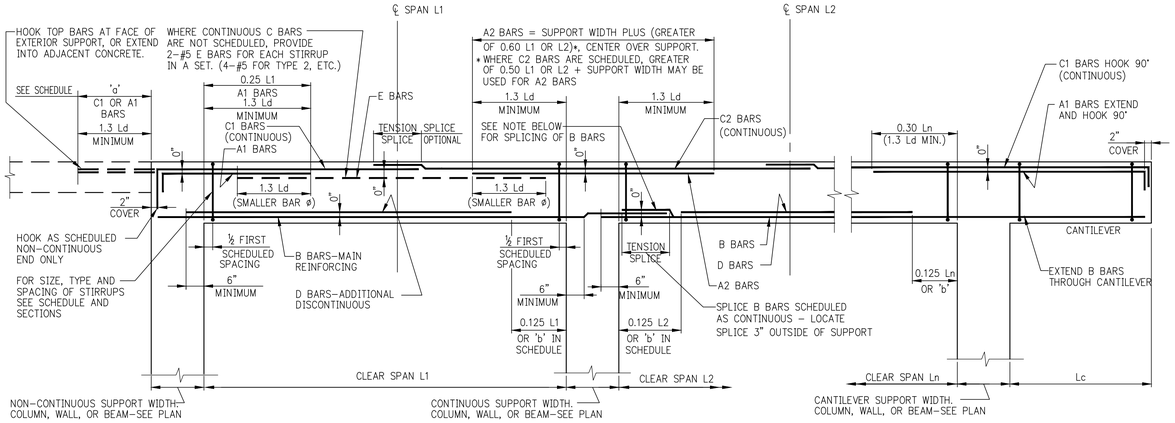
PAGE#: 27 OF XX

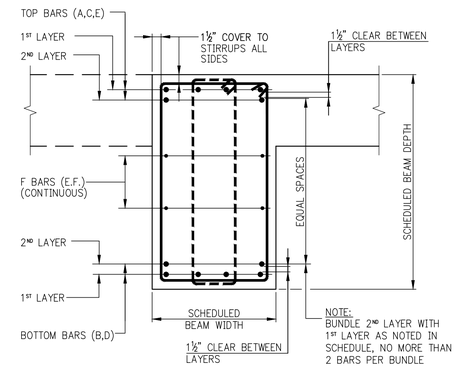


NOTE:
USE TYPICAL CUTOFF LENGTHS SHOWN UNLESS 'a' OR 'b' DIMENSIONS OR OTHER DIMENSIONS ARE GIVEN IN THE BEAM SCHEDULE

TYPICAL BEAM ELEVATION

MINIMUM SHEAR REINFORCEMENT FOR DEEP BEAMS (D_> Ln/4)		
b=BEAM WIDTH	MINIMUM STIRRUPS(Av) (SPACING = S)*	MINIMUM F BARS (Avh) (SPACING = S2)*
UP TO 12"	1–#4 @ 12" MAX.	#4 E.F. @ 12" MAX.
12"+ TO 24"	2–#4 @ 12" MAX.	#4 E.F. @ 12" MAX.
24"+ TO 36"	3–#4 OR 2–#5 @ 12" MAX.	#5 E.F. @ 12" MAX.
36"+ TO 42"	2–#5 @ 12" MAX.	#6 E.F. @ 12" MAX.
42"+ TO 48"	4–#4 OR 3–#5 @ 12" MAX.	#6 E.F. @ 12" MAX.
OVER 48"	← DESIGNER TO PROVIDE →	

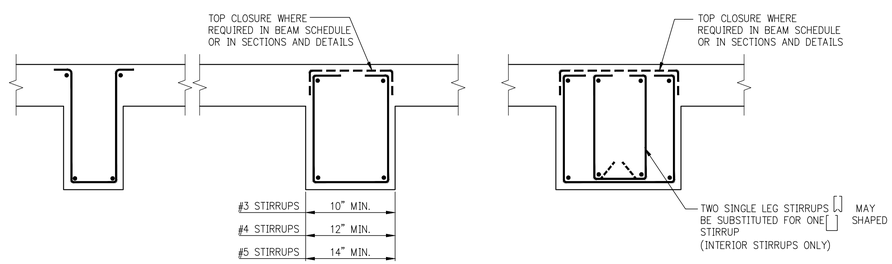
* PER ACI 11.8.4 AND 11.8.5, SPACINGS S AND S2 "SHALL NOT EXCEED D/5, NOR 12 INCHES."



TYPICAL BEAM SECTION

NOTES:

1. WHERE BARS ARE PLACED IN TWO LAYERS THE MINIMUM CLEAR DISTANCE BETWEEN LAYERS SHALL BE 1½".
2. BEAM REINFORCEMENT SHALL BE LOCATED LATERALLY AS REQUIRED TO CLEAR COLUMN VERTICAL REINFORCEMENT.
3. WHERE BEAMS MEET AND CROSS EACH OTHER AT A SUPPORT, THE SHALLOWER BEAM SHALL HAVE ITS TOP REINFORCEMENT PLACED IN THE OUTERMOST (TOP) LAYER.
4. IN THE EVENT ONE CROSSING BEAM IS A CANTILEVER, THE CANTILEVER BEAM SHALL HAVE ITS TOP REINFORCEMENT PLACED IN THE OUTERMOST (TOP) LAYER.
5. WHERE F BARS (FACE OR "SKIN" BARS) ARE INDICATED IN THE BEAM SCHEDULE, THEY SHALL BE UNIFORMLY SPACED ON BOTH BEAM FACES AND SHALL BE CONTINUOUS, WITH STAGGERED TENSION SPLICES.
6. SEE SCHEDULE OF SHEAR REINFORCEMENT FOR DEEP BEAMS (D> Ln/4) FOR MINIMUM STIRRUP AND FACE BAR REQUIREMENTS.
7. THE FIRST STIRRUP AT EACH END SHALL BE PLACED AT ½ THE FIRST SCHEDULED SPACE FROM THE FACE OF SUPPORTING MEMBER. SUBSEQUENT STIRRUPS SHALL BE SPACED AS INDICATED IN THE BEAM SCHEDULE.
8. WHERE MORE THAN ONE STIRRUP IS INDICATED IN A SET, PLACE EACH SET AT THE SCHEDULED SPACING.
9. SCHEDULED STIRRUP SPACING IS THE SAME AT EACH END UNLESS OTHERWISE NOTED.

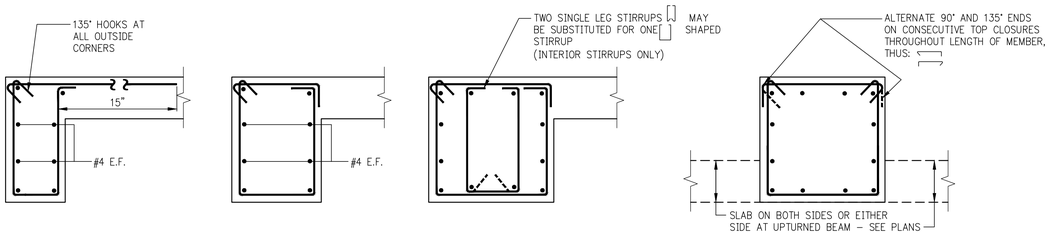


NARROW WEB–TURN HOOKS INTO SLAB

TYPICAL WEB–TURN HOOKS INWARD

MULTIPLE LEGS

INTERIOR BEAMS



NARROW

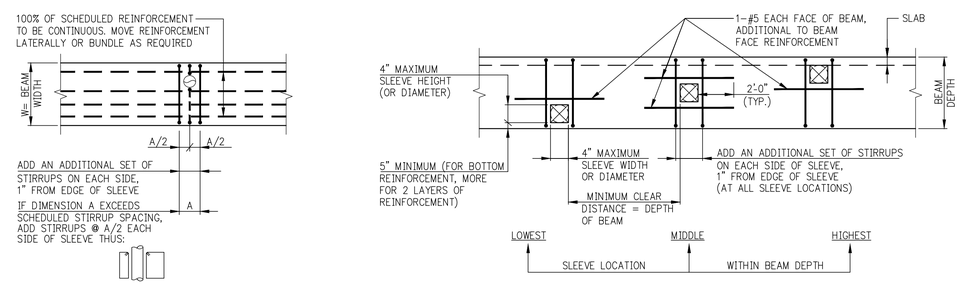
TYPICAL

MULTIPLE LEGS

BEAM WITH NO SLAB OR UPTURNED BEAM

EDGE/SPANDREL BEAMS

NOTES:
1. TOP CLOSURES REQUIRED IN ALL EDGE/SPANDREL BEAMS.
2. 2–#4 E.F. IS MINIMUM FACE REINF. REQUIRED, UNLESS BEAM SCHEDULE (OR DETAIL) CALLS FOR HEAVIER REINF.

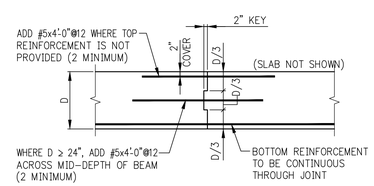


PLAN – VERTICAL SLEEVE IN BEAM

ELEVATION – HORIZONTAL SLEEVES IN BEAM

SLEEVE PENETRATIONS THROUGH BEAMS

NOTES:
1. ALL SCHEDULED BEAM REINFORCEMENT (NOT SHOWN) IS TO BE CONTINUOUS
2. NO OPENINGS LARGER THAN 4" (SQUARE OR ROUND) ARE PERMITTED UNLESS SPECIFICALLY INDICATED ON STRUCTURAL PLANS.



ELEVATION – BEAM CONSTRUCTION JOINT

NOTE:
CONTRACTOR MUST SUBMIT LOCATIONS OF ALL CONSTRUCTION JOINTS TO THE ENGINEER FOR REVIEW PRIOR TO CONSTRUCTION.

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

REVISIONS:

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#	DATE	DESCRIPTION

ISSUED DRAWINGS:

GENE KAUFMAN ARCHITECT PC
525 BROADWAY, NEW YORK, N.Y. 10012
TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

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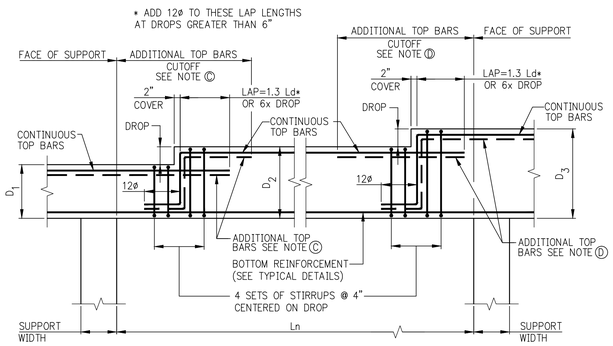
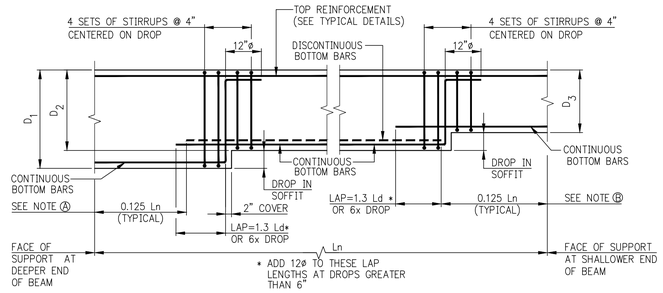


ELEVATION – DROP AT TOP OF BEAM

(SLAB NOT SHOWN)

NOTE Ⓒ :
IF LAP LENGTH OF LOWER ADDITIONAL TOP BARS (D_1) EXTENDS BEYOND THE CUTOFF LENGTH, THEN ADDITIONAL TOP BARS NEED NOT BE PLACED AT TOP OF DEEPER PORTION OF BEAM (D_2)

NOTE Ⓓ :
IF DROP OCCURS BEYOND THE CUTOFF LENGTH OF UPPER LEVEL ADDITIONAL TOP BARS (D_3), THEN ADDITIONAL TOP BARS NEED NOT BE PLACED IN SHALLOWER PORTION OF BEAM (D_2)

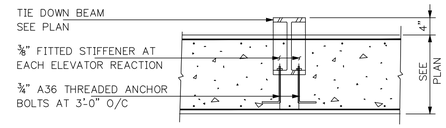


ELEVATION – DROP IN BEAM SOFFIT

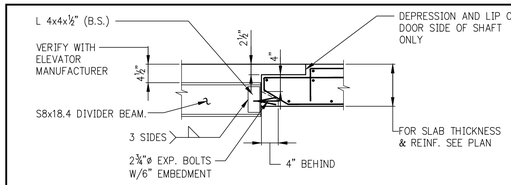
(SLAB NOT SHOWN)

NOTE Ⓐ :
IF DISCONTINUOUS BOTTOM BARS ARE CUT OFF WITHIN SPLICE LENGTH OF CONTINUOUS BOTTOM BARS, THEN DISCONTINUOUS BOTTOM BARS NEED NOT BE CONTINUED AT BOTTOM OF DEEPER PORTION OF BEAM (D_1)

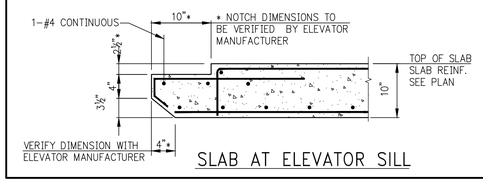
NOTE Ⓑ :
IF DROP OCCURS WITHIN TYPICAL CUTOFF OF DISCONTINUOUS BOTTOM BARS, THEN DISCONTINUOUS BOTTOM BARS NEED NOT BE CONTINUED IN SHALLOWER PORTION OF BEAM (D_3)



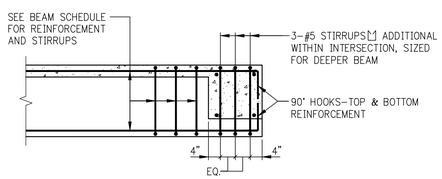
TYPICAL ELEVATOR TIE DOWN BEAM DETAIL



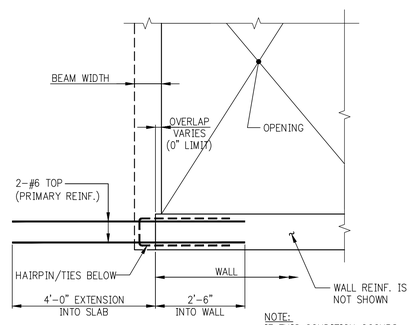
ELEVATOR DIVIDER BEAM CONNECTION AT SLAB



SLAB AT ELEVATOR SILL



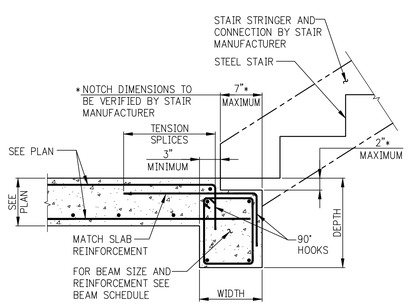
ELEVATION



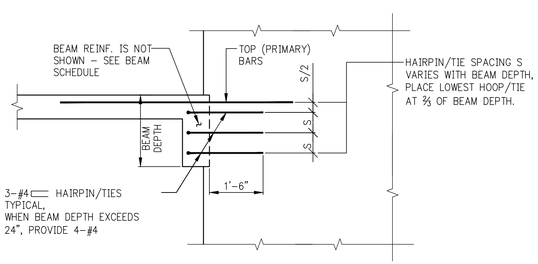
PLAN

NOTE:
IF THIS CONDITION OCCURS AT A COLUMN, PROVIDE 90° HOOKS ON BRACKET REINF. IF EMBEDMENT IS LIMITED.

DEEP BEAM FRAMING INTO SHALLOW BEAM

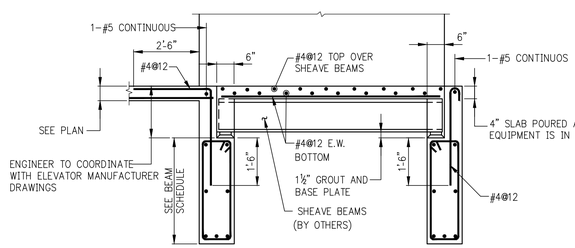


EDGE BEAM AT STEEL STAIR SUPPORT



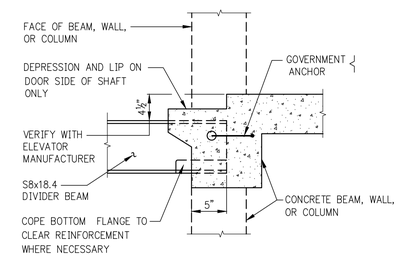
ELEVATION

BEAM SUPPORT BRACKET AT END OF WALL

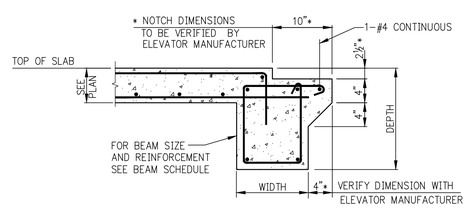


ELEVATOR SHEAVE BEAM

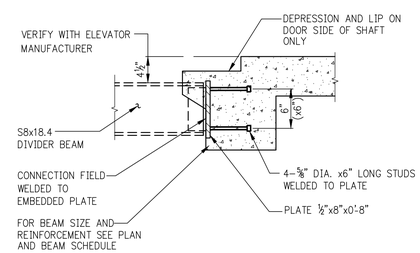
NOTE:
SHEAVE BEAMS TO BE SET BY ELEVATOR CONTRACTOR.



ELEVATOR DIVIDER BEAM CONNECTION



BEAM AT ELEVATOR SILL



ALTERNATIVE ELEVATOR DIVIDER BEAM CONNECTION

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FAIRFIELD INN & SUITES SM Marriott

SPRINGHILL SUITES ® Marriott

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TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

TYPICAL SUPERSTRUCTURE DETAILS

SEAL & SIGNATURE:

STATE OF NEW YORK · SUHAIL L. MAKKI · 057139 · LICENSED PROFESSIONAL ENGINEER

DATE: APRIL 07, 2015
SCALE: AS NOTED
DRAWING NUMBER:
S-965.00

PAGE#: 29 OF XX

TABLE #1:

TENSION LAP SPLICE LENGTHS (CLASS B MINIMUM)

TABLE 1.A: ¾" COVER TO OUTER LAYER BARS
OUTER LAYER LAP LENGTHS (IN INCHES)

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	16	16	16	16	16	16	16	16
#4	21	20	20	20	20	20	20	20
#5	31	27	24	24	24	24	24	24
#6	43	37	33	30	29	29	29	29
#7	69	60	53	49	45	42	40	38
#8	85	74	66	60	56	52	49	47
#9	103	89	80	73	67	63	59	56
#10	121	105	94	86	79	74	70	66
#11	140	122	109	99	92	86	81	77

TABLE 1.B: ¾" COVER TO OUTER LAYER BARS
INNER LAYER LAP LENGTHS (IN INCHES)

NOTE: USE TABLE 1.A IF BAR SPACING IS LESS THAN 4" O/C UP TO #8, 5" O/C FOR #9, #10, #11

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	16	16	16	16	16	16	16	16
#4	20	20	20	20	20	20	20	20
#5	24	24	24	24	24	24	24	24
#6	30	29	29	29	29	29	29	29
#7	48	42	38	34	34	34	34	34
#8	61	53	47	43	40	39	39	39
#9	75	65	58	53	49	46	44	44
#10	89	77	69	63	58	55	51	49
#11	104	90	81	74	68	64	60	57

TABLE 1.C: 1½" COVER TO OUTER LAYER BARS
OUTER LAYER LAP LENGTHS (IN INCHES)

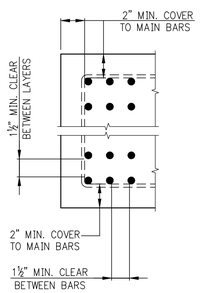
NOTE: USE TABLE 1.A IF BAR SPACING IS LESS THAN 4" O/C UP TO #8, 5" O/C FOR #9, #10, #11

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	16	16	16	16	16	16	16	16
#4	20	20	20	20	20	20	20	20
#5	24	24	24	24	24	24	24	24
#6	29	29	29	29	29	29	29	29
#7	42	37	34	34	34	34	34	34
#8	53	46	41	39	39	39	39	39
#9	66	57	51	46	44	44	44	44
#10	79	68	61	56	51	49	49	49
#11	92	80	72	65	60	57	54	54

TABLE 1.D: 1½" COVER TO OUTER LAYER BARS
INNER LAYER LAP LENGTHS (IN INCHES)

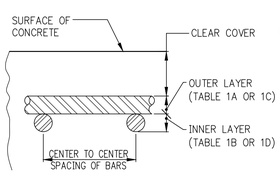
NOTE: USE TABLE 1.A IF BAR SPACING IS LESS THAN 5" O/C UP TO #8, 6" O/C FOR #9, #10, #11

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	16	16	16	16	16	16	16	16
#4	20	20	20	20	20	20	20	20
#5	24	24	24	24	24	24	24	24
#6	29	29	29	29	29	29	29	29
#7	37	34	34	34	34	34	34	34
#8	43	39	39	39	39	39	39	39
#9	53	46	44	44	44	44	44	44
#10	64	55	49	49	49	49	49	49
#11	75	65	58	54	54	54	54	54



MULTIPLE LAYERS

PROVIDE MINIMUM COVER AND CLEARANCES SHOWN, USE TABLE 1.A FOR LAP SPLICE LENGTHS.



NOTES FOR TENSION LAP SPLICES

1. REINFORCEMENT IS UNCOATED, WITH Fy=60,000 PSI.
2. CONCRETE IS NORMAL WEIGHT (144–150#/C.F.).
3. "TOP"' REINFORCEMENT:
   a. WHERE HORIZONTAL REINFORCEMENT IS PLACED SUCH THAT MORE THAN 12 INCHES OF FRESH CONCRETE IS CAST BELOW THE SPLICE, TABULATED LENGTHS MUST BE MULTIPLIED BY 1.3.
   b. SUCH LOCATIONS INCLUDE, BUT ARE NOT LIMITED TO, BEAMS, SLABS, FOOTINGS, MATS, AND WALLS.
   c. WALL HORIZONTAL REINFORCEMENT INCLUDE BARS EACH FACE , ADDED BARS, CORNER BARS, "U" BARS, ETC.
   d. "FRESH" CONCRETE INCLUDES ALL CONCRETE CAST BELOW "TOP" REINFORCEMENT WITHIN PERIOD OF TWO HOURS.
4. TABULATED LENGTHS MUST BE MULTIPLIED BY THE FOLLOWING MODIFICATION FACTORS:
   a. LIGHTWEIGHT CONCRETE 1.3
   b. EPOXY–COATED BARS:
      1.) BARS WITH COVER < 3db, OR WITH CLEAR SPACING < 6db ...1.5*
      2.) ALL OTHER CONDITIONS 1.2

   * FOR EPOXY–COATED 'TOP' BARS THE MAXIMUM FOR COMBINED FACTORS = 1.7
5. WHERE TENSION DEVELOPMENT LENGTH (Ld) IS REQUIRED ON PLANS OR IN DETAILS, SEE TENSION DEVELOPMENT LENGTH TABLES.
6. CLASS A LAP SPLICE LENGTHS (AS DEFINED AS BY ACI) ARE EQUAL TO TENSION DEVELOPMENT LENGTHS. SEE TABLES FOR TENSION DEVELOPMENT LENGTHS (Ld). APPLY APPROPRIATE MODIFICATION FACTORS TO CLASS A SPLICE LENGTHS.

TABLE #2:

TENSION DEVELOPMENT LENGTHS (Ld) (IN INCHES)

TABLE 2.A: ¾" COVER TO OUTER LAYER BARS
OUTER LAYER DEVELOPMENT LENGTHS

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	12	12	12	12	12	12	12	12
#4	16	14	13	12	12	12	12	12
#5	24	21	19	17	16	15	14	13
#6	33	28	25	23	22	20	19	18
#7	53	46	41	37	35	32	31	29
#8	66	57	51	46	43	40	38	36
#9	79	69	61	56	52	49	46	43
#10	93	81	72	66	61	57	54	51
#11	108	94	84	76	71	66	62	59

TABLE 2.B: ¾" COVER TO OUTER LAYER BARS
INNER LAYER DEVELOPMENT LENGTHS

NOTE: USE TABLE 2.A IF BAR SPACING IS LESS THAN 4" O.C. UP TO #8, 5" O.C. FOR #9, #10, #11

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	12	12	12	12	12	12	12	12
#4	13	12	12	12	12	12	12	12
#5	16	14	13	13	13	13	13	13
#6	23	20	18	16	15	15	15	15
#7	37	32	29	26	24	23	22	20
#8	47	41	36	33	31	29	27	26
#9	57	50	44	41	38	35	33	31
#10	68	59	53	48	45	42	40	38
#11	80	69	62	57	52	49	46	44

TABLE 2.C: 1½" COVER TO OUTER LAYER BARS
OUTER LAYER DEVELOPMENT LENGTHS

NOTE: USE TABLE 2.A IF BAR SPACING IS LESS THAN 4" O.C. UP TO #8, 5" O.C. FOR #9, #10, #11

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	12	12	12	12	12	12	12	12
#4	13	12	12	12	12	12	12	12
#5	16	14	13	13	13	13	13	13
#6	20	17	15	15	15	15	15	15
#7	32	28	25	23	21	20	19	18
#8	41	36	32	29	27	25	24	23
#9	50	44	39	36	33	31	29	28
#10	60	52	47	43	40	37	35	33
#11	71	61	55	50	46	43	41	39

TABLE 2.D: 1½" COVER TO OUTER LAYER BARS
INNER LAYER DEVELOPMENT LENGTHS

NOTE: USE TABLE 2.A IF BAR SPACING IS LESS THAN 5" O.C. UP TO #8, 6" O.C. FOR #9, #10, #11

BAR \ f'c	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	12	12	12	12	12	12	12	12
#4	13	12	12	12	12	12	12	12
#5	16	14	13	13	13	13	13	13
#6	20	17	15	15	15	15	15	15
#7	29	25	22	20	19	18	18	18
#8	33	28	25	23	22	20	20	20
#9	41	35	31	29	27	25	23	23
#10	49	42	38	35	32	30	28	27
#11	58	50	45	41	38	35	33	32

NOTES FOR TENSION DEVELOPMENT LENGTHS (Ld)

1. REINFORCEMENT IS UNCOATED, WITH Fy=60,000 PSI.
2. CONCRETE IS NORMAL WEIGHT (144–150#/C.F.).
3. "TOP"' REINFORCEMENT:
   a. WHERE HORIZONTAL REINFORCEMENT IS PLACED SUCH THAT MORE THAN 12 INCHES OF FRESH CONCRETE IS CAST BELOW THE DEVELOPMENT LENGTH, TABULATED LENGTHS MUST BE MULTIPLIED BY 1.3.
   b. SUCH LOCATIONS INCLUDE, BUT ARE NOT LIMITED TO, BEAMS, SLABS, FOOTINGS, MATS, AND WALLS.
   c. WALL HORIZONTAL REINFORCEMENT INCLUDE BARS EACH FACE , ADDED BARS, CORNER BARS, "U" BARS, ETC.
   d. "FRESH" CONCRETE INCLUDES ALL CONCRETE CAST BELOW "TOP" REINFORCEMENT WITHIN PERIOD OF TWO HOURS.
4. TABULATED LENGTHS MUST BE MULTIPLIED BY THE FOLLOWING MODIFICATION FACTORS:
   a. LIGHTWEIGHT CONCRETE 1.3
   b. EPOXY–COATED BARS:
      1.) BARS WITH COVER < 3db, OR WITH CLEAR SPACING < 6db ...1.5*
      2.) ALL OTHER CONDITIONS 1.2

   * FOR EPOXY–COATED 'TOP' BARS THE MAXIMUM FOR COMBINED FACTORS = 1.7
5. WHERE TENSION DEVELOPMENT LENGTH (Ld) IS REQUIRED ON PLANS OR IN DETAILS, SEE TENSION DEVELOPMENT LENGTH TABLES.
6. CLASS A LAP SPLICE LENGTHS (AS DEFINED BY ACI) ARE EQUAL TO TENSION DEVELOPMENT LENGTHS. SEE TABLES FOR TENSION DEVELOPMENT LENGTHS (Ld). APPLY APPROPRIATE MODIFICATION FACTORS TO CLASS A SPLICE LENGTHS.

TABLE #3

TENSION DEVELOPMENT LENGTHS FOR STANDARD END HOOKS (ldh)

(LENGTHS IN INCHES)

BAR SIZE	CONCRETE STRENGTH (PSI)							
	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000+
#3	9	7	7	6	6	6	6	6
#4	11	10	9	8	7	7	7	6
#5	14	12	11	10	9	9	8	8
#6	17	15	13	12	11	10	10	9
#7	19	17	15	14	13	12	11	11
#8	22	19	17	16	15	14	13	12
#9	25	22	19	18	16	15	15	14
#10	28	24	22	20	19	17	16	16
#11	31	27	24	22	21	19	18	17
#14	37	32	29	27	25	23	22	21
#18	50	43	39	35	33	31	29	27

NOTES:

1. TABLE #3 CONFORMS TO ACI 318–2002 (AND 2005). TABULATED VALUES ARE BASED UPON ACI 12.5.2 , ASSUMING GRADE 60 REINFORCEMENT AND NORMALWEIGHT CONCRETE.
2. PER ACI 12.5.3 (a), FOR #11 AND SMALLER BARS, IF COVER TO BAR IS 2½ INCHES OR MORE, AND FOR 90 DEGREE HOOK WITH COVER ON BAR EXTENSION BEYOND HOOK NOT LESS THAN 2 INCHES, A MODIFICATION FACTOR OF 0.7 MAY BE APPLIED. MINIMUM ldh SHALL NOT BE LESS THAN 8db NOR 6 INCHES.

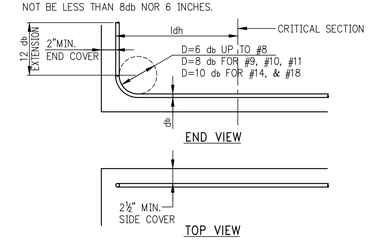


TABLE #4

COMPRESSION LAP SPLICES

(LENGTHS IN INCHES)

BAR SIZE	GRADE OF REINFORCEMENT		
	60 KSI (30 DIA.)	75 KSI (44 DIA.)	80 KSI (48 DIA.)
#3	12	17	18
#4	15	22	24
#5	19	28	30
#6	23	33	36
#7	27	39	42
#8	30	44	48
#9	34	50	54
#10	38	56	61
#11	43	62	68
#14 AND #18	1. LAP SPLICES ARE NOT PERMITTED. USE MECHANICAL CONNECTIONS OR WELDED SPLICES FOR #14 AND #18, PER ACI 318 (12.14.3). 2. LAP SPLICES OF #14 AND #18 BARS TO #11 AND SMALLER BARS ARE PERMITTED PER ACI 318 (12.16.2).		

3. FOR BARS OF DIFFERENT SIZE, USE LARGER OF: SPLICE LENGTH OF SMALLER BAR (TABLE #4) OR DEVELOPMENT LENGTH OF LARGER BAR (FROM TABLE #5) PER ACI 318 (12.16.2).

NOTE:

TABLE #4 APPLIES FOR NORMALWEIGHT CONCRETE WITH f'c = 3,000 PSI OR GREATER.

TABLE #5

DEVELOPMENT LENGTHS FOR BARS IN COMPRESSION

(LENGTHS IN INCHES)

BAR SIZE	fy = 60,000 PSI			fy = 75,000 PSI			fy = 80,000 PSI		
	CONC. f'c (IN PSI)			CONC. f'c (IN PSI)			CONC. f'c (IN PSI)		
	3,000	4,000	5,000 OR MORE	3,000	4,000	5,000 OR MORE	3,000	4,000	5,000 OR MORE
#3	12	12	12	12	12	12	12	12	12
#4	12	12	12	14	12	12	15	13	12
#5	14	12	12	17	15	14	18	16	15
#6	17	15	14	21	18	17	22	19	18
#7	19	17	16	24	21	20	26	22	21
#8	22	19	18	28	24	23	29	25	24
#9	25	22	21	31	27	25	33	28	27
#10	28	24	23	34	30	28	36	31	30
#11	31	27	26	38	33	31	40	34	33
#14	37	32	31	48	42	39	51	44	42
#18	50	43	41	62	54	51	65	56	54

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FAIRFIELD INN & SUITES SM Marriott

SPRINGHILL SUITES ® Marriott

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SEAL & SIGNATURE:

STATE OF NEW YORK · SUSAN L. MARCUS · 057139 · LICENSED PROFESSIONAL ENGINEER

DATE: APRIL 07, 2015
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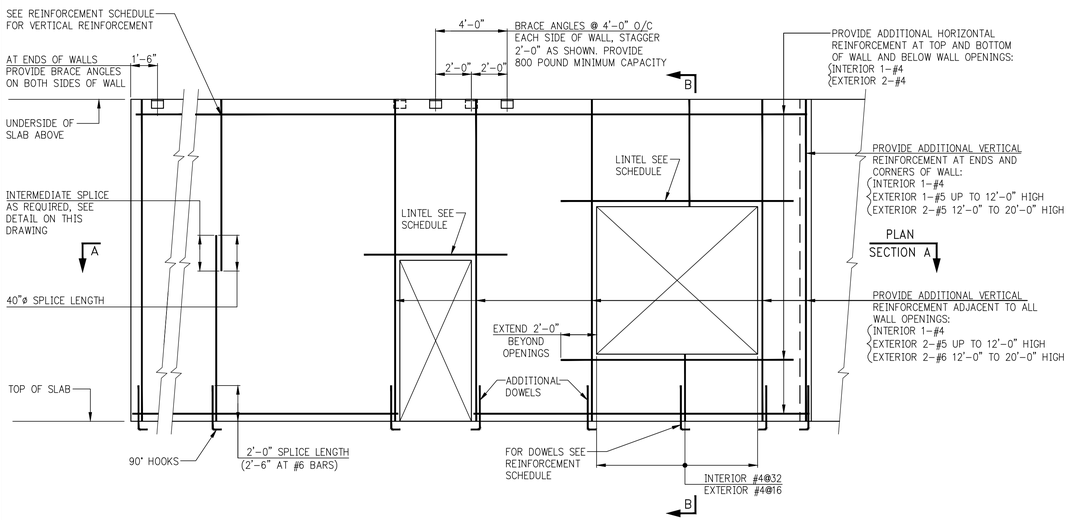
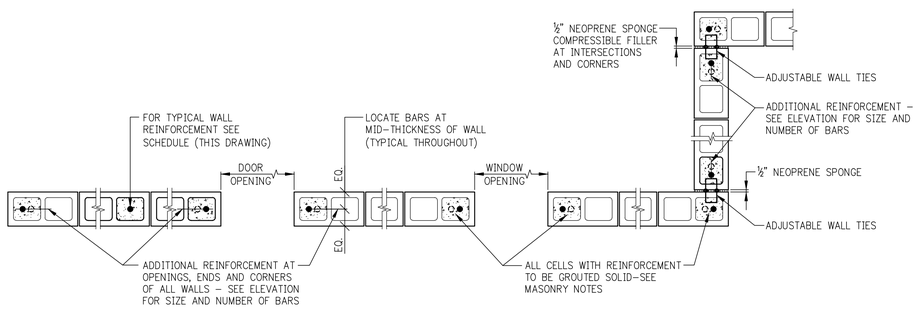


WALL REINFORCEMENT ELEVATION

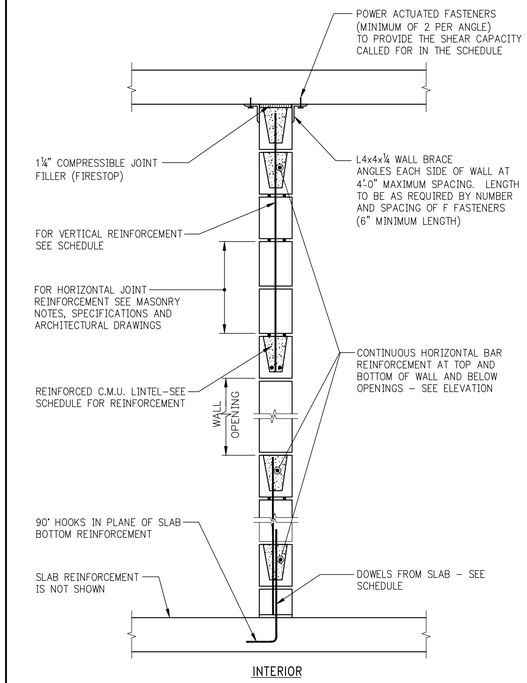
NOTES:

1. ABOVE DETAIL APPLIES TO ALL MASONRY (C.M.U.) WALLS.
2. FOR MULTIWYTHE EXTERIOR WALLS ABOVE DETAIL APPLIES TO C.M.U. BACKUP WALL ONLY. SEE SECTION BELOW FOR ADDITIONAL INFORMATION



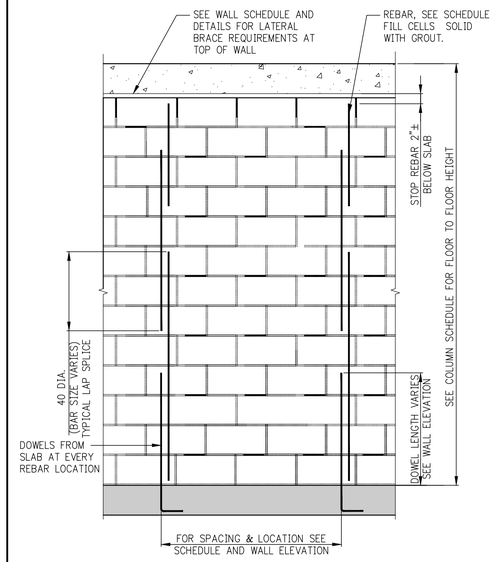
PLAN SECTION A

(FOR DOWELS SEE ELEVATION)



INTERIOR

SECTION B



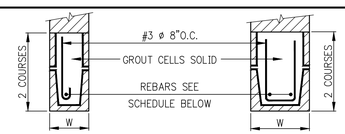
SPLICE LENGTH OF REBAR IN CMU WALL

TYPE OF LOADING *	LINTEL SECTION NOMINAL SIZE (IN.)	REQUIRED REINFORCEMENT — CLEAR SPAN 3'-4"	4'-0"	4'-8"	5'-4"	6'-0"	6'-8"	7'-4"	8'-0"	10'-0"
WALL LOADS	6x8	1-#4	1-#4	1-#4	2-#4	2-#5	–	–	–	–
	6x16	–	–	–	–	2-#4	2-#4	2-#4	2-#4	2-#5
FLOOR & ROOF LOADS	6x16	1-#4	1-#4	1-#4	1-#5	2-#4	2-#4	2-#5	2-#5	2-#6
WALL LOADS	8x8	1-#4	2-#4	2-#4	2-#4	2-#4	2-#5	2-#6	–	–
	8x16	–	–	–	–	–	–	2-#5	2-#5	2-#6
FLOOR & ROOF LOADS	8x8	2-#4	–	–	–	–	–	–	–	–
	8x16	2-#4	2-#4	2-#4	2-#4	2-#4	2-#4	2-#5	2-#5	2-#6

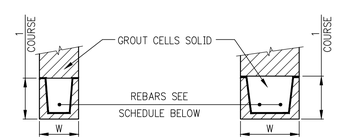
(*) INCLUDES WEIGHT OF LINTEL

NOTES:

1. WALL LOADS ASSUMED 300lbs. PER LINEAR FOOT.
2. FLOOR & ROOF LOADS INCLUDING WALL LOADS ASSUMED 1000lbs. PER LINEAR FOOT.
3. 8" LINTELS ASSUMED TO WEIGH 50#/FT.
4. 16" LINTELS ASSUMED TO WEIGH 100#/FT.
5. IF ACTUAL LOADS EXCEED THOSE ASSUMED, CONTRACTOR IS TO OBTAIN DIRECTION FROM THE ENGINEER.
6. FOR LINTELS OVER 10'-0" LONG, CONTRACTOR IS TO OBTAIN DIRECTION FROM THE ENGINEER.



TWO COURSE (16" DEEP) LINTELS

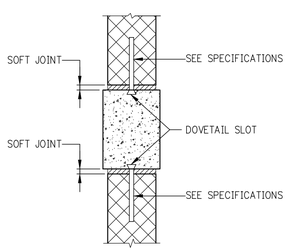


SINGLE COURSE (8" DEEP) LINTELS

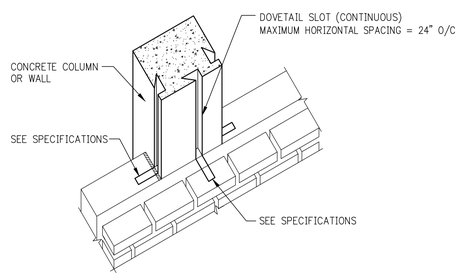
NOTES:

1. PROVIDE BLOCK LINTELS FOR ALL OPENINGS IN INTERIOR BLOCK PARTITIONS, AND EXTERIOR WALLS FOR WHICH STEEL LINTELS ARE NOT SHOWN. REFER TO ARCHITECTURAL DRAWINGS FOR SIZE AND LOCATION OF OPENINGS. PROVIDE 8" MINIMUM BEARING AT EACH END.
2. W AS PER TABLE (FIRST DIMENSION).
3. GROUT SHALL BE FINE ONLY.

REINFORCED BLOCK LINTEL



PART PLAN AT INTERIOR COLUMN SHOWING PARTITION ANCHORAGE



ISOMETRIC SHOWING DOVETAIL SLOT ANCHORS IN CONCRETE COLUMN OR WALL

C.M.U. WALL REINFORCEMENT SCHEDULE (AND LATERAL BRACING LOAD AT TOP)

LOCATION AND HEIGHT OF WALL	MINIMUM BLOCK THICKNESS	VERTICAL REINFORCEMENT	DOWELS FROM SLAB	LATERAL BRACING FORCE (TOP) #/FOOT	REMARKS
INTERIOR UP TO 10'-0"	4"	#4@8'-0"	#4@8'-0"		
INTERIOR 10'-1" TO 16'-0"	6"	#4@48	#4@48		
INTERIOR 16'-1" TO 20'-0"	8"	#4@48	#4@48		
EXTERIOR UP TO 8'-0"	4"	#4@32	#4@16		
EXTERIOR 8'-1" TO 10'-0"	6"	#4@32	#4@16		
EXTERIOR 10'-1" TO 12'-0"	8"	#4@32	#4@16		
EXTERIOR 12'-1" TO 16'-0"	8"	#4@16	#5@16		
EXTERIOR 16'-1" TO 20'-0"	12"	#4@16	#5@16		
EXTERIOR CANTILEVER (PARAPET, ETC.) UP TO 8'-0"	8"	#4@16	#5@16		

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LOOSE LINTEL SCHEDULE
(ANGLES OR W-SHAPE PLUS PLATE)

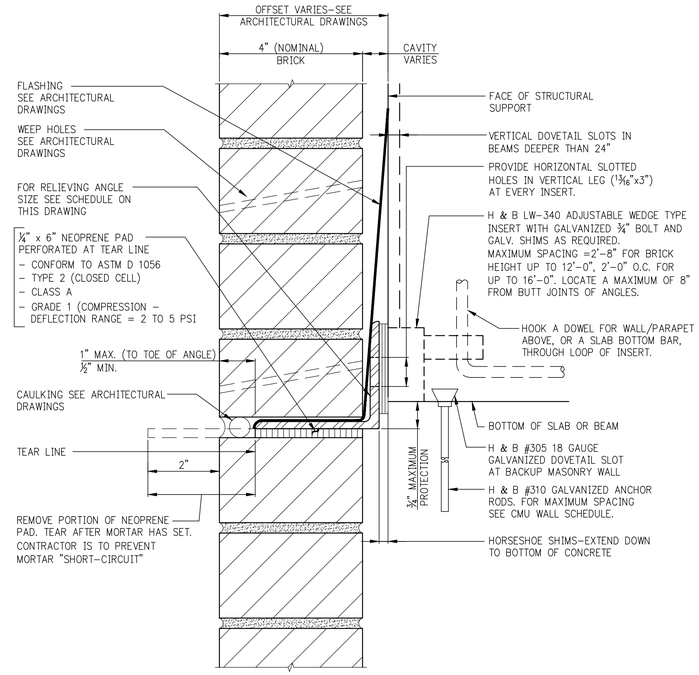
MASONRY OPENING	ANGLE SIZE PER EACH 4" WIDTH OF MASONRY (OR W + PL)	ANGLE SIZE FOR 6" WIDTH OF MASONRY
UP TO 5'-0"	L3½ x 3½ x 5/16	L6 x 4 x ⅜
5'-1" TO 8'-0"	L6 x 3½ x 5/16	L6 x 4 x ½
8'-1" TO 10'-8"	L6 x 3½ x ⅜	–
10'-9" TO 14'-0"	W8x15 + BOTTOM PL ⅜ x 7 (WELD PLATE TO BOTTOM FLANGE)	–

NOTES:
1. ANGLE LENGTH = MASONRY OPENING PLUS 1'-0" (6" BEARING AT EACH END).
2. ANGLE LONG LEG IS VERTICAL.
3. W8 + PL TO BE USED AT 8" WIDE WALL ONLY.
4. PROVIDE FIREPROOFING ON LINTELS FOR MASONRY OPENINGS GREATER THAN 4'-0", AS REQUIRED BY CODE.
5. JOINTS SHALL NOT BE LOCATED OVER THE MASONRY OPENING.

SCHEDULE OF BRICK RELIEVING ANGLES FOR VARYING OFFSETS
(OUTSIDE FACE OF BRICK TO FACE OF SUPPORT)

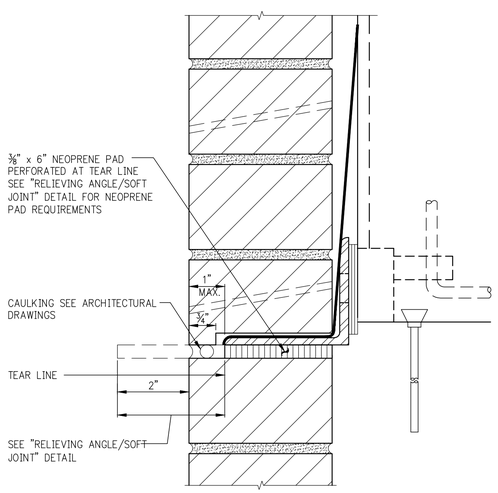
OFFSET DIMENSION	RELIEVING ANGLE SIZE	H & B LW-340 INSERT SPACING VS. BRICK HEIGHT		REMARKS
		BRICK HEIGHT (FL-FL TYPICAL)	INSERT SPACING	
5 IN	L6 x 4 x 5/16 LLV	UP TO 12F	32" O/C	
		12F TO 16F	24" O/C	
6 IN	L5 x 5 x 5/16	UP TO 12F	32" O/C	
		12F TO 16F	24" O/C	
7 IN	L6 x 6 x ⅜	UP TO 12F	32" O/C	
		12F TO 16F	24" O/C	
8 IN	L6* x 6 x 7/16 LLH	UP TO 12F	32" O/C	*TRIM 1" FROM 8" LEG
		12F TO 16F	24" O/C	

NOTES:
1. ALL BOLTS ¾" DIAMETER.
2. ALL ANGLES TO BE A36, ANGLES, BOLTS AND SHIMS TO BE GALVANIZED.



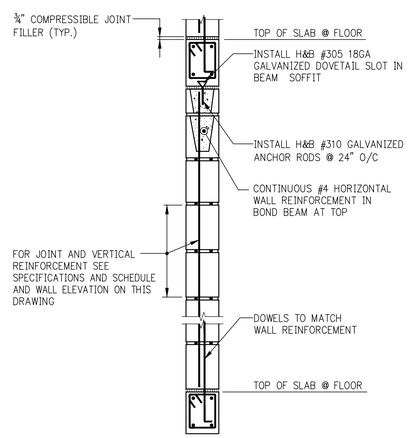
RELIEVING ANGLE/SOFT JOINT

NOTES:
1. SEE ARCHITECTURAL DRAWINGS FOR ADDITIONAL INFORMATION AND FURTHER MASONRY REQUIREMENTS.
2. PROVIDE AT EVERY FLOOR AND AT INTERMEDIATE LEVELS.
3. "H&B" REPRESENTS HOHMANN & BARNARD INC. OR APPROVED EQUAL.

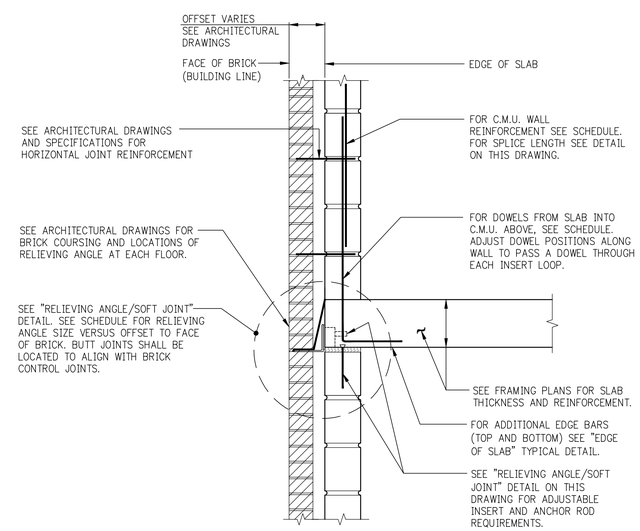


SOFT JOINT WITH LIP BRICK

NOTE:
FOR ALL DETAILS OTHER THAN LIP BRICK AND NEOPRENE PAD, SEE "RELIEVING ANGLE/SOFT JOINT" DETAIL ON THIS DRAWING.



WALL ANCHORAGE AT BEAMS BETWEEN SCISSOR STAIRS



SLAB EDGE AT BRICK CAVITY WALL

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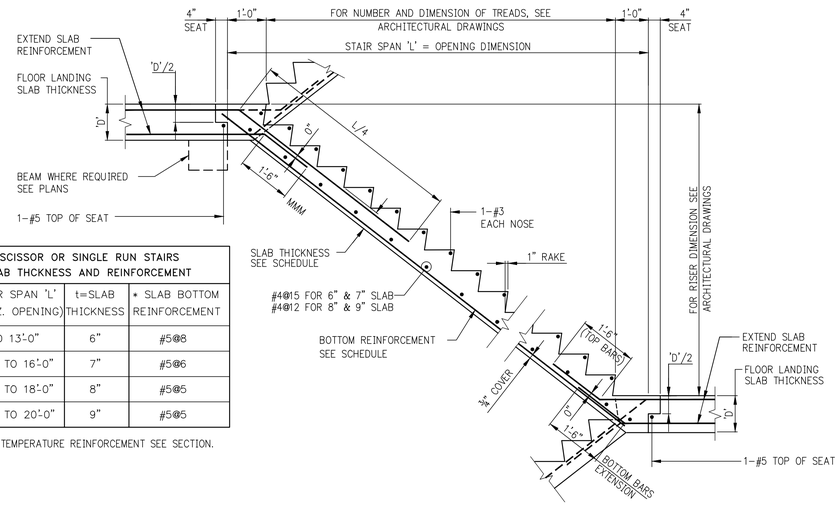
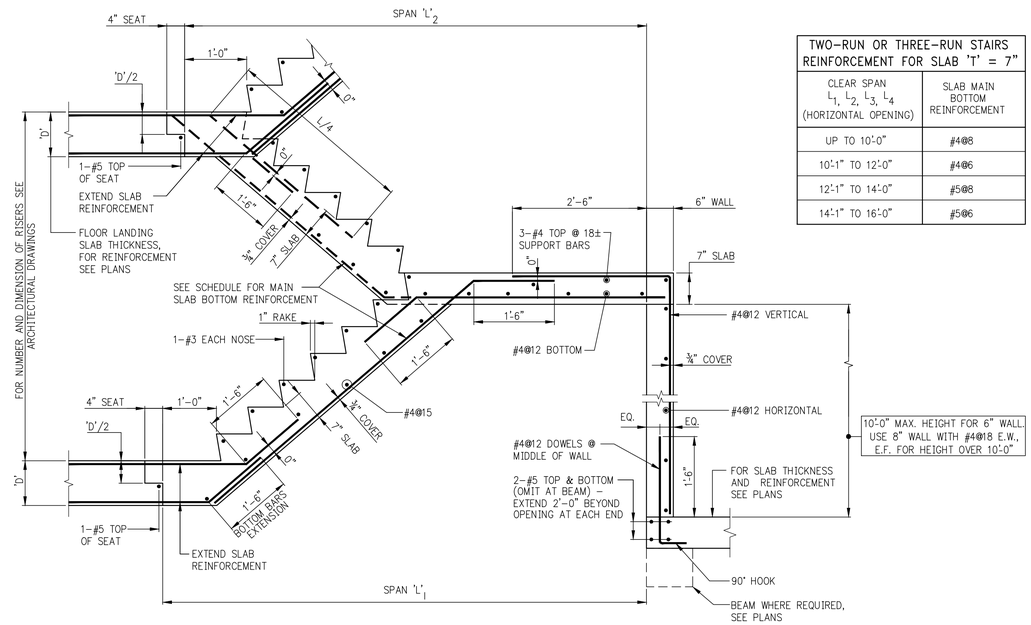


SCISSOR OR SINGLE RUN STAIRS SLAB THCKNESS AND REINFORCEMENT		
CLEAR SPAN 'L' (HORIZ. OPENING)	t=SLAB THICKNESS	* SLAB BOTTOM REINFORCEMENT
UP TO 13'-0"	6"	#5@8
13'-1" TO 16'-0"	7"	#5@6
16'-1" TO 18'-0"	8"	#5@5
18'-1" TO 20'-0"	9"	#5@5

* FOR TEMPERATURE REINFORCEMENT SEE SECTION.

SCISSOR OR SINGLE RUN STAIR

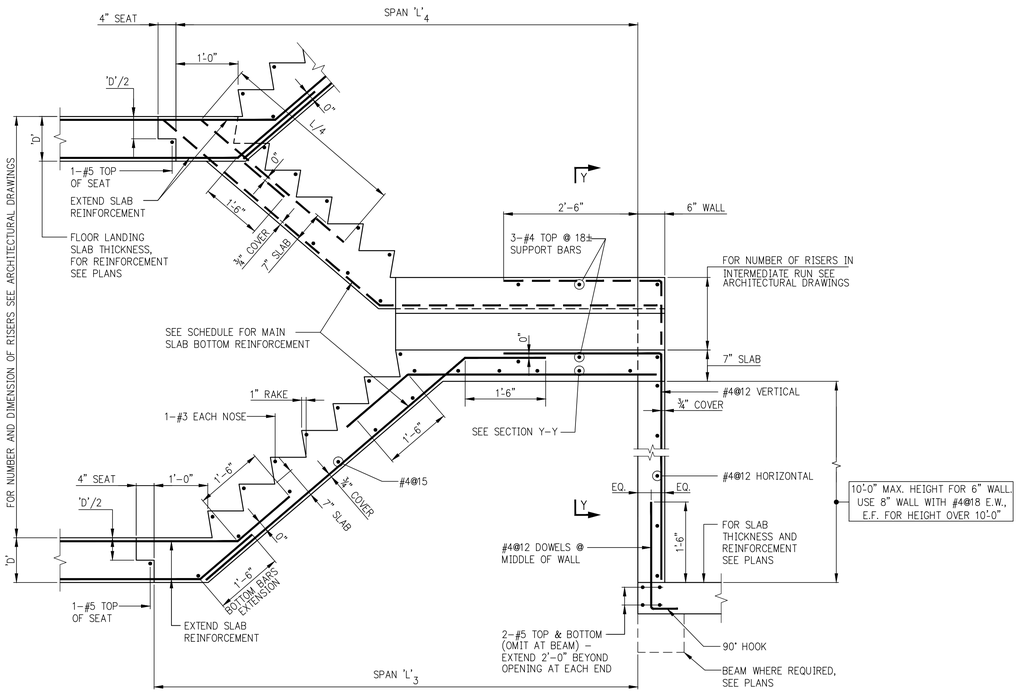
FOR FLOOR REINFORCEMENT EXTENDED INTO STAIR SLAB, SEE FRAMING PLANS.



TWO-RUN OR THREE-RUN STAIRS REINFORCEMENT FOR SLAB 'T' = 7"	
CLEAR SPAN L_1, L_2, L_3, L_4 (HORIZONTAL OPENING)	SLAB MAIN BOTTOM REINFORCEMENT
UP TO 10'-0"	#4@8
10'-1" TO 12'-0"	#4@6
12'-1" TO 14'-0"	#5@8
14'-1" TO 16'-0"	#5@6

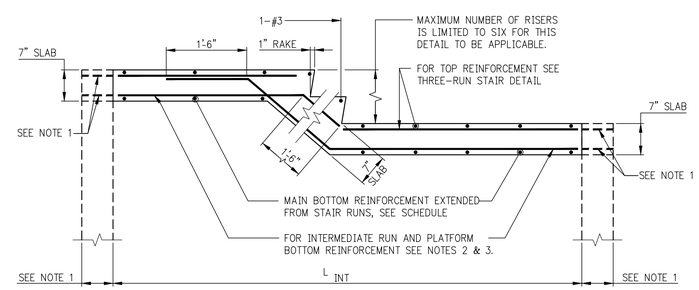
10'-0" MAX. HEIGHT FOR 6" WALL. USE 8" WALL WITH #4@18 E.W., E.F. FOR HEIGHT OVER 10'-0"

TWO-RUN STAIR



10'-0" MAX. HEIGHT FOR 6" WALL. USE 8" WALL WITH #4@18 E.W., E.F. FOR HEIGHT OVER 10'-0"

THREE-RUN STAIR

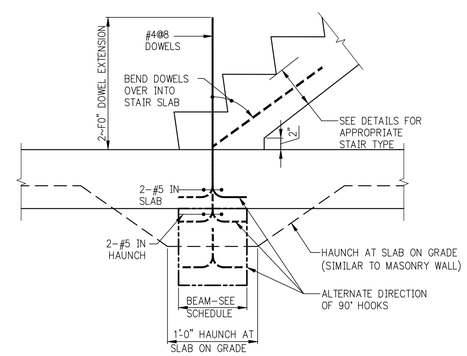


SECTION Y-Y

(AT THREE-RUN STAIR)

NOTES:

1. EXTEND SLAB AND REINFORCEMENT OVER SUPPORT WALLS WHERE WALLS ARE SHOWN ON PLANS.
2. WHERE L_{INT} IS NOT SUPPORTED AT ENDS, PROVIDE: #4@12 BOTTOM
3. WHERE L_{INT} IS SUPPORTED, PROVIDE: #4@8 FOR L_{INT} UP TO 10'-0", #4@6 FOR L_{INT} BETWEEN 10'-1" AND 12'-0". FOR L_{INT} SPANNING MORE THAN 12'-0", DESIGNER TO PROVIDE DETAILS.



BOTTOM OF STAIR-NO SLAB OPENING

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECTS. DO NOT SCALE THE DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE CONSULTANTS.

REVISIONS:

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03	05-13-15	ISSUE TO OER
02	04-17-15	SUPERSTRUCTURE BID SET
01	04-07-15	ISSUED TO DOB
#	DATE	DESCRIPTION

ISSUED DRAWINGS:

GENE KAUFMAN ARCHITECT PC

525 BROADWAY, NEW YORK, N.Y. 10012
TEL. (212) 625-8700 FAX. (212) 625-8867

338 WEST 36TH STREET
NEW YORK, NY

T□□IC□L ST□□ DET□ILS

SEAL & SIGNATURE:

STATE OF NEW YORK · SULIMAN L. MALIK · 057530 · LICENSED PROFESSIONAL ENGINEER

DATE: APRIL 07, 2015
SCALE: AS NOTED
DRAWING NUMBER:

S-980.00

PAGE#: 33 OF XX

APPENDIX 2

CITIZEN PARTICIPATION PLAN

The NYC Office of Environmental Remediation and West 36 LLC 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, West 36 LLC 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, Samantha Morris, 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 online. Internet access to view OER's document repositories is available at public libraries. This document repository is intended to house, for community review, all principal documents generated during the cleanup program including Remedial Investigation plans and reports, Remedial Action work plans and reports, and all public notices and fact sheets produced during the lifetime of the remedial project. The library nearest the Site is:

New York Public Library – Stephen A. Schwarzman Building
461 Fifth Avenue (At Fifth Avenue and 42nd St)
New York, NY 10016
(917) 275-6975
Hours of Operation

Sun	1:00pm - 5:00pm
Mon	10:00am - 6:00pm
Tue	10:00am - 8:00pm
Wed	10:00am - 8:00pm
Thu	10:00am - 6:00pm
Fri	10:00am - 6:00pm
Sat	10:00am - 6:00pm

Digital Documentation: NYC OER requires the use of digital documents in our repository as a means of minimizing paper use while also increasing convenience in access and ease of use.

Issues of Public Concern: The major issues of concern to the public will be potential impacts of nuisance odors and dust during the disturbance of soil at the Site. This work will be performed in accordance with procedures that will be specified under a Remedial Program and considers and takes preventive measures for exposure to future residents of the property and those on adjacent properties during construction. Detailed plans to monitor the potential for

exposure including a CHASP and a CAMP are required components of the remedial program. Implementation of these plans will be under the direct oversight of the NYCOER.

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 reviewed and approved by OER prior to distribution and mailed by the Enrollee. 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. 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 to the Site and announcing the issuance of the Notice of Completion.

APPENDIX 3

SUSTAINABILITY STATEMENT

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

Reuse of Clean, Recyclable Materials and Reduced Consumption of Non-Renewable Resources: 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.

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.

Natural gas will be utilized for fuel in the new building.

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

Stormwater Retention: Stormwater retention improves water quality by lowering the rate of combined stormwater and sewer discharges to NYC's sewage treatment plants during periods of precipitation, and reduces the volume of untreated influent to local surface waters.
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 Voluntary Cleanup Program: West 336 LLC is participating in OER's Paperless Voluntary 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: West 336 LLC is participating in OER's low-energy project management program. Under this program, whenever possible, meetings are held using remote communication technologies, such as videoconferencing and teleconferencing to reduce energy consumption and traffic congestion associated with personal transportation.

Trees and Plantings: Trees and other plantings provide habitat and add to NYC's environmental quality in a wide variety of ways. Native plant species and native habitat provide optimal support to local fauna, promote local biodiversity, and require less maintenance.
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 4

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 final remedial report. Soil screening will be performed during invasive work performed during the remedy and development phases prior to issuance of final signoff by OER.

1.2 Stockpile Methods

Excavated soil from suspected areas of contamination (e.g., hot spots, USTs, drains, etc.) will be stockpiled separately and will be segregated from clean soil and construction materials. Stockpiles will be used only when necessary and will be removed as soon as practicable. While stockpiles are in place, they will be inspected daily, and before and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by OER. Excavated soils will be stockpiled on, at minimum, double layers of 8-mil minimum sheeting, will be kept covered at all times with appropriately anchored plastic tarps, and will be routinely inspected. Broken or ripped tarps will be promptly replaced.
All stockpile activities will be compliant with applicable laws and regulations. Soil stockpile areas will be appropriately graded to control run-off in accordance with applicable laws and regulations. Stockpiles of excavated soils and other materials shall be located at least of 50 feet from the property boundaries, where possible. Hay bales or equivalent will surround soil stockpiles except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

1.3 Characterization of Excavated Materials

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

1.4 Materials Excavation, Load-Out, and Departure

The PE/QEP overseeing the remedial action will:

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

Locations where vehicles exit the Site shall be inspected daily for evidence of soil tracking off premises. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.

Open and uncontrolled mechanical processing of historical fill and contaminated soil on-Site will not be performed without prior OER approval.

1.5 Off-Site Materials Transport

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

Outbound truck transport routes are described in the remedial report. 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 New York City 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 final remedial report.

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 final remedial report.

All impacted soil/fill or other waste excavated and removed from the Site will be managed as regulated material and will be disposed in accordance with applicable laws and regulations. Historic fill and contaminated soils taken off-Site will be handled as solid waste and will not be disposed at a Part 360-16 Registration Facility (also known as a Soil Recycling Facility). Waste characterization will be performed for off-Site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be

reported in the final remedial report. A manifest system for off-Site transportation of exported materials will be employed. Manifest information will be reported in the final remedial report. Hazardous wastes derived from on-Site will be stored, transported, and disposed of in compliance with applicable laws and regulations.

If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e., clean soil removed for development purposes), including transport to a Part 360-16 Registration Facility, a formal request will be made for approval by OER with an associated plan compliant with 6NYCRR Part 360-16. This request and plan will include the location, volume and a description of the material to be recycled, including verification that the material is not impacted by site uses and that the material complies with receipt requirements for recycling under 6NYCRR Part 360. This material will be appropriately handled on-Site to prevent mixing with impacted material.

1.7 Materials Reuse On-Site

Soil and fill that is derived from the property that meets the Soil Cleanup Objectives (SCOs) established in this plan may be reused on-Site. The SCOs for on-Site reuse are listed in Section 4.2 of this cleanup plan. 'Reuse on-Site' means material that is excavated during the remedy or development, does not leave the property, and is relocated within the same property and on land with comparable levels of contaminants in soil/fill material, compliant with applicable laws and regulations, 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 remedial plan are followed. The expected location for placement of reused material is shown in Section 4.2.

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

1.8 Demarcation

After completion of hotspot removal and any other invasive remedial activities, and prior to backfilling, the top of the residual soil/fill will be defined by one of three methods: (1) placement of a demarcation layer. The demarcation layer will consist of geosynthetic fencing or equivalent

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

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

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. All imported soils will meet OER-approved backfill and cover soil quality objectives for this Site. The backfill quality objectives are listed in Section 4.2. A process will be established to evaluate sources of backfill to be imported to the Site, and will include an examination of source location, current and historical use(s), and any applicable documentation. Material from industrial sites, spill sites, environmental remediation sites or other potentially contaminated sites will not be imported to the Site.

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

- Clean soil from construction projects at non-industrial sites in compliance with applicable laws and regulations;
- Clean soil from roadway or other transportation-related projects in compliance with applicable laws and regulations;
- Clean recycled concrete aggregate (RCA) from facilities permitted or registered by the regulations of 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 remedial plan. The final remedial report 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.

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

Composite samples of imported material will be taken at a minimum frequency of one sample for every 500 cubic yards of material. Once it is determined that the fill material meets imported backfill or cover soil chemical requirements and is non-hazardous, and lacks petroleum contamination, the material will be loaded onto trucks for delivery to the Site.
Recycled concrete aggregate (RCA) will be imported from facilities permitted or registered by NYSDEC. Facilities will be identified in the final remedial report. 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. Liquids discharged into the New York City sewer system will receive prior approval by New York City Department of Environmental Protection (NYC DEP). The NYC DEP regulates discharges to the New York City sewers under Title 15, Rules of the City of New York Chapter 19. Discharge to the New

York City sewer system will require an authorization and sampling data demonstrating that the groundwater meets the City's discharge criteria. The dewatering fluid will be pretreated as necessary to meet the NYC DEP discharge criteria. If discharge to the City sewer system is not appropriate, the dewatering fluids will be managed by transportation and disposal at an off-Site treatment facility.

Discharge of water generated during remedial construction to surface waters (i.e. a stream or river) is prohibited without a SPDES permit issued by New York State Department of Environmental Conservation.

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 remedial plan (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 for Unknown Contamination Sources

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

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

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 this remedial plan.

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 5

VAPOR BARRIER SPECIFICATIONS

VAPORBLOCK® PLUS™ VBP20

Under-Slab Vapor / Gas Barrier

RAVEN INDUSTRIES

Product Description

VaporBlock® Plus™ 20 is a seven-layer co-extruded barrier made from state-of-the-art polyethylene and EVOH resins to provide unmatched impact strength as well as superior resistance to gas and moisture transmission. VaporBlock® Plus™ 20 is a highly resilient underslab / vertical wall barrier designed to restrict naturally occurring gases such as radon and/or methane from migrating through the ground and concrete slab. VaporBlock® Plus™ 20 is more than 100 times less permeable than typical high-performance polyethylene vapor retarders against Methane, Radon and other harmful VOCs.

VaporBlock® Plus™ 20 is one of the most effective underslab gas barriers in the building industry today far exceeding ASTM E-1745 (Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs) Class A, B and C requirements. Available in a 20 (Class A) mil thicknesses designed to meet the most stringent requirements. VaporBlock® Plus™ 20 is produced within the strict guidelines of our ISO 9001:2008 Certified Management System.

Product Use

VaporBlock® Plus™ 20 resists gas and moisture migration into the building envelop when properly installed to provide protection from toxic/harmful chemicals. It can be installed as part of a passive or active control system extending across the entire building including floors, walls and crawl spaces. When installed as a passive system it is recommended to also include a ventilated system with sump(s) that could be converted to an active control system with properly designed ventilation fans.

VaporBlock® Plus™ 20 works to protect your flooring and other moisture-sensitive furnishings in the building's interior from moisture and water vapor migration, greatly reducing condensation, mold and degradation.

Size & Packaging

VaporBlock® Plus™ 20 is available in 10' x 150' rolls to maximize coverage. All rolls are folded on heavy-duty cores for ease in handling and installation. Other custom sizes with factory welded seams are available based on minimum volume requirements. Installation instructions and ASTM E-1745 classifications accompany each roll.

Under-Slab Vapor/Gas Retarder

Product	Part #
VaporBlock Plus 20	VBP20

APPLICATIONS

- Radon Barrier
- Methane Barrier
- VOC Barrier
- Under-Slab Vapor Retarder
- Foundation Wall Vapor Retarder

VaporBlock® Plus™
UNDERSLAB VAPOR RETARDER / GAS BARRIER

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VAPORBLOCK® PLUS™ VBP20

Under-Slab Vapor / Gas Barrier

PROPERTIES	TEST METHOD	VAPORBLOCK PLUS 20 IMPERIAL	VAPORBLOCK PLUS 20 METRIC
Appearance		White/Gold	
Thickness, Nominal		20 mil	0.51 mm
Weight		102 lbs/MSF	498 g/m²
Classification	ASTM E 1745	CLASS A, B & C	
Tensile Strength lbf/in (N/cm) average MD & TD (new material)	ASTM E 154 Section 9 (D-882)	58 lbf	102 N
Impact Resistance	ASTM D 1709	2600 g	
Maximum Use Temperature		180° F	82° C
Minimum Use Temperature		-70° F	-57° C
Permeance (new material)	ASTM E 154 Section 7 ASTM E 96 Procedure B	0.0098 Perms grains/(ft²·hr·in·Hg)	0.0064 Perms g/(24hr·m²·mm Hg)
(after conditioning) Perms (same measurement as above permeance)	ASTM E 154 Section 8, E96 Section 11, E96 Section 12, E96 Section 13, E96	0.0079 0.0079 0.0097 0.0113	0.0052 0.0052 0.0064 0.0074
WVTR	ASTM E 96 Procedure B	0.0040 grains/hr-ft²	0.0028 gm/hr-m²
Radon Diffusion Coeffiecient	K124/02/95	< 1.1 x 10^{-13} m²/s	
Methane Permeance	ASTM D 1434	< 1.7 x 10^{-10} m²/d• atm 0.32 GTR (Gas Transmission Rate) ml/m²•D•ATM	

VaporBlock® Plus™ Placement

All instructions on architectural or structural drawings should be reviewed and followed.
Detailed installation instructions accompany each roll of VaporBlock® Plus™ and can also be located on our website.
ASTM E-1643 also provides general installation information for vapor retarders.

VaporBlock® Plus™ UNDERSLAB VAPOR RETARDER / GAS BARRIER

VaporBlock® Plus™ is a seven-layer co-extruded barrier made using high quality virgin-grade polyethylene and EVOH resins to provide unmatched impact strength as well as superior resistance to gas and moisture transmission.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage. Limited Warranty available at www.RavenEFD.com

RAVEN INDUSTRIES

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Email: **efdsales@ravenind.com**
www.ravenefd.com
1/11 EFD 1125

Scan QR Code to download current technical data sheets via the Raven website.

VAPORBLOCK® PLUS™ VBP20

Under-Slab Vapor / Gas Barrier

RAVEN INDUSTRIES

Product Description

VaporBlock® Plus™ 20 is a seven-layer co-extruded barrier made from state-of-the-art polyethylene and EVOH resins to provide unmatched impact strength as well as superior resistance to gas and moisture transmission. VaporBlock® Plus™ 20 is a highly resilient underslab / vertical wall barrier designed to restrict naturally occurring gases such as radon and/or methane from migrating through the ground and concrete slab. VaporBlock® Plus™ 20 is more than 100 times less permeable than typical high-performance polyethylene vapor retarders against Methane, Radon and other harmful VOCs.

VaporBlock® Plus™ 20 is one of the most effective underslab gas barriers in the building industry today far exceeding ASTM E-1745 (Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs) Class A, B and C requirements. Available in a 20 (Class A) mil thicknesses designed to meet the most stringent requirements. VaporBlock® Plus™ 20 is produced within the strict guidelines of our ISO 9001:2008 Certified Management System.

Product Use

VaporBlock® Plus™ 20 resists gas and moisture migration into the building envelop when properly installed to provide protection from toxic/harmful chemicals. It can be installed as part of a passive or active control system extending across the entire building including floors, walls and crawl spaces. When installed as a passive system it is recommended to also include a ventilated system with sump(s) that could be converted to an active control system with properly designed ventilation fans.

VaporBlock® Plus™ 20 works to protect your flooring and other moisture-sensitive furnishings in the building's interior from moisture and water vapor migration, greatly reducing condensation, mold and degradation.

Size & Packaging

VaporBlock® Plus™ 20 is available in 10' x 150' rolls to maximize coverage. All rolls are folded on heavy-duty cores for ease in handling and installation. Other custom sizes with factory welded seams are available based on minimum volume requirements. Installation instructions and ASTM E-1745 classifications accompany each roll.

Under-Slab Vapor/Gas Retarder

Product	Part #
VaporBlock Plus 20	VBP 20

APPLICATIONS

- Radon Barrier
- Methane Barrier
- VOC Barrier
- Under-Slab Vapor Retarder
- Foundation Wall Vapor Retarder

VaporBlock® Plus™
UNDERSLAB VAPOR RETARDER / GAS BARRIER

VAPORBLOCK® PLUS™ VBP20

Under-Slab Vapor / Gas Barrier

ISO 9001:2008
CERTIFIED MANAGEMENT SYSTEM

		VAPORBLOCK PLUS 20	
PROPERTIES	**TEST METHOD**	**IMPERIAL**	**METRIC**
APPEARANCE		White/Gold	
THICKNESS, NOMINAL		20 mil	0.51 mm
WEIGHT		102 lbs/MSF	498 g/m²
CLASSIFICATION	ASTM E 1745	CLASS A, B & C	
TENSILE STRENGTH LBF/IN (N/CM) AVERAGE MD & TD (NEW MATERIAL)	ASTM E 154 Section 9 (D-882)	58 lbf	102 N
IMPACT RESISTANCE	ASTM D 1709	2600 g	
MAXIMUM USE TEMPERATURE		180° F	82° C
MINIMUM USE TEMPERATURE		-70° F	-57° C
PERMEANCE (NEW MATERIAL)	ASTM E 154 Section 7 ASTM E 96 Procedure B	0.0051 Perms grains/(ft²·hr·in·Hg)	0.0034 Perms g/(24hr·m²·mm Hg)
RADON DIFFUSION COEFFIECIENT	K124/02/95	< 1.1 x 10^{-13} m²/s	
METHANE PERMEANCE	ASTM D 1434	< 1.7 x 10^{-10} m²/d• atm 0.32 GTR (Gas Transmission Rate) ml/m²•D•ATM	

VaporBlock® Plus™ Placement

All instructions on architectural or structural drawings should be reviewed and followed.
Detailed installation instructions accompany each roll of VaporBlock® Plus™ and can also be located on our website.
ASTM E-1643 also provides general installation information for vapor retarders.

VaporBlock® Plus™
UNDERSLAB VAPOR RETARDER / GAS BARRIER

VaporBlock® Plus™ is a seven-layer co-extruded barrier made using high quality virgin-grade polyethylene and EVOH resins to provide unmatched impact strength as well as superior resistance to gas and moisture transmission.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage.

RAVEN INDUSTRIES

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www.ravenefd.com

Limited Warranty available at www.RavenEFD.com

VaporBlock® Plus™

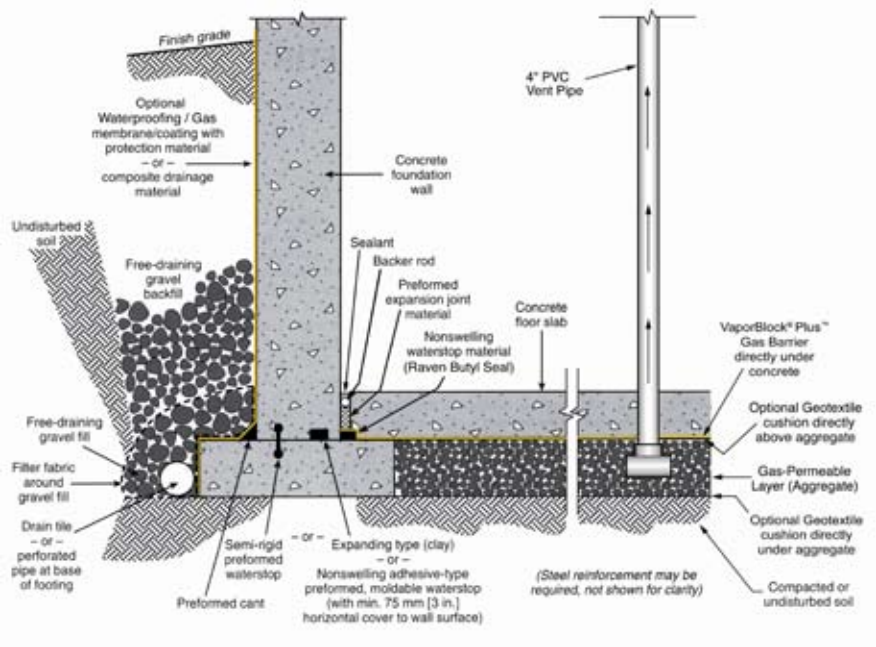
UNDERSLAB VAPOR RETARDER / GAS BARRIER

INSTALLATION GUIDELINES

Please Note: *Read these instructions thoroughly before installation to ensure proper use of* ***VaporBlock® Plus™****. ASTM E 1465, ASTM E 2121 and, ASTM E 1643 also provide valuable information regarding the installation of vapor / gas barriers. When installing this product, contractors shall conform to all applicable local, state and federal regulations and laws pertaining to residential and commercial building construction.*

- **When VaporBlock Plus gas barrier is used as part of an active control system for radon or other gas, a ventilation system will be required.**
- **If designed as a passive system, it is recommended to install a ventilation system that could be converted to an active system if needed.**

Materials List:
VaporBlock® Plus™ Vapor / Gas Barrier
VaporBond Plus 4" Foil Seaming Tape
Butyl Seal 2-Sided Tape
VaporBoot Plus Pipe Boots 12/Box (recommended)
VaporBoot Tape (optional)



Elements of a moisture/gas-resistant floor system. General illustration only.
(Note: This example shows multiple options for waterstop placement.

VAPORBLOCK® PLUS™ PLACEMENT

1.1. Level and tamp or roll granular base as specified. A base for a gas-reduction system may require a 4" to 6" gas permeable layer of clean coarse aggregate as specified by your architectural or structural drawings after installation of the recommended gas collection system. In this situation, a cushion layer consisting of a non-woven geotextile fabric placed directly under **VaporBlock® Plus™** will help protect the barrier from damage due to possible sharp coarse aggregate.

1.2. Unroll **VaporBlock Plus** running the longest dimension parallel with the direction of the pour and pull open all folds to full width. (Fig. 1)

1.3. Lap **VaporBlock Plus** over the footings and seal with Raven Butyl Seal tape at the footing-wall connection. Prime concrete surfaces and assure they are dry and clean prior to applying Raven Butyl Seal Tape. Apply even and firm pressure with a rubber roller. Overlap joints a minimum of 6" and seal overlap with Raven VaporBond Tape. When used as a gas

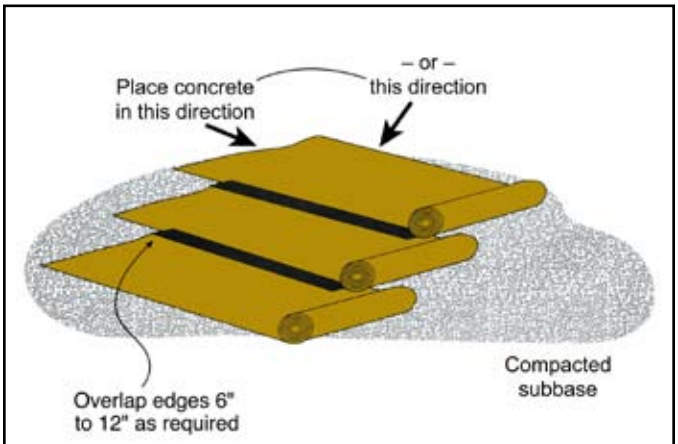


Fig. 1: VaporBlock Plus Overlaping Roll-out Method

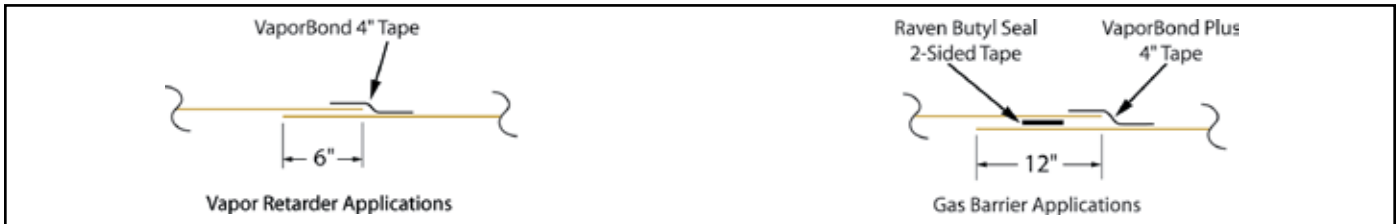


Fig. 2: VaporBlock Plus Overlap Joint Sealing Methods

Top original diagram and figure #1 were reprinted with permission by the Portland Cement Association.
Reference: Kanare, Howard M., Concrete Floors and Moisture, EB119, Portland Cement Association, Skokie, Illinois, and National Ready Mixed Concrete Association, Silver Spring, Maryland, USA, 2008, 176 pages.

barrier, overlap joints a minimum of 12″ and seal in-between overlap with 2-sided Raven Butyl Seal Tape. Then seal with VaporBond Plus Tape centered on the overlap seam. (Fig. 2)

1.4. Seal around all plumbing, conduit, support columns or other penetrations that come through the **VaporBlock Plus** membrane. Pipes four inches or smaller can be sealed with Raven VaporBoot Plus preformed pipe boots. VaporBoot Plus preformed pipe boots are formed in steps for 1″, 2″, 3″ and 4″ PVC pipe or IPS size and are sold in units of 12 per box (Fig. 3 & 5).

Pipe boots may also be fabricated from excess **VaporBlock Plus** membrane (Fig. 4 & 6) and sealed with VaporBoot Tape or VaporBond Plus Tape (sold separately).

Reminder Note: All holes or penetrations through the membrane will need a patch cut to a minimum of 12″ from the opening in all directions.

To fabricate pipe boots from **VaporBlock Plus** excess material (see Fig. 4 & 6 for A-F):

A) Cut a square large enough to overlap 12″ in all directions.

B) Mark where to cut opening on the center of the square and cut four to eight slices about 3/8″ less than the diameter of the pipe.

C) Force the square over the pipe leaving the tightly stretched cut area around the bottom of the pipe with approximately a 1/2″ of the boot material running vertically up the pipe. *(no more than a 1/2″ of stretched boot material is recommended)*

D) Once boot is positioned, seal the perimeter to the membrane by applying 2-sided Raven Butyl Seal Tape in between the two layers. Secure boot down firmly over the membrane taking care not to have any large folds or creases.

E) Use VaporBoot Tape or VaporBond Plus Tape to secure the boot to the pipe.

VaporBoot Tape (option) – fold tape in half lengthwise, remove half of the release liner and wrap around the pipe allowing 1″ extra for overlap sealing. Peel off the second half of the release liner and work the tape outward gradually forming a complete seal.

VaporBond Plus Tape (option) - Tape completely around pipe overlapping the to get a tight seal against the pipe.

F) Complete the process by taping over the boot perimeter edge with VaporBond Plus Tape to create a monolithic membrane between the surface of the slab and gas/moisture sources below and at the slab perimeter. (Fig. 4 & 6)

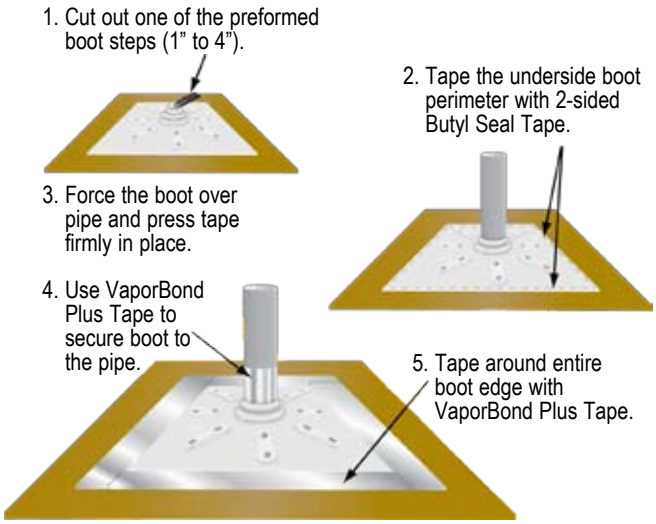


Fig. 3

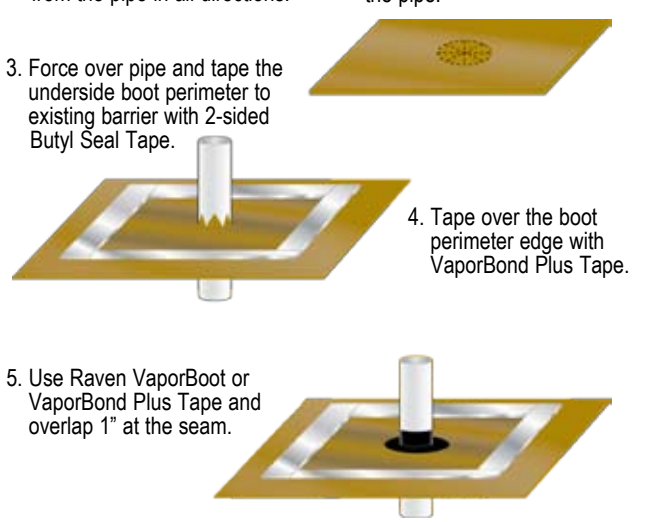


Fig. 4

Original figure #4 diagram is reprinted with permission by the Portland Cement Association.
Reference: Kanare, Howard M., Concrete Floors and Moisture, EB119, Portland Cement Association, Skokie, Illinois, and National Ready Mixed Concrete Association, Silver Spring, Maryland, USA, 2008, 176 pages.

Preformed Pipe Boot

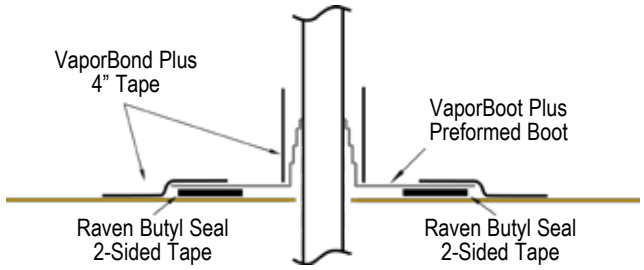


Fig. 5

Square Material Pipe Boot

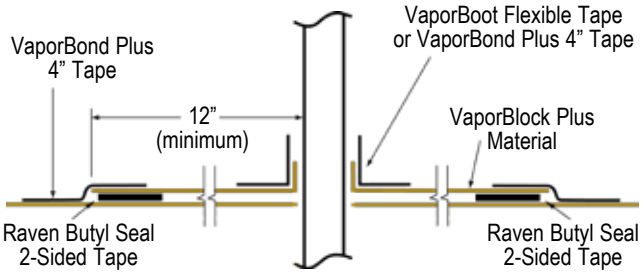


Fig. 6

MULTIPLE PENETRATION PIPE BOOT INSTALLATION

1.5. For side-by-side multiple penetrations;

A) Cut a patch large enough to overlap 12″ in all directions (Fig. 7) of penetrations.

B) Mark where to cut openings and cut four to eight slices about 3/8″ less than the diameter of the penetration for each.

C) Slide patch material over penetration to achieve a tight fit.

D) Once patch is positioned, seal the perimeter to the membrane by applying 2-sided Raven Butyl Seal Tape in-between the two layers. (Fig. 8)

E) After applying Raven Butyl Seal Tape between the patch and membrane, tape around each of the penetrations and the patch with VaporBond Plus 4″ foil tape. (Fig. 9) For additional protection apply an acceptable polyurethane elastomeric sealant around the penetrations. (Fig. 10)

1.6. Holes or openings through **VaporBlock Plus** are to be repaired by cutting a piece of **VaporBlock Plus** 12″ larger in all directions from the opening. Seal the patch to the barrier with 2-sided Raven Butyl Seal Tape and seal the edges of the patch with VaporBond Plus Tape.

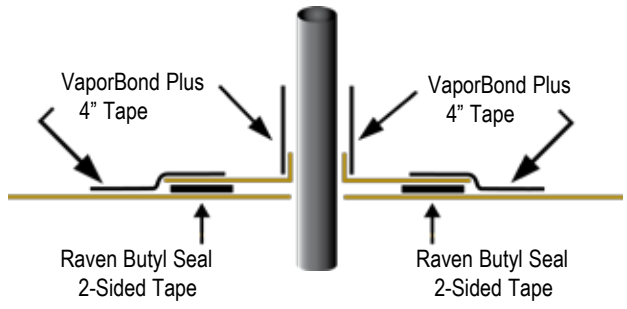


Fig. 6

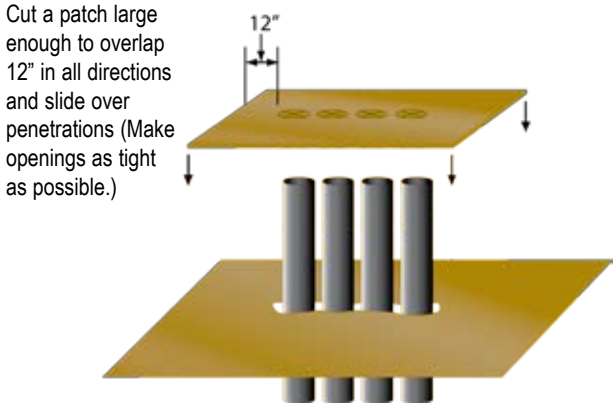


Fig. 7

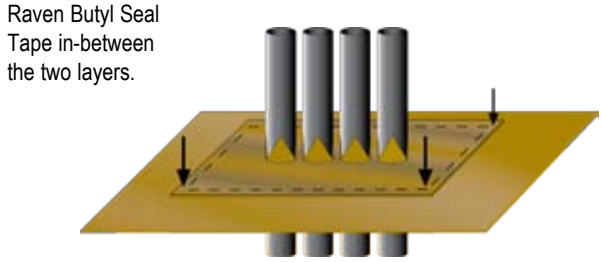


Fig. 8

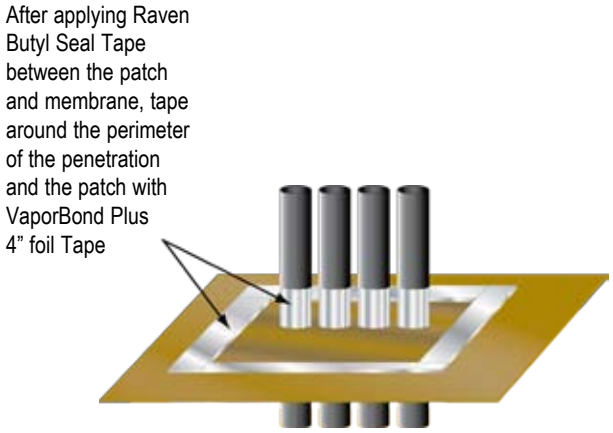


Fig. 9

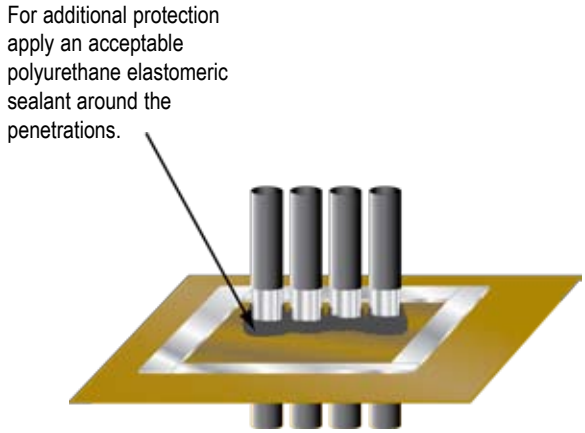


Fig. 10

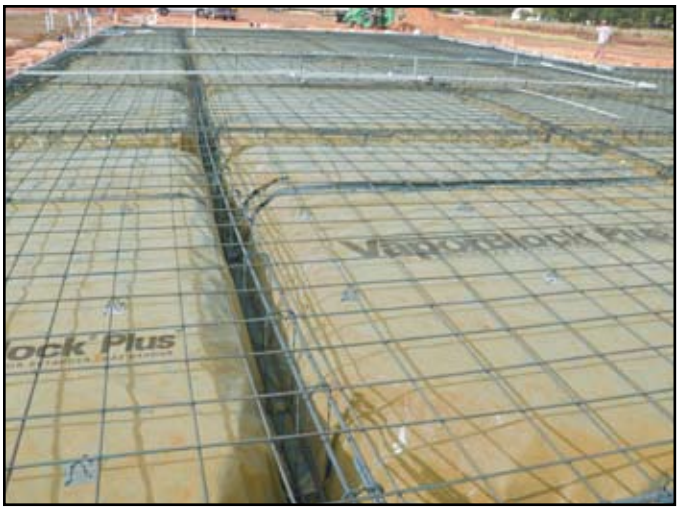
VAPORBLOCK® PLUS™ PROTECTION

2.1. When installing reinforcing steel and utilities, in addition to the placement of concrete, take precaution to protect **VaporBlock Plus**. Carelessness during installation can damage the most puncture–resistant membrane. Sheets of plywood cushioned with geotextile fabric temporarily placed on **VaporBlock Plus** provide for additional protection in high traffic areas including concrete buggies.

2.2. Use only brick-type or chair-type reinforcing bar supports to protect **VaporBlock Plus** from puncture.

2.3. Avoid driving stakes through **VaporBlock Plus**. If this cannot be avoided, each individual hole must be repaired per section 1.6.

2.4. If a cushion or blotter layer is required in the design between **VaporBlock Plus** and the slab, additional care should be given if sharp crushed rock is used. Washed rock will provide less chance of damage during placement. Care must be taken to protect blotter layer from precipitation before concrete is placed.



Note: To the best of our knowledge, these are typical installation procedures and are intended as guidelines only. Architectural or structural drawings must be reviewed and followed as well on a project basis. NO WARRANTIES ARE MADE AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS OR GUIDELINES REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and we disclaim all liability for resulting loss or damage.

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ISO 9001:2000
CERTIFIED MANAGEMENT SYSTEM

www.vaporblockplus.com

6/09 EFD 1127

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.

Preprufe 300R & 160R membranes are applied either horizontally to smooth prepared concrete, carton forms or well rolled and compacted sand 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

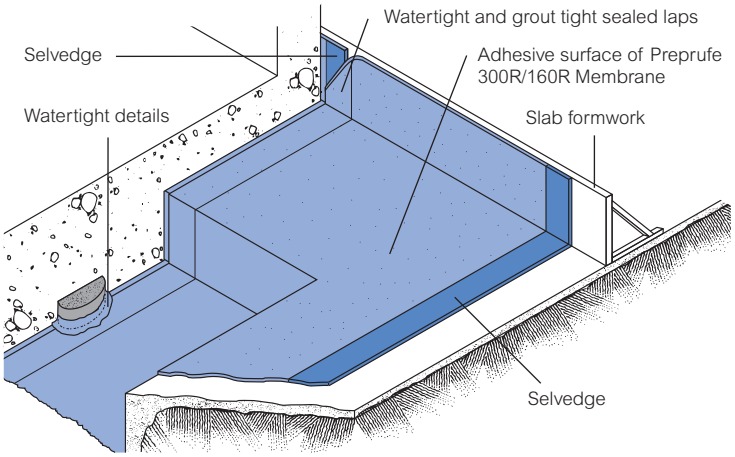
Installation

The most current application instructions, detail drawings and technical letters can be viewed at www.graceconstruction.com. Technical letters are provided for the following subjects to assist in the installation of Preprufe:

- Chemical Resistance
- Minimizing Concrete Shrinkage and Curling
- Rebar Chairs on Preprufe 300R Membrane
- Removal of Formwork Placed Against Preprufe Membranes
- Winter Lap Sealing and the use of Preprufe Tape LT

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.



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

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 97/3325

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. 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.

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 Letters 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. Secure the top of the membrane using a batten such as a termination bar or similar 2 in. (50 mm) below the top edge (see Figure 3). Fastening can be made through the selvedge so that the membrane lays flat and allows firmly rolled overlaps. Immediately remove the plastic release liner. Any additional fasteners must be covered with a patch of Preprufe Tape (see Figure 4).

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 and roll firmly. Immediately remove printed plastic release liner from the tape.

Details

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

- internal and external corners
- penetrations
- tiebacks
- columns
- grade beam pilecaps
- tie-ins
- terminations

Membrane Repair

Inspect the membrane before installation of reinforcement steel, formwork and final placement of concrete. The membrane can be easily cleaned by jet 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 R Membrane and Tape.

It is recommended that concrete be poured within 56 days (42 days in hot climates) of application of the membrane. Concrete must be placed and compacted carefully to avoid damage to the membrane. Never use a sharp object to consolidate the concrete.

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.

As a guide, to reach the minimum compressive strength stated above, a structural concrete mix with an ultimate strength of 6000 psi (40 N/mm^2) will typically require a cure time of approximately 6 days at an average ambient temperature of 25°F (-4°C), or 2 days at 70°F (21°C).

Figure 1

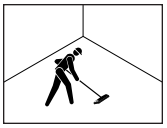


Figure 2

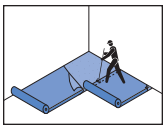
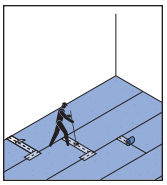
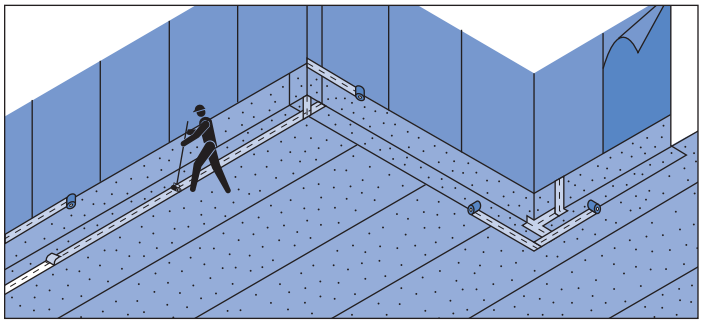


Figure 3

Figure 4

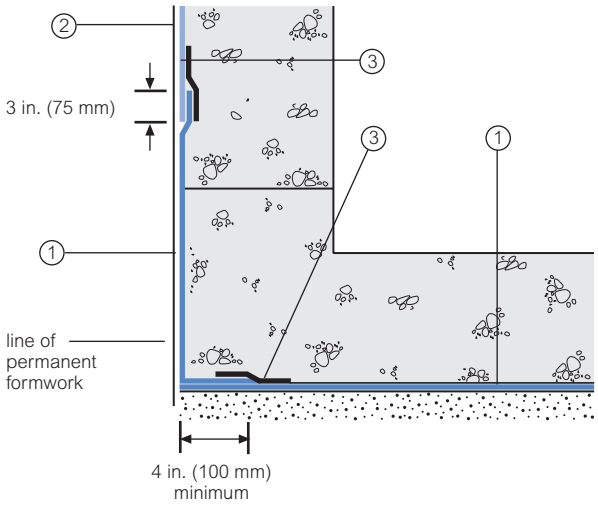




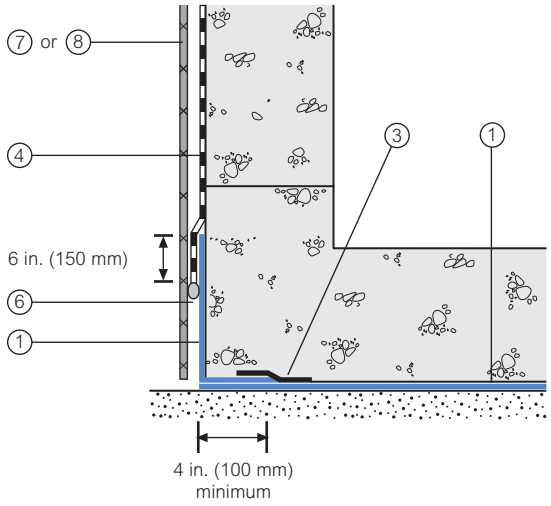
Detail Drawings

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

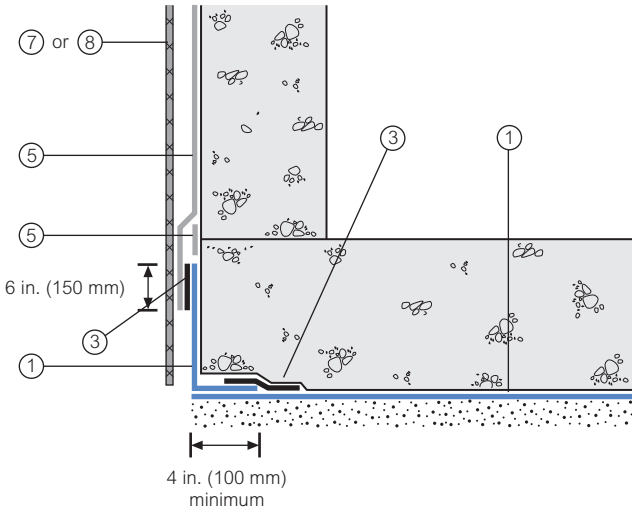
Wall base detail against permanent shutter



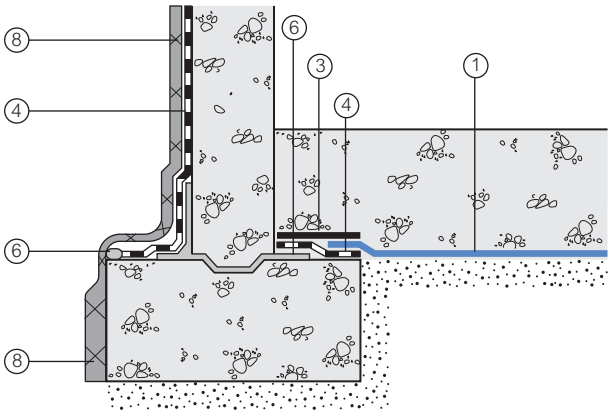
Bituthene wall base detail (Option 1)



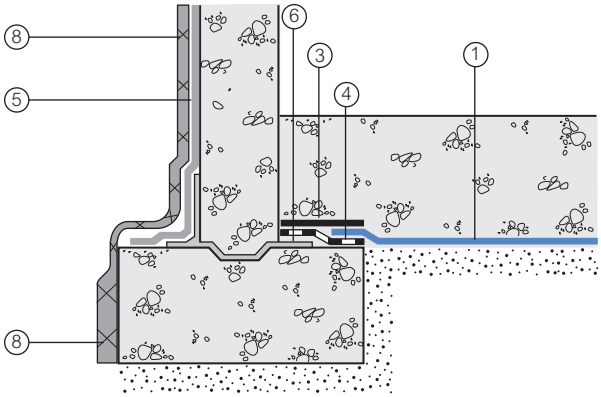
Procor wall base detail (Option 1)



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®

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) nominal	0.032 in. (0.8 mm) nominal	ASTM D3767
Low temperature flexibility	Unaffected at -10°F (-23°C)	Unaffected at -10°F (-23°C)	ASTM D1970
Resistance to hydrostatic head, minimum	231 ft (70 m)	231 ft (70 m)	ASTM D5385, modified[1]
Elongation, minimum	300%	300%	ASTM D412, modified[2]
Tensile strength, film, minimum	4000 psi (27.6 MPa)	4000 psi (27.6 MPa)	ASTM D412
Crack cycling at -10°F (-23°C), 100 cycles	Unaffected	Unaffected	ASTM C836
Puncture resistance, minimum	221 lbs (990 N)	100 lbs (445 N)	ASTM E154
Peel adhesion to concrete, minimum	5.0 lbs/in. (880 N/m) width	5.0 lbs/in. (880 N/m) width	ASTM D903, modified[3]
Lap peel adhesion	2.5 lbs/in. (440 N/m) width	2.5 lbs/in. (440 N/m) width	ASTM D1876, modified[4]
Permeance to water vapor transmission, maximum	0.01 perms (0.6 ng/(Pa × s × m^2))	0.01 perms (0.6 ng/(Pa × s × m^2))	ASTM E96, method B
Water absorption, maximum	0.5%	0.5%	ASTM D570
Methane permeability	9.1 mls/m^2/day	N/A	University of London, QMW College[3]
Permeability[5] (hydraulic conductivity)	K=<1.4 x 10^{-11}cm.s^{-1}	K=<1.4 x 10^{-11}cm.s^{-1}	ASTM D5084-90

Footnotes:

1. 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.
2. Elongation of membrane is run at a rate of 2 in. (50 mm) per minute.
3. 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.
4. 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 at 25°F (-4°C).
5. Result is lower limit of apparatus. Membrane therefore considered impermeable.

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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GRACE

PRODUCT INFORMATION

Bituthene® Liquid Membrane

Two component, elastomeric, liquid applied detailing compound for use with Grace waterproofing membranes

Advantages

- **Liquid applied –** conforms to irregular profiles
- **Waterproof –** resistant to water vapor and water pressure
- **Tough, rubber-like –** flexible and damage resistant
- **Chemically cured –** unaffected by in-service temperature variations
- **Cold applied –** no flame hazard
- **System compatible –** formulated for use with Grace waterproofing membrane systems

Description

Bituthene® Liquid Membrane is a two component, elastomeric, cold applied, trowel grade material designed for a variety of uses with the Grace waterproofing systems. The VOC (Volatile Organic Compound) content is 10 g/L.

Architectural and Industrial Maintenance Regulations limit the VOC content in products classified as Architectural Coatings. Refer to Technical Letters at www.graceconstruction.com for most current list of allowable limits.

Use

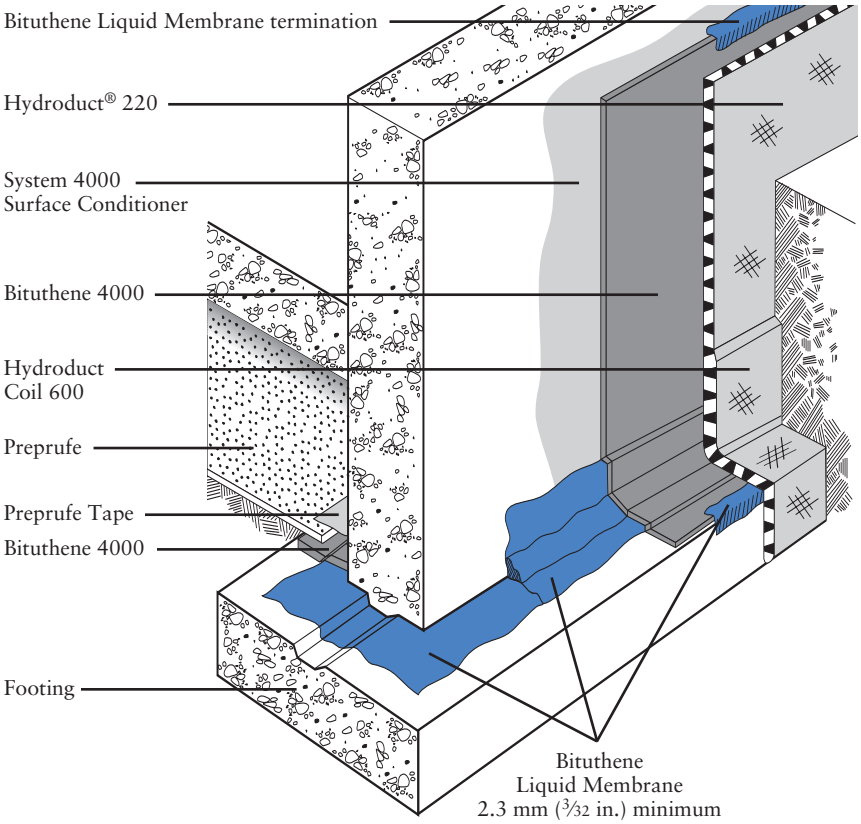
Bituthene Liquid Membrane is ideally suited for the following uses:

- Fillet material at inside corners
- Reinforcement material at inside corners
- Flashing material around drains, protrusions, curbs and parapets
- Sealing material at terminations
- Repair material for defects on concrete surfaces
- Flashing material at corners

The two parts of Bituthene Liquid Membrane are mixed on site and troweled on to provide a simple and quick waterproofing detailing aid in conjunction with Bituthene, Preprufe® and Procor® systems.

Compatibility

Bituthene Liquid Membrane is completely compatible with Bituthene, Preprufe and Procor and with existing asphalt or coal tar-based waterproofing materials. It is also compatible with cured silicone and polyurethane sealants. It is not compatible with creosote, pentachlorophenol, linseed oil or polysulfide-based sealants.



GRACE
Construction Products

Supply

Bituthene Liquid Membrane (Parts A & B)

Unit size	5.7 L (1.5 gal)	15.1 L (4 gal)
Weight per unit	8 kg (16 lbs)	20 kg (44 lbs)
Units per pallet	100	24

Physical Properties

Property	Typical Value	Test Method
Color Part A Part B Mixture of Parts A and B	 Black Clear Black	
Solids content	100%	ASTM D1644
Elongation	250% minimum	ASTM D412
Peel strength	880 N/m (5 lbs/in.) minimum	ASTM D903
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -32°C (-25°F)	Unaffected	ASTM D1970

Application Procedures

Safety, Storage and Handling Information

Bituthene products must be handled properly. Vapors from solvent-based primers and mastic are harmful and flammable. Grace Protection Board Adhesive is extremely flammable. For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Material Safety Data Sheets (MSDS) are available at www.graceconstruction.com and users should acquaint themselves with this information. Carefully read detailed precaution statements on product labels and the MSDS before use.

Surface Preparation

All surfaces must be dry and free from dirt, grease, oil, dust or other contaminants. Bituthene Liquid Membrane may be applied at temperatures of -4°C (25°F) or above. Below 5°C (40°F), store in a warm place before application.

Mixing

Add the entire contents of the Part B container to Part A and mix for 3 to 5 minutes until uniform. Part A is black and Part B is clear. Take care to scrape material from the side and bottom of the containers to assure thorough mixing. A low speed (150 rpm) mechanical mixer with flat paddle blades is required. Do not apply any material if streaks can be seen due to insufficient mixing.

Once mixed, Bituthene Liquid Membrane must be applied by trowel within 1.5 hours. More time is available at lower temperatures. At high temperatures, thickening and curing will be faster. Material that has thickened must be discarded. The material will cure to a very flexible rubber-like material.

Bituthene Liquid Membrane must be applied at a minimum thickness of 2.3 mm (3⁄32 in.) unless otherwise noted on details. In fillet applications, the face of the fillet should be a minimum of 20 mm (3⁄4 in.). In corner flashing application details, it should extend 150 mm (6 in.) in each direction from the corner. Bituthene Liquid Membrane will adhere to primed or unprimed concrete.

Bituthene Liquid Membrane should be allowed to cure at least 24 hours before flood testing.

Coverage

As a fillet material, 3.8 L (1 gal) will cover approximately 30 m (100 linear feet). As a flashing material, 3.8 L (1 gal) will cover approximately 1.6 m^2 (17 ft^2). As a fillet and reinforcement, 3.8 L (1 gal) will cover approximately 4.3 m (14 linear feet).

Cleaning

Clean tools and equipment with mineral spirits before Bituthene Liquid Membrane has cured. Mineral spirits is a combustible liquid and should be used only in accordance with the manufacturer's safety recommendations. **Do not use solvents to clean hands or skin.**

For Technical Assistance call toll free at 866-333-3SBM (3726).

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Construction Products

APPENDIX 6

CONSTRUCTION HEALTH AND SAFETY PLAN

CONSTRUCTION HEALTH & SAFETY PLAN

338 West 36th Street
E-137; Block 759, Lot 61
Manhattan, New York

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A. Health and Safety Fact Sheets

1.0 INTRODUCTION

This Construction Health & Safety Plan (CHASP) has been prepared by Hydro Tech Environmental, Corp. (Hydro Tech) as a part of the Remedial Action Work Plan (RAWP) for 338 West 36th Street (Block 759, Lot 61) and situated in the borough of Brooklyn, New York.

This CHASP will conform to applicable regulations, safe work practices and the project's requirements, and addresses those activities associated with the development of a 28-story hotel building with a partial cellar. The northeastern and southwestern portion of the Subject Property will remained undeveloped and be used as front yard and rear yard after construction.

The Hydro Tech Project Manager (PM), Site Safety Officer (SSO) and field staff (when necessary) will implement the Plan during construction. Compliance with this HASP is required of all persons and third parties who perform the scope of work documented for this project. Assistance in implementing this CHASP can be obtained from the SSO. The content of this CHASP may change or undergo revisions based upon additional information that is made available to health and safety personnel, monitoring results, or changes in the technical scope of work.

It should be noted that this CHASP does not apply to any other scopes of work that may be performed at the Site that are not specifically outlined in this report. Through preparation of this HASP, Hydro Tech and all Subcontractors (if any) do not guarantee the health or safety of any person entering this Site. Due to the nature of this Site and the activities occurring thereon, it is not possible to discover, evaluate and provide protection for all possible hazards that may be encountered. Only those portions of this CHASP that specifically apply to authorized personnel of Hydro Tech will enact the activities at the Site. Strict adherence to the applicable portions of these health and safety guidelines set forth herein will reduce, but not eliminate the potential for injury at this Site. The health and safety guidelines in this CHASP were prepared specifically for this Site and should not be utilized for any other site without prior research and evaluation by trained health and safety specialists and approval by Hydro Tech.

2.0 SCOPE OF WORK

This Construction HASP has been prepared as a part of the RAWP to be implemented during the upcoming development of the Site. Prior environmental assessments identified Semi-Volatile Organic Compounds (SVOCs), acetone and metals including copper, lead, mercury and nickel in soil/fill beneath the Site at concentrations exceeding their respective Unrestricted Use Soil Cleanup Objectives (SCOs). A range of vapors associated with organic chlorinated solvents and petroleum constituents were also detected beneath the Site.

The portions of the construction activities specifically addressed in this Construction HASP will include the following and will be performed in the following sequence:

- Supervision of the excavation of soil/fill and other material
- Supervision of the installation of concrete foundations
- Supervision of the installation of vapor barrier system

Prior to any fieldwork, the New York City One-Call Unit will be contacted so that all public utilities can be marked out. The proposed schedule of fieldwork will be coordinated with the developer and the OER.

3.0 STAFFING

This section briefly describes the personnel involved in Site remedial activities, their contact information and their health and safety responsibilities. This section also provides directions to hospital in the case of a health emergency.

EMERGENCY NUMBERS

Contact	Phone Number
Beth Israel Medical Group	212-604-1800
New York City EMS	911
NYPD	911
NYFD	911
National Response Center	(800) 424-8802
Poison Information Center	(800) 562-8816
Chemtree	(800) 424-9555

Project Management/Health and Safety Personnel

Title	Contact	Phone Number	Cell Phone
Geologist	Rachel Ataman	(631) 462-5866	(631) 457-0032
Site Safety Officer	Paul I. Matli	(718) 636-0800	(631) 241-7264
Project Manager	Paul I. Matli	(718) 636-0800	(631) 241-7165

Directions To Beth Israel Medical Group (See Attached Figure 1)

1. Head southeast on West 36th Street toward 8th Avenue;
2. Turn right onto 7th Avenue;
3. Turn right onto West 23rd Street;

Destination will be on the right.

PROJECT MANAGER

As necessary, the Project Manager will perform the following:

- Has the overall responsibility for the health and safety of site personnel
- Ensures that adequate resources are provided to the field staff to carry out their responsibilities as outlined below.
- Ensures that fieldwork is scheduled with adequate personnel and equipment resources to complete the job in a safe manner.
- Ensures that adequate communication between field crews and emergency response personnel is maintained.
- Ensures that field site personnel are adequately trained and qualified to work at the Site.

SITE SAFETY OFFICER

As necessary, the Site Safety Officer will perform the following:

- Directs and coordinates health and safety monitoring activities.
- Ensures that field teams utilize proper personal protective equipment (PPE).
- Conducts initial on-Site, specific training prior to personnel and/or subcontractors proceeding to work.

- Conducts and documents periodic safety briefings; ensures that field team members comply with this Construction HASP.
- Completes and maintains Accident/Incident Report Forms.
- Notifies corporate administration of all accidents/incidents.
- Determines upgrade or downgrade of PPE based on site conditions and/or downgrade of PPE based on site conditions and/or real-time monitoring results.
- Ensures that monitoring instruments are calibrated daily or as determined by manufacturer's suggested instructions.
- Maintains health and safety field log books.
- Develops and ensures implementation of the Construction HASP.
- Approves revised or new safety protocols for field operations.
- Coordinates revisions of this Construction HASP with field personnel and the SSO Division Contracting Officer.
- Responsible for the development of new company safety protocols and procedures and resolution of any outstanding safety issues which may arise during the conduction of site work.
- Reviews personnel and subcontractors current and up-to-date medical examination and acceptability of health and safety training.

FIELD PERSONNEL AND SUBCONTRACTORS (IF ANY)

- Reports any unsafe or potentially hazardous conditions to the SSO
- Maintains knowledge of the information, instructions, and emergency response actions contained in this Construction HASP.
- Comply with rules, regulations and procedures as set forth in this Construction HASP and any revisions that are instituted.
- Prevents admittance to work sites by unauthorized personnel.

4.0 CHEMICAL & WASTE DESCRIPTION/CHARACTERIZATION

The following list of compounds is based on the results of the recent subsurface investigation:

Volatile Organic Compounds in soil:

- Acetone

Semi Volatile Organic Compounds in soil:

- Acenaphthene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Chrysene
- Dibenzo(a,h)anthracene
- Dibenzofuran
- Indeno(1,2,3-cd)pyrene
- Naphthalene
- Phenanthrene
- Phenol

Heavy Metals in soil:

- Copper
- Lead
- Mercury
- Nickel

Volatile Organic Compounds in groundwater:

- 2-Butanone
- Acetone

Semi Volatile Organic Compounds in groundwater:

- Acenaphthene
- Acenaphthylene
- Bis(2-ethylhexyl)phthalate

Heavy Metals in groundwater:

- Antimory
- Manganese
- Selenium
- Sodium

Volatile Organic Compounds in soil vapors:

- 1,2,4-Trimethylbenzene
- 1,3,5-Trimethylbenzene
- 2-Butanone
- Acetone
- Benzene
- Bromodichloromethane
- Chloroform
- Cyclohexane
- Dibromochloromethane
- Dichlorodifluoromethane
- Ethyl Benzene
- Isopropanol
- Methylene Chloride
- n-Hexane
- o-Xylene
- p-&m-Xylene
- p-Ethyltolune
- Tetrachloroethylene
- Toluene
- Trichlorofluoromethane (Freon 11)

Appendix A contains Material Safety Data Sheets

The following information references are presented in order to identify the properties, characteristics and hazards of the compounds and metals that may/will be encountered at the Site.

* Dangerous Properties of Industrial Materials - Sax
* Chemical Hazards of the Workplace - Proctor/Hughes
* Condensed Chemical Dictionary - Hawley
* Rapid Guide to Hazardous Chemical in the Workplace - Lewis 1990.
* NIOSH Guide to Chemical Hazards – 1990.
* ACGIH TLV Values and Biological Exposure Indices - 1991-1992.

5.0 HAZARD ASSESSMENT AND MITIGATION

The potential hazards associated with planned site activities include chemical, physical and biological hazards associated with the construction. This section discusses those hazards that are anticipated to be encountered during the activities listed in the scope of work.

The potential to encounter chemical hazards is dependent upon the work activity performed (invasive or non-invasive), the duration, and location of the work activity. Such hazards could include inhalation or skin contact with chemicals that could cause: dermatitis, skin burn, being overcome by vapors, or asphyxiation. In addition, the handling of contaminated materials and chemicals could result in fire and/or explosion.

The potential to encounter physical hazards during site work includes: heat stress, exposure to excessive noise, loss of limbs, being crushed, head injuries, cuts and bruises, and other physical hazards due to motor vehicle operation, heavy equipment and power tools.

CHEMICAL HAZARDS

The potential for personnel and subcontractors to come in contact with chemical hazards may occur during the following tasks:

- Excavation
- Installation of vapor barrier
- Pouring of concrete foundation(s)

Exposure Pathways

Exposure to these compounds during ongoing activities may occur through inhalation of contaminated dust particles, inhalation of volatile vapor fume compounds, by way of dermal absorption, and accidental ingestion of the contaminant by either direct or indirect cross contamination activities (eating, smoking, poor hygiene). Indirectly, inhalation of contaminated dust particles can occur during adverse weather conditions (high or changing wind directions) or during operations that may generate airborne dust such as excavation.

Dust Suppression

The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities.

1. Applying water on haul roads.
2. Wetting equipment and excavation faces.
3. Spraying water on buckets during excavation and dumping.
4. Hauling materials in properly sealed or watertight containers.
5. Restricting vehicle speeds to 10mph.
6. Covering excavated areas and material after excavation activity ceases.
7. Reducing the excavation size and/or number of excavations.

8. Applying a dust suppressant, such as calcium chloride, in high vehicle traffic areas.

To evaluate the effectiveness if the dust suppression measures, air monitoring will be performed utilizing real-time dust-monitoring equipment. The requirements for air monitoring during post-remediation soil disturbance activities are presented in Section 5.0.

Additional Precautions
Dermal absorption or skin contact with chemical compounds is possible during invasive activities at the Site, including the excavation and/or capping of soils. The use of PPE in accordance with Section 9.0 and strict adherence to proper decontamination procedures should significantly reduce the risk of skin contact.

The potential for accidental ingestion of potentially hazardous chemicals is expected to be remote, when good hygiene practices are used. Unauthorized personnel, including all children, will not be allowed access to the Site.

PHYSICAL HAZARDS
A variety of physical hazards may be present during Site activities. These hazards are similar to those associated with any construction type project and include digging or boring operations and excavation activities in the vicinity of underground utility locations. These physical hazards are due to motor vehicles, and heavy equipment operation, the use of improper use of power and hand tools, misuse of pressurized cylinders, walking on objects, tripping over objects, working on surfaces which have the potential to promote falling, mishandling and improper storage of solid and hazardous materials, skin burns, crushing of fingers, toes, limbs, hit on the head by falling objects or hit one's head due to not seeing the object of concern, temporary loss of one's hearing and/or eyesight. Theses hazards are not unique and are generally familiarly to most hazardous waste site workers at construction sites. Additional task specific safety requirements will be covered during safety briefings.

6.0 SPILL PREVENTION AND CONTROL PLAN

Accidental spill and leaks of hazardous and non-hazardous materials will be properly controlled so that they do not adversely impact storm drain systems or receiving waters. A spill prevention and control plan will include the following:

Spill/Leak Prevention Measures;
-Place any material under cover (tarp) and away from storm drains or sensitive water bodies
-Properly label all containers so that the contents are easily identifiable
-Berm storage areas so that if a spill or leak occur they are easily contained

Spill Response Procedures
- Assessment of the Site and potential impacts by the SSO
- Containment of the material
- Notification of the personnel present at the Site and ensure evacuation procedure if necessary.

Spill Cleanup Procedures
-If small non-hazardous spill, use cleanup materials such as absorbents or rags and damp cloths and dispose of properly;
-If large non-hazardous spill or hazardous spill, a private hazmat team may need to be contacted to assess the situation and conduct the cleanup and proper disposal of the material.

Reporting
-Petroleum spills will be reported immediately to the NYSDEC Spill Hotline.
-If material is unknown or hazardous, contact the local Fire Department.

Training
-The SSO is responsible for providing refreshment training to all employees working on-site about spill prevention, spill response and cleanup on a routine basis.
-The SSO will identify key spill response personnel to assist in the spill control and cleanup procedures.

7.0 TRAINING

GENERAL HEALTH AND SAFETY TRAINING
In accordance with 29 CFR 1910.120, all construction personnel involved with the portions of the scope of work described in Section 2.0 will be briefed by the Project Manager on the potential hazards and the overall requirements in meeting the specifications of this Construction HASP.

The SSO will have the responsibility of ensuring that personnel assigned to this project comply with these requirements. Written certification of completion of any required training, if necessary, will be provided to the SSO.

MANAGER/SUPERVISOR TRAINING
In accordance with 29 CFR 1910.120, on-Site management and supervisors who will be directly responsible for, or who supervise employees engaged in hazardous waste operation shall receive training as required in this Construction HASP and at least eight (8) additional hours of specialized training on managing such operations at the time of job assignment.

ANNUAL 8-HOUR REFRESHER TRAINING
Annual 8-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualification for fieldwork. The following topics will be reviewed: toxicology, respiratory protection, including air purifying devices and self-contained breathing apparatus (SCBA), medical surveillance, decontamination procedures and personnel protective clothing. In addition, topics deemed necessary by the SSO may be added to the above list.

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

ON-SITE SAFETY BRIEFINGS
Project personnel and visitors will be given periodic on-site health and safety briefings by the SSO, or their designee, to assist site personnel in safely conducting their work activities. The briefings will include information on new operations to be conducted, changes in work practices, or changes in the Site's environmental conditions. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety audits.

ADDITIONAL TRAINING
Additional training may be required by the SSO for participation in certain field tasks during the course of the project. Such additional training could be in the safe operation of heavy or power tool equipment or hazard communication training.

HAZWOPER TRAINING
All remedial personnel that will be in direct contact with the native soil/fill materials must complete an initial 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and, where necessary, a current 8-hour refresher course

SUBCONTRACTOR TRAINING
Subcontractor personnel working on-site may be exempted from the contents of this Construction HASP. The SSO will determine if this exemption is allowed. In any case, the subcontractor personnel who are exposed to hazards are not exempted from the contents of this Construction HASP.

8.0 MEDICAL SURVEILLANCE

GENERAL
No general or specific medical surveillance or other medical requirements are set forth in this Construction HASP.

9.0 SITE CONTROL, PPE & COMMUNICATIONS

SITE CONTROL
The area where the activities of the scope of work will be performed is considered to be the Exclusion Zone (EZ). All areas where excavation and handling of contaminated materials take place are considered the EZ. This zone will be clearly delineated by cones, tape, or other means. The SSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy
- Appropriate personal protective equipment (as necessary)

The remaining portions of the Site outside of the EZ will consist of a Support Zone (SZ) and a Contamination Reduction Zone (CRZ). Appropriate sanitary facilities, safety equipment, packaged/decontaminated and labeled samples will be located in SZ. Potentially contaminated personnel or materials will be allowed in the CRZ for decontamination as necessary.

PERSONAL PROTECTIVE EQUIPMENT
General
The level of protection worn by field personnel will be enforced by the SSO. Levels of protection may be upgraded or downgraded at the discretion of the SSO. The decision shall be based on real-time air monitoring, site history data, and prior site experience. Any changes in the level of protection shall be recorded in the health and safety field logbook.

PPE Specifications
For tasks requiring Level C PPE, the following equipment shall be used:
- Cotton or disposable coveralls

- Disposable outer coveralls (Poly-coated Tyvek)
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC), steel toe/shank
- Boot covers (as needed)
- Hard Hat
- Hearing protection (as needed)
- Splash suit and face shield for decontamination operations (as needed)

For tasks requiring Level D PPE, the following equipment shall be used:
- Cotton or disposable coveralls
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC) steel toe/shank
- Boot covers (as needed)

- Hard hat
- Hearing protection (as needed)
- Safety glasses

For tasks requiring Level D PPE, the following equipment shall be used:

- Cotton or disposable coveralls
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC) steel toe/shank
- Boot covers (as needed)
- Hard hat
- Hearing protection (as needed)
- Safety glasses

For tasks requiring respiratory protection, the following equipment shall be used:

Level D - No respiratory protective equipment necessary except for a dust mask
Level C - A full-face air-purifying respirator equipped with organic vapor/pesticide-HEPA cartridges
Level B - An air line respirator or a self-contained breathing apparatus (SCBA)

LEVEL OF PERSONAL PROTECTIVE EQUIPMENT REQUIRED

Activity	**Level of Protection Respiratory/PPE**
Excavations	C/D
Foundation Construction	C/D

COMMUNICATIONS
Communications is the ability to talk with others. While working in Level C Protection, personnel may find that communication become a more difficult task and process to accomplish. This is further complicated by distance and space. In order to address this problem, electronic instruments, mechanical devices or hand signals will be used as follows:

- Walkie-Talkies - Hand held radios would be utilized as much as possible by field teams for communication between downrange operations and the Command Post base station.

- Telephones - A mobile telephone will be located in the Command Post vehicle in the Support Zone for communication with emergency support services/facilities. If a telephone is demobilized, the nearest public phones will be identified.

- Air Horns - A member of the downrange field team will carry an air horn and another will be evident in the Support Zone to alert field personnel to an emergency situation.

- Hand Signals - Members of the field team using the buddy system will employ this communication method. Signals become especially important when in the vicinity of heavy moving equipment and when using Level B respiratory equipment. The signals shall become familiar to the entire field team before site operations commence and they will be reinforced and reviewed during site-specific training.

HAND SIGNALS FOR ON-SITE COMMUNICATION

Signal	**Meaning**
Hand gripping throat	Out of air, can't breathe
Grip partners' wrist	Leave area immediately; no debate
Hands on top of head	Need assistance
Thumbs up	OK, I'm all right; I understand
Thumbs down	No; negative, unable to understand you. I'm not all right

10.0 AIR MONITORING PLAN

GENERAL

Continuous air monitoring in the EZ during invasive tasks will accompany site operations, as indicated in this HASP or as required by the SSO. Monitoring will be performed to verify the adequacy of respiratory protection, to aid in site layout and to document work exposure. All monitoring instruments shall be operated by qualified personnel only and will be calibrated daily prior to use, or more often as necessary. For additional references and information, see Hydro Tech's Site-Specific Air Monitoring Program.

REAL-TIME MONITORING

Instrumentation

A PID (to monitor total volatile organic concentrations) will be used to measure worker breathing zone ambient on-site concentrations during on-site activities. The equipment will be calibrated daily and the results noted in the project field book. A background level will be established, at a minimum, on a daily basis, and recorded in the field book.

The following response actions will be taken based on PID readings in the breathing zone. All work will be performed in level D PPE unless breathing zone volatile organic concentrations exceed 5 ppm. Once levels of 25 ppm are measured, work will be stopped.

Volatile Organics	Photoionization Detector (PID)	>5ppm	Temporarily halt work activities & monitor until readings decrease to below 5ppm.
		>5ppm<25ppm	Halt work activities, upgrade to level C continue monitoring.
		>25ppm	Shut down work activities

During soil excavation, particulate monitoring will be performed using a real-time particulate monitor that will monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

Object to be measured: Dust. Mists, Aerosols
Size range: < 0.1 to 10 microns
Sensitivity: 0.001 mg/m3
Overall Accuracy: = 10% as compared to gravimetric analysis of stearic acid or reference dust.

Particulate levels will be monitored immediately downwind at the working site and integrated over a period not to exceed 15 minutes. The action level will be established at 150 ug/m3 over the integrated period not to exceed 15 minutes.

Action Levels
Action levels for upgrading of PPE in this Construction HASP will apply to all site work during the duration of field activities at the Site. The action level is the presence of visible airborne dust. When airborne dust is observed, specific dust-mitigating procedures will be implemented. These dust-mitigating procedures are documented in Section 6.0.

11.0 SAFETY CONSIDERATIONS

GENERAL

In addition to the specific requirements of this HASP, common sense should be used at all times. The general safety rules and practices below will be in effect at the Site at the discretion of the Project Manager, SSO or other authorized personnel.

- The site will be suitably marked or barricaded as necessary to prevent unauthorized visitors but not hinder emergency services if needed.

- As needed, all open holes, trenches, and obstacles will be properly barricaded in accordance with local site requirements. These requirements will be determined by proximity to traffic ways, both pedestrian and vehicular, and site of the hole, trench, or obstacle. If holes are required to be left open during non-working hours, they will be adequately decked over or barricaded and sufficiently lighted.

- Before any digging or boring operations are conducted, underground utility locations will be identified. All boring, excavation, and other site work will be planned and performed with consideration for underground lines. Any excavation work will be performed in accordance with Hydro Tech's Standard Operating Procedures for Excavations.

- Either workers or other people will enact dust-mitigating procedures when the potential for the inhalation of dust particles is present.

- The act of smoking and/or ignition sources in the vicinity of potentially flammable or contaminated material is strictly prohibited.

- Drilling, boring, and use of cranes and drilling rigs, erection of towers, movement of vehicles and equipment and other activities will be planned and performed with consideration for the location, height, and relative position of aboveground utilities and fixtures, including signs; canopies; building and other structures and construction; and natural features such as trees, boulders, bodies of water, and terrain.

- When working in areas where flammable vapors may be present, particular care shall be exercised with tools and equipment that may be sources of ignition. All tools and equipment provided must be properly bonded and/or grounded. Metal buttons and zippers are prohibited on safety clothing for areas that may contain a flammable or explosive atmosphere.

- Approved and appropriate safety equipment (as specified in this Construction HASP), such as eye protection, hard hats, foot protection, and respirators, must be worn in areas where required. In addition, eye protection must be worn when sampling soil or water that may be contaminated.

- No smoking, eating, chewing tobacco, gum chewing, or drinking will be allowed in the contaminated areas.

- Contaminated tools and hands must be kept away from the face.

- Personnel must use personal hygiene safe guards (washing up) at the end of the shift or as soon as possible after leaving the Site.

- Each sample must be treated and handled as though it were contaminated.

- Persons with long hair and/or loose fitting clothing that could become entangled in power equipment must take adequate precautions.

- Horseplay is prohibited in the work area.

- Work while under the influence of intoxicants, narcotics, or controlled substances is prohibited.

POSTED SIGNS

Posted danger signs will be used where an immediate hazard exists. Caution signs will be posted to warn against potential hazards and to caution against unsafe practices. Traffic control methods and barricades will be used as needed. Wooden stakes and flagging tape, or equally effective material will be used to demarcate all restricted areas.

Other postings may include the OSHA poster, emergency hospital route, and telephone numbers of contact personnel.

INVASIVE OPERATIONS
The SSO will be present on-Site during all invasive work (e.g. excavations and capping). The SSO will ensure that appropriate monitoring, levels of protection, and safety procedures are followed. No personnel will enter any excavations for any reasons. All non-essential personnel will stay at least 10 feet back from the edge of the excavation and out of the swing radius of the backhoe. No drums or other potential sources will be sampled or removed during this phase without further additions to the Construction HASP.

The proximity of water, sewer, and electrical lines will be identified prior to invasive operations. The possibility of the presence of underground conduits or vessels containing materials under pressure will also be investigated prior to invasive operations. Properly-sized containment systems will be utilized and consideration of the potential volume of liquid or waste released during operations will be discussed with members of the field team to minimize the potential for spills and provide a method for collection of waste materials. Emergency evacuation procedures and the location of safety equipment will be established prior to start up operations. The use of protective clothing, especially hard hats, boots, and gloves will be required during drilling and other heavy equipment work.

SOIL, GROUNDWATER AND LIQUID WASTE SAMPLING
During Site invasive excavation, soil sampling for waste characterization may be required for disposal purposes. No groundwater or liquid waste sampling is anticipated during site remediation.

HEAVY EQUIPMENT DECONTAMINATION
Personnel steam cleaning heavy equipment, if necessary shall use the prescribed level of protection and adhere to the buddy system. Initially this task usually employs Level C. The heavy equipment decontamination shall be restricted to authorized personnel only. Special consideration will be given to wind speed and direction. Downwind areas are to be kept free of personnel to avoid unnecessary exposure to potential airborne contamination.

ADDITIONAL SAFETY CONSIDERATIONS
No other additional safety considerations at this time.

12.0 DECONTAMINATION AND DISPOSAL PROCEDURES

CONTAMINATION PREVENTION
One of the most important aspects of decontamination is the prevention of contamination. Good contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

<u>Personnel:</u>
Do not walk through areas of obvious or known contamination.
Do not directly handle or touch contaminated materials.
Make sure that there are no cuts or tears on PPE.
Fasten all closures in suits; cover with tape if necessary.
Particular care should be taken to prevent any skin injuries.
Stay upwind of airborne contaminants.
Do not carry cigarettes, cosmetics, gum, etc. into contaminated areas.

Sampling and Monitoring:
When required by the SSO, cover instruments with clear plastic, leaving openings for sampling ports. Keep all decontaminated sampling materials in bags prior to emplacement of sample matrix.

Heavy Equipment:
Care should be taken to limit the amount of contamination that comes in contact with heavy equipment (tires). Dust control measures may be needed on roads inside the site boundaries.

PERSONNEL DECONTAMINATION
All personnel shall pass through an outlined decontamination procedure when exiting the hot zone at each location. A field wash for equipment and PPE shall be set up at each work location. The system will include a gross wash and rinse for all disposable clothing and boots worn in the EZ. Upon exiting the EZ, all personnel will wash their hands, arms, neck, and face before entering the Support Zone.

EQUIPMENT DECONTAMINATION
Equipment used at the Site that is potentially contaminated shall be decontaminated to prevent hazardous materials from leaving the Site. All heavy equipment will be decontaminated at the decontamination pad and inspected by the SSO and Project Manager before it leaves the Site. The decontamination area will provide for the containment of all wastewater from the decontamination process. Respirators, airline and any other personnel equipment that comes in contact with contaminated soils shall pass through a field wash.

DECONTAMINATION DURING MEDICAL EMERGENCIES
If emergency life-saving first aid and/or medical treatment are required, normal decontamination procedures may need to be abbreviated or omitted. The Site SSO or designee will accompany contaminated victims to the medical facility to provide advice on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances and /or medical personnel. Outer garments are then removed at the medical facility.

No attempt will be made to wash or rinse the victim, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material that could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed. Note that heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing must be promptly removed. Less serious forms of heat stress also require prompt attention and removal of protective clothing immediately. Decontamination should be omitted or minimized and treatment begun immediately unless the victim is obviously contaminated.

DISPOSAL PROCEDURES
The SSO and Project Manager will develop a segregating system of non-hazardous waste and hazardous waste. All discarded material, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating sanitary hazards, or causing litter to be left on site. All potentially contaminated materials, e.g. clothing, gloves, etc., will be bagged or drummed as necessary, labeled and segregated for disposal. All non-

contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste.

13.0 EMERGENCY PLAN

The potential for the development of an emergency situation is low considering the low concentrations of hazardous substances at the work site. Nevertheless, an emergency situation could occur. All personnel, prior to the start of work, will know the emergency plan outlined in this section. The emergency plan will be available for use at all times during site work.

Various individual site characteristics will determine preliminary actions taken to assure that this emergency plan is successfully implemented in the event of a site emergency. Careful consideration must be given to the proximity of neighborhood housing or places of employment, and to the relative possibility of site fire, explosion or release of vapors or gases that could affect the surrounding community.

The Project Manager shall make contact with local fire, police, and other emergency units prior to beginning work on site. In these contacts, the Project Manager will inform the emergency units about the nature and duration of work expected to the Site and the type of contaminants and the possible health or safety effects of emergencies involving these contaminants. At this time, the Project Manager and the emergency response units shall make the necessary arrangements to be prepared for any emergencies that could occur.

The Project Manager shall implement the contingency plan whenever conditions at the Site warrant such action. The Project Manager will be responsible for coordination of the evacuation emergency treatment, and transportation of site personnel as necessary, and notification of emergency response units and the appropriate management staff.

EVACUATION

In the event of an emergency situation, such as fire, explosion, or significant release of toxic gases, an air horn or other appropriate device will be sounded for approximately 10 second intervals indicating the initiation of evacuation procedures. All personnel will evacuate and assemble near the entrance to the site. The location shall be upwind of the Site where possible.

For efficient and safe site evacuation and assessment of the emergency situation, the Project Manager will have authority to initiate action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The SSO or designated SSO must ensure that access for emergency equipment is provided and that all combustion apparatuses have been shut down once the alarm has been sounded. Once the safety of all personnel is established, the Fire Department and other emergency response groups as necessary will be notified by telephone of the emergency.

POTENTIAL OR ACTUAL FIRE OR EXPLOSION

Immediately evacuate the Site (air horn will sound for 10-second intervals), notify the local fire and police departments, and other appropriate emergency response groups if an actual fire or explosion has taken place.

PERSONNEL INJURY
Emergency first aid shall be applied on site as deemed necessary. If necessary, the individual shall be decontaminated and transported to the nearest medical facility.

The ambulance/rescue squad shall be contacted for transport as necessary in an emergency. However, since some situations may require transport of an injured party by other means, the hospital route is identified below. A map to this facility provided with this HASP in Section 2.2.3.

ACCIDENT/INCIDENT REPORTING
As soon as first aid and/or emergency response needs have been met, the employer of the injured party must be immediately notified of any incident. Written confirmation of verbal reports is to be submitted within 24 hours. A standard report form entitled "Accident Data Report" is to be used for this purpose.

For reporting purposes, the term accident refers to fatalities, lost time injuries, spill, or exposure to hazardous materials (toxic materials, explosive or flammable materials).

Any information released from the health care provider, which is not deemed confidential patient information, is to be attached to the appropriate form. Any medical information that is released by patient consent is to be filed in the individuals' medical records and treated as confidential.

OVERT PERSONNEL EXPOSURE

SKIN CONTACT:	Use copious amounts of soap and water. Wash/rinse affected area thoroughly, and then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination.
INHALATION:	Move personnel to fresh air and if necessary, decontaminate and transport to hospital.
INGESTION:	Decontamination and transport to emergency medical facility.
PUNCTURE WOUND OR LACERATION:	Decontaminate and transport to emergency medical facility.

ADVERSE WEATHER CONDITIONS
In the event of adverse weather conditions, the SSO or designee will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

* Potential for heat stress and heat-related injuries
* Potential for cold stress and cold-related injuries
* Treacherous weather-related conditions
* Limited visibility
* Potential for electrical storms

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lighting. Observe daily weather reports and evacuate if necessary in case of inclement weather conditions.

EMERGENCY RESPONSE EQUIPMENT LIST
Some or all of the following will either be available on-Site or be able to be brought to the Site within a 2-hour period:

* 55 Gallon Drums
* 85 Gallon Drums
* Absorbent Pads
* Absorbent Booms
* Speedy-Dry
* Plastic Sheeting
* Hay Bales
* Pneumatic Nibbler
* Back Hoe
* Pressure Washer
* Air Compressor
* Wilden Pumps
* Equipment Storage Trailer
* Submersible Pumps
* Miscellaneous Hand Tools
* Portable Lighting

LARGE EQUIPMENT
If necessary, the following large equipment will be brought to the Site within 2-hours:

* Large Vacuum Truck
* Super Sucker
* Dump Trucks
* Drill Rig
* Utility Vehicle

14.0 LOGS, REPORTS AND RECORD KEEPING

Medical and Training Records

The Site Superintendent keeps medical and training records. All subcontractors must provide verification of training and medical qualifications to the Site Superintendent. The Site Superintendent will keep a log of personnel meeting appropriate training and medical qualifications for site work. The log will be kept in the project file. Medical records will be maintained in accordance with 29 CFR 1910.20.

Onsite Log

A log of personnel onsite each day will be kept by the Site Superintendent. Originals will be kept in the project file.

Exposure Records

Any monitoring results, laboratory reports, calculations and air sampling data sheets are part of an employee exposure record. These records will be kept in accordance with 29 CFR 1910.20. The originals will be sent to the Hydro Tech records coordinator. For subcontractor employees, the original will be sent to the subcontractor employer and a copy kept in the project file.

Accident/Incident Reports

An accident/incident report must be completed for all accidents and incidents. Hydro Tech will send the originals to the appropriate Hydro Tech records coordinator for maintenance. Copies will be distributed as stated. A copy of the forms will be kept in the project file.

OSHA Form 200

An OSHA Form 200 (Log of Occupational Injuries and Illnesses) will be kept at the Site. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to the Hydro Tech corporate records administrator for maintenance. Subcontractor employers must also meet the requirements of maintaining an OSHA 200 form. The Hydro Tech accident/incident report meets the requirements of the OSHA Form 101 (Supplemental Record) and must be maintained with the OSHA Form 200 for all recordable injuries or illnesses.

Health and Safety Field Log Book

The SSO or designee will maintain the logbook in accordance with standard Hydro Tech procedures. Daily site conditions, activities, personnel, calibration records, monitoring results and significant events will be recorded. The original logbooks will become part of the exposure records file.

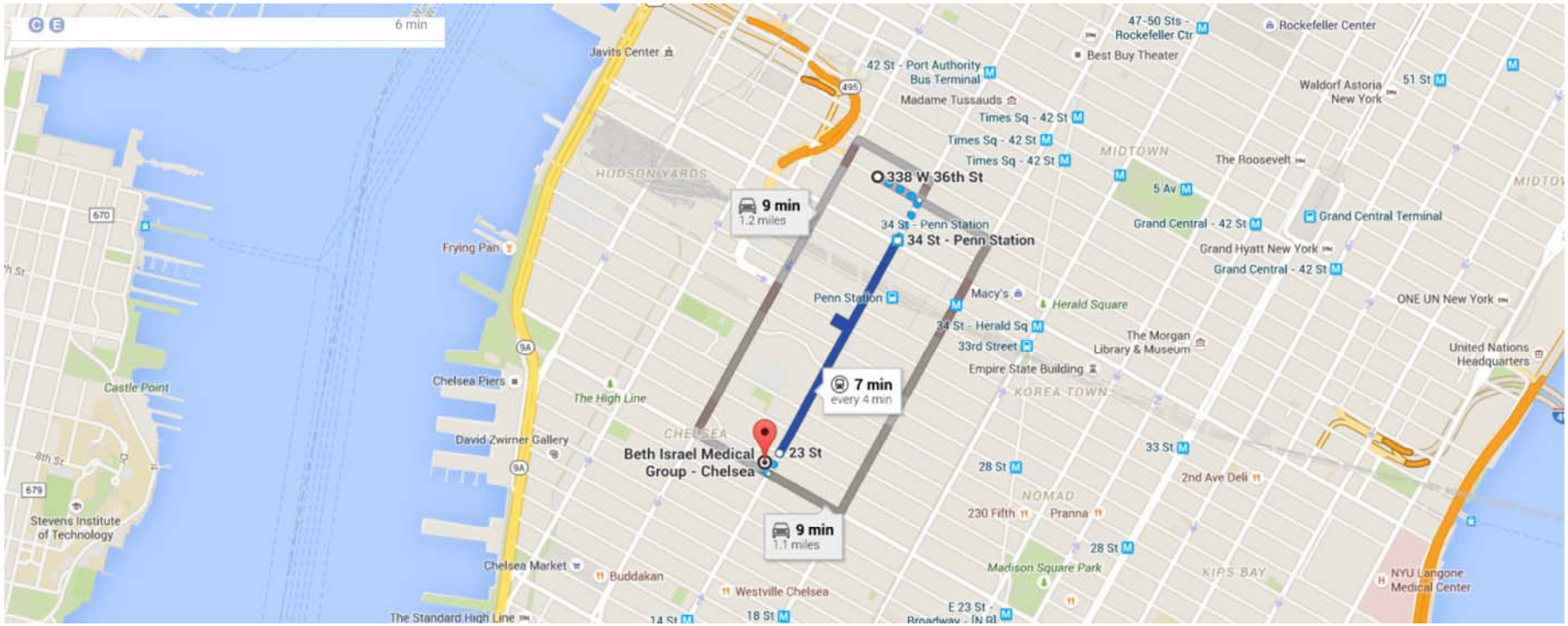
15.0 SANITATION

Since sanitary sewer connection has not been established, provisions shall be made for access to sanitary systems by using nearby public facilities consistent with provisions of governing local ordinance codes. This will include the use of outside firms providing and maintaining "Porta Potties" or similar devices.

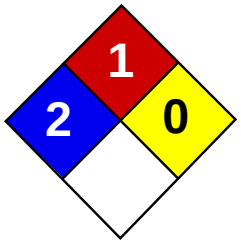
If a commercial/industrial laundry is used to clean or launder clothing that is potentially contaminated, they shall be informed of the potential harmful effects of exposure to hazardous substances related to the affected clothing.

Personnel and subcontractors sites shall follow decontamination procedures described in the Construction HASP. This will generally include, when necessary, site-specific training in shower usage and cleanup, personal hygiene requirements and the donning of protective equipment/clothing.

FIGURE 1
DIRECTIONS TO HOSPITAL


6 min
Javits Center
42 St - Port Authority Bus Terminal
Madame Tussauds
Times Sq - 42 St
Times Sq - 42 St
Times Sq - 42 St
47-50 Sts - Rockefeller Ctr
Best Buy Theater
Rockefeller Center
Waldorf Astoria New York
51 St
MIDTOWN
The Roosevelt
5 Av
HUDSON YARDS
338 W 36th St
9 min
1.2 miles
34 St - Penn Station
34 St - Penn Station
Grand Central - 42 St
Grand Central Terminal
Grand Hyatt New York
Grand Central - 42 St
Frying Pan
Penn Station
Macy's
Herald Square
34 St - Herald Sq
33rd Street
The Morgan Library & Museum
ONE UN New York
United Nations Headquarters
Empire State Building
KOREA TOWN
Castle Point
Chelsea Piers
The High Line
7 min
every 4 min
David Zwirner Gallery
CHELSEA
Beth Israel Medical Group - Chelsea
23 St
28 St
33 St
2nd Ave Deli
NOMAD
230 Fifth
Pranna
9 min
1.1 miles
28 St
Stevens Institute of Technology
Chelsea Market
Buddakan
Madison Square Park
KIPS BAY
NYU Langone Medical Center
Westville Chelsea
The Standard High Line
18 St
E 23 St - Broadway - [N R]

ATTACHMENT A
HEALTH AND SAFETY FACT SHEETS



Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C2HCl3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/

spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m3) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:
Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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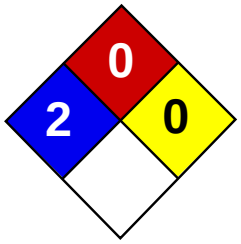

Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet
Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolvel; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C2-Cl4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium , barium. Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Publishe Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects(teratogenic). May affect genetic material (mutagenic). May cause cancer.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symtoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorentiation, seizures, enotional instability, stupor, coma). It may cause pulmonary edema Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver(hepatitis,fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/ central nervous system/peripheral nervous system (impaired memory, numbness of extremeties, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fatthead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 11/01/2010 12:00 PM

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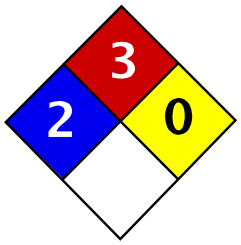

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
p-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: p-Xylene

Catalog Codes: SLX1120

CAS#: 106-42-3

RTECS: ZE2625000

TSCA: TSCA 8(b) inventory: p-Xylene

CI#: Not applicable.

Synonym: p-Methyltoluene

Chemical Name: 1,4-Dimethylbenzene

Chemical Formula: C6H4(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{p-}Xylene	106-42-3	100

Toxicological Data on Ingredients: p-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 12400 mg/kg [Rabbit.]. VAPOR (LC50): Acute: 4550 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to blood, kidneys, the nervous system, liver.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 527°C (980.6°F)

Flash Points: CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

Flammable Limits: LOWER: 1.1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Toxic flammable liquid, insoluble or very slightly soluble in water.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)
TWA: 434 STEL: 651 (mg/m3) from ACGIHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 138°C (280.4°F)

Melting Point: 12°C (53.6°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 9 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:
Easily soluble in methanol, diethyl ether.
Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 5000 mg/kg [Rat.].
Acute dermal toxicity (LD50): 12400 mg/kg [Rabbit.].
Acute toxicity of the vapor (LC50): 4550 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier.
0900 Detected in maternal milk in human.
Narcotic effect; may cause nervous system disturbances.

Special Remarks on other Toxic Effects on Humans: Material is irritating to mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: p-Xylene
Florida: p-Xylene
Massachusetts RTK: p-Xylene
New Jersey: p-Xylene
TSCA 8(b) inventory: p-Xylene
SARA 313 toxic chemical notification and release reporting: p-Xylene
CERCLA: Hazardous substances.: p-Xylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R10- Flammable.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.
R48/20- Harmful: danger of serious

damage to health by prolonged exposure through inhalation.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Material safety data sheet emitted by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du rÃ¨glement sur le transport des marchandises dangeureuses au canada. Centre de conformitÃ© internatinal LtÃ©e. 1986.

Other Special Considerations: Not available.

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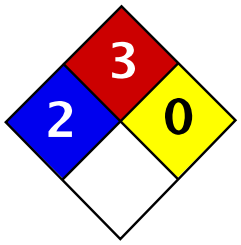

Health	2
Fire	3
Reactivity	0
Personal Protection	J

Material Safety Data Sheet
m-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: m-Xylene

Catalog Codes: SLX1066

CAS#: 108-38-3

RTECS: ZE2275000

TSCA: TSCA 8(b) inventory: m-Xylene

CI#: Not applicable.

Synonym: m-Methyltoluene

Chemical Name: 1,3-Dimethylbenzene

Chemical Formula: C6H4(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{m-}Xylene	108-38-3	100

Toxicological Data on Ingredients: m-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit.].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to blood, kidneys, the nervous system, liver.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 527°C (980.6°F)

Flash Points: CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

Flammable Limits: LOWER: 1.1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid, insoluble in water.

Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Splash goggles. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)
TWA: 434 STEL: 651 (mg/m3) from ACGIHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 139.3°C (282.7°F)

Melting Point: -47.87°C (-54.2°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 6 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:
Easily soluble in methanol, diethyl ether.
Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:
Acute oral toxicity (LD50): 5000 mg/kg [Rat.].
Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit.].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier.
0900 Detected in maternal milk in human.
Narcotic effect; may cause nervous system disturbances.

Special Remarks on other Toxic Effects on Humans: Material is irritating to mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: m-Xylene
Massachusetts RTK: m-Xylene
TSCA 8(b) inventory: m-Xylene
SARA 313 toxic chemical notification and release reporting: m-Xylene
CERCLA: Hazardous substances.: m-Xylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R10- Flammable.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Wear appropriate respirator when
ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Material safety data sheet emitted by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du rÃ¨glement sur le transport des marchandises dangeureuses au canada. Centre de conformitÃ© internatinal LtÃ©e. 1986.

Other Special Considerations: Not available.

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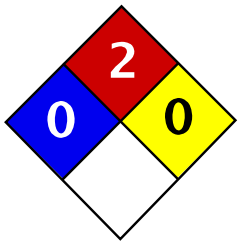

Health	0
Fire	2
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Mesitylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Mesitylene

Catalog Codes: SLM2410

CAS#: 108-67-8

RTECS: OX6825000

TSCA: TSCA 8(b) inventory: Mesitylene

CI#: Not available.

Synonym: 1,3,5-Trimethylbenzene

Chemical Formula: C9H12

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Mesitylene	108-67-8	100

Toxicological Data on Ingredients: Mesitylene: VAPOR (LC50): Acute: 4881.9 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of eye contact (irritant), of ingestion, of inhalation (lung irritant). Slightly hazardous in case of skin contact (irritant, permeator), .

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes,

keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 559°C (1038.2°F)

Flash Points: CLOSED CUP: 43°C (109.4°F).

Flammable Limits: Not available.

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a

concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Avoid contact with eyes Wear suitable protective clothing If ingested, seek medical advice immediately and show the container or the label.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 CEIL: 35 (ppm)
TWA: 125 CEIL: 170 (mg/m3)
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 120.2 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 164.7°C (328.5°F)

Melting Point: -44.8°C (-48.6°F)

Critical Temperature: Not available.

Specific Gravity: 0.8637 (Water = 1)

Vapor Pressure: 1.86 mm of Hg (@ 20°C)

Vapor Density: 4.14 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.23 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute toxicity of the vapor (LC50): 4881.9 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation (lung irritant).
Slightly hazardous in case of skin contact (irritant, permeator), .

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : 1,3,5-Trimethylbenzene : UN2325 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Florida: Mesitylene
New Jersey: Mesitylene
TSCA 8(b) inventory: Mesitylene

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).

DSCL (EEC):
R10- Flammable.
R36/37- Irritating to eyes and respiratory system.

HMIS (U.S.A.):

Health Hazard: 0

Fire Hazard: 2

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

BENZO(B)FLUORANTHENE
Benzo(e)acephenanthrylene
2,3-Benzofluoroanthene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 205-99-2
RTECS # CU1400000
ICSC # 0720

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest.
• **SKIN**	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• **EYES**		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Tightly closed.	Unbreakable packaging; put breakable packaging into closed unbreakable container.

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0720

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International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

I M P O R T A N T D A T A	**PHYSICAL STATE; APPEARANCE:** COLOURLESS TO YELLOW CRYSTALS. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Melting point: 168°C Solubility in water: none	Vapour pressure, Pa at 20°C: <10 Octanol/water partition coefficient as log Pow: 6.04
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.	

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.

ADDITIONAL INFORMATION

ICSC: 0720 **BENZO(B)FLUORANTHENE**

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International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

BENZO(K)FLUOROANTHENE
11,12-Benzofluoroanthene
Dibenzo(b,j,k)fluorene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 207-08-9
RTECS # DF6350000
ICSC # 0721

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• **SKIN**	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• **EYES**		Safety goggles or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Separated from strong oxidants. Tightly closed.	

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0721

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

I M P O R T A N T D A T A	**PHYSICAL STATE; APPEARANCE:** YELLOW CRYSTALS. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. Reacts with strong oxidants. **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 480°C Melting point: 215.7°C	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.84
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.	

NOTES

Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.

ADDITIONAL INFORMATION

ICSC: 0721 **BENZO(K)FLUORANTHENE**

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International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

BENZ(a)ANTHRACENE
1,2-Benzoanthracene
Benzo(a)anthracene
2,3-Benzphenanthrene
Naphthanthracene
$C_{18}H_{12}$
Molecular mass: 228.3

CAS # 56-55-3
RTECS # CV9275000
ICSC # 0385
EC # 601-033-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.		Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest.
• **SKIN**		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• **EYES**		Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Well closed.	T symbol R: 45 S: 53-45

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0385

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International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS TO YELLOW-BROWN FLUORESCENT FLAKES OR POWDER.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV not established.

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

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

EFFECTS OF SHORT-TERM EXPOSURE:

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES

Sublimation point: 435°C
Melting point: 162°C
Relative density (water = 1): 1.274

Solubility in water: none
Vapour pressure, Pa at 20°C: 292
Octanol/water partition coefficient as log Pow: 5.61

ENVIRONMENTAL DATA

In the food chain important to humans, bioaccumulation takes place, specifically in seafood.

NOTES

This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name.

ADDITIONAL INFORMATION

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Material Safety Data Sheet

Benzo[a]pyrene, 98%

ACC# 37175

Section 1 - Chemical Product and Company Identification

MSDS Name: Benzo[a]pyrene, 98%
Catalog Numbers: AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000
Synonyms: 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
50-32-8	Benzo[a]pyrene	>96	200-028-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow to brown powder.
Danger! May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Cancer hazard. May cause allergic skin reaction. May cause heritable genetic damage.
Target Organs: Reproductive system, skin.

Potential Health Effects

Eye: May cause eye irritation.
Skin: May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.
Ingestion: May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.
Inhalation: May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.
Chronic: May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: Not available.
Autoignition Temperature: Not available.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.
Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs

Benzo[a]pyrene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches).	0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Benzo[a]pyrene: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Powder
Appearance: yellow to brown
Odor: faint aromatic odor
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 495 deg C @ 760 mm Hg
Freezing/Melting Point:175 - 179 deg C
Decomposition Temperature: Not available.
Solubility: 1.60x10-3 mg/l @25°C
Specific Gravity/Density: Not available.
Molecular Formula:C20H12
Molecular Weight:252.31

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Dust generation.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 50-32-8: DJ3675000
LD50/LC50:

Not available.

Carcinogenicity:
CAS# 50-32-8:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No information found
Teratogenicity: No information found
Reproductive Effects: Adverse reproductive effects have occurred in experimental animals.
Mutagenicity: Mutagenic effects have occurred in humans.Mutagenic effects have occurred in experimental animals.
Neurotoxicity: No information found
Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 50-32-8: waste number U022.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	NOT REGULATED FOR DOMESTIC TRANSPORT	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a} pyrene)
Hazard Class:		9
UN Number:		UN3077
Packing Group:		III

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 50-32-8 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 50-32-8: 1 lb final RQ; 0.454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 50-32-8: immediate, delayed.

Section 313

This material contains Benzo[a]pyrene (CAS# 50-32-8, >96%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

Clean Air Act:

This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 50-32-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 50-32-8: 0.06 æg/day NSRL

European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T N

Risk Phrases:

R 43 May cause sensitization by skin contact.
R 45 May cause cancer.
R 46 May cause heritable genetic damage.
R 60 May impair fertility.
R 61 May cause harm to the unborn child.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.
S 60 This material and its container must be disposed of as hazardou
s waste.
S 61 Avoid release to the environment. Refer to special instructions
/safety data sheets.

WGK (Water Danger/Protection)
CAS# 50-32-8: No information available.
Canada - DSL/NDSL
CAS# 50-32-8 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of D2A.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
Canadian Ingredient Disclosure List
CAS# 50-32-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997
Revision #7 Date: 6/30/2006

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Material Safety Data Sheet

Chrysene, 98%

ACC# 95251

Section 1 - Chemical Product and Company Identification

MSDS Name: Chrysene, 98%
Catalog Numbers: AC224140000, AC224140010, AC224140050, AC224145000
Synonyms: 1,2-Benzophenanthrene; Benzo(a)phenanthrene; 1,2,5,6-Dibenzonaphthalene.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
218-01-9	Chrysene	98	205-923-4

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: very light beige solid.
Caution! May cause eye and skin irritation. May cause respiratory tract irritation. May cause cancer in humans.
Target Organs: Liver, skin.

Potential Health Effects
Eye: May cause eye irritation.
Skin: May cause skin irritation.
Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea.
Inhalation: May cause respiratory tract irritation.
Chronic: May cause cancer according to animal studies.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air

immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or chemical foam.
Flash Point: Not applicable.
Autoignition Temperature: Not available.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: ; Flammability: 1; Instability:

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash hands before eating. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Avoid breathing dust.
Storage: Store in a tightly closed container. Store in a cool, dry area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Chrysene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches).	0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Chrysene: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance: very light beige
Odor: Not available.
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 448 deg C @ 760 mm Hg
Freezing/Melting Point:250-255 deg C
Decomposition Temperature: Not available.
Solubility: insoluble
Specific Gravity/Density: Not available.
Molecular Formula:C18H12
Molecular Weight:228.29

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Dust generation.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 218-01-9: GC0700000
LD50/LC50:
Not available.

Carcinogenicity:
CAS# 218-01-9:

- **ACGIH:** A3 - Confirmed animal carcinogen with unknown relevance to humans

- **California:** carcinogen, initial date 1/1/90
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No information found
Teratogenicity: No information found
Reproductive Effects: No information found
Mutagenicity: Chrysene was mutagenic to S. Typhimurium in the presence of an exogenous metabolic system.
Neurotoxicity: No information found
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Water flea LC50 = 1.9 mg/L; 2 Hr.; Unspecified Fish toxicity : LC50 (96hr) Neauthes arenacedentata >1ppm.(Rossi,S.S. et al Marine Pollut. Bull. 1978) Invertebrate toxicity : lethal treshold concentration (24hr) Daphnia Magna 0,7æg/l.(* Newsted,J.L. et al Environ. Toxicol. Chem. 1987) Bioaccumulation : 24hr Daphnia Magna log bioconcentration factor 3.7845 (*)
Environmental: Degradation studies : biodegradated by white rot fungus (Proc.Annu.Meet.Am.Wood-Preserv.Assoc.1989) May be utilised by axenic cultures of microorganisms e.g. Pseudomonas pancimobilis EPA505, which may have novel degradative systems(Mueller,J.G. et al ppl.Environ.Microbiol.1990; Mueller, J.G. et al Environ.Sci.Technol.1991).
Physical: Not found.
Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 218-01-9: waste number U050.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 218-01-9 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

Section 313

This material contains Chrysene (CAS# 218-01-9, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 218-01-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Chrysene, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 218-01-9: 0.35 æg/day NSRL (oral)

European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 45 May cause cancer.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.
S 60 This material and its container must be disposed of as hazardou s waste.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 218-01-9: No information available.

Canada - DSL/NDSL

CAS# 218-01-9 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 218-01-9 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 6/30/1999
Revision #4 Date: 10/03/2005

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Material Safety Data Sheet

Fluoranthene, 98%

ACC# 80991

Section 1 - Chemical Product and Company Identification

MSDS Name: Fluoranthene, 98%
Catalog Numbers: AC119170000, AC119170250, AC119171000, AC119175000
Synonyms: 1,2-(1,8-Naphthalenediyl)benzene; 1,2-(1,8-Naphthylene)benzene; 1,2-Benzacenaphthene; Benzene, 1,2-(1,8-naphthylene)-; Benzo(j,k)fluorene; Benzo(jk)fluoranthene; Benzo(jk)fluorene
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
206-44-0	Fluoranthene	98	205-912-4

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow needles.
Caution! Harmful. Causes eye and skin irritation and possible burns. May be harmful if absorbed through the skin. May be harmful if swallowed. May cause heart and liver injury.
Target Organs: Heart, liver, lungs.

Potential Health Effects

Eye: Causes eye irritation and possible burns.
Skin: May be harmful if absorbed through the skin. Causes severe skin irritation and possible burns.
Ingestion: May be harmful if swallowed. May cause rapid heartbeat and cardiac arrythmias. May cause liver injury, pulmonary edema, and respiratory arrest. May cause gastrointestinal disturbances such as nausea.
Inhalation: May cause effects similar to those described for ingestion. May produce cardiac failure and pulmonary edema.
Chronic: Prolonged or repeated skin contact may cause defatting and dermatitis.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the

upper and lower eyelids. Get medical aid imme diately. Do NOT allow victim to rub eyes or keep eyes closed. Extensiv e irrigation with water is required (at least 30 minutes).
Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes.
Ingestion: Never give anything by mouth to an unconscious person. Get medical aid immediately. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media: In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.
Flash Point: Not applicable.
Autoignition Temperature: Not applicable.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale. Use only in a chemical fume hood. Do not breathe dust.
Storage: Keep containers tightly closed. Store in a cool, dry area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Fluoranthene	none listed	none listed	none listed

OSHA Vacated PELs: Fluoranthene: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves and clothing to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Needles
Appearance: yellow
Odor: None reported.
pH: Not available.
Vapor Pressure: 0.01 mm Hg @ 20 deg C
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 384 deg C @ 760.00mmHg
Freezing/Melting Point:107.00 - 110.00 deg C
Decomposition Temperature: Not available.
Solubility: insoluble
Specific Gravity/Density:1.252 g/cm3
Molecular Formula:C16H10
Molecular Weight:202.25

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, strong oxidants.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, acrid smoke and fumes.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 206-44-0: LL4025000
LD50/LC50:
CAS# 206-44-0:
Oral, rat: LD50 = 2 gm/kg;

Skin, rabbit: LD50 = 3180 mg/kg;
.

Carcinogenicity:
CAS# 206-44-0: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: IARC Group 3: Limited or insufficient evidence for carcinogenicity in both animals and humans.Experimental tumorigenic data has been reported.
Teratogenicity: No information found
Reproductive Effects: No information found
Mutagenicity: Mutation in microorganisms: Salmonella typhimurium = 5ug/plate.Mutation in mammalian somatic cells: Human Lymphocyte = 2 umol/L.
Neurotoxicity: No information found
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Bluegill/Sunfish: 3980 um/L; 96 H; (not specified) No data available.
Environmental: Remains in the upper few cm of soil, but can be transported to groundwater. Biodegrades from soil in a few years. Will not volatilize from soil or water. Rapidly absorbed to sediment and particulates and will readily bioconcentrate. Unadsorbed substance in water will degrade by photolysis in a days to weeks. Stable in sediment for decades or more. In the atmostphere, photodegrades with half life of 4 - 5 days, but may transport long distances without settling or raining out.
Physical: No information available.
Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 206-44-0: waste number U120.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 206-44-0 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 206-44-0: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 206-44-0: immediate.
Section 313
This material contains Fluoranthene (CAS# 206-44-0, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 206-44-0 is listed as a Priority Pollutant under the Clean Water Act. CAS# 206-44-0 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 206-44-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
XN
Risk Phrases:
R 21/22 Harmful in contact with skin and if swallowed.

Safety Phrases:
S 22 Do not breathe dust.
S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)
CAS# 206-44-0: No information available.
Canada - DSL/NDSL
CAS# 206-44-0 is listed on Canada's NDSL List.
Canada - WHMIS

This product has a WHMIS classification of D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 206-44-0 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997
Revision #5 Date: 10/03/2005

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

MSDS Number: **L2347** * * * * * *Effective Date:* ***08/10/04*** * * * * * *Supercedes:* ***11/02/01***

MSDS **Material Safety Data Sheet**

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

LEAD METAL

1. Product Identification

Synonyms: Granular lead, pigment metal; C.I. 77575
CAS No.: 7439-92-1
Molecular Weight: 207.19
Chemical Formula: Pb
Product Codes:
J.T. Baker: 2256, 2266
Mallinckrodt: 5668

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Lead	7439-92-1	95 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

Lead can be absorbed through the respiratory system. Local irritation of bronchia and lungs can occur and, in cases of acute exposure, symptoms such as metallic taste, chest and abdominal pain, and increased lead blood levels may follow. See also Ingestion.
Ingestion:
POISON! The symptoms of lead poisoning include abdominal pain and spasms, nausea, vomiting, headache. Acute poisoning can lead to muscle weakness, "lead line" on the gums, metallic taste, definite loss of appetite, insomnia, dizziness, high lead levels in blood and urine with shock, coma and death in extreme cases.
Skin Contact:
Lead and lead compounds may be absorbed through the skin on prolonged exposure; the symptoms of lead poisoning described for ingestion exposure may occur. Contact over short periods may cause local irritation, redness and pain.
Eye Contact:
Absorption can occur through eye tissues but the more common hazards are local irritation or abrasion.
Chronic Exposure:
Lead is a cumulative poison and exposure even to small amounts can raise the body's content to toxic levels. The symptoms of chronic exposure are like those of ingestion poisoning; restlessness, irritability, visual disturbances, hypertension and gray facial color may also be noted.
Aggravation of Pre-existing Conditions:
Persons with pre-existing kidney, nerve or circulatory disorders or with skin or eye problems may be more susceptible to the effects of this substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. Powder/dust is flammable when heated or exposed to flame.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Can produce toxic lead fumes at elevated temperatures and also react with oxidizing materials.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

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7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Areas in which exposure to lead

metal or lead compounds may occur should be identified by signs or appropriate means, and access to the area should be limited to authorized persons. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For lead, metal and inorganic dusts and fumes, as Pb:
-OSHA Permissible Exposure Limit (PEL): 0.05 mg/m3 (TWA)
For lead, elemental and inorganic compounds, as Pb:
-ACGIH Threshold Limit Value (TLV): 0.05 mg/m3 (TWA), A3 animal carcinogen
ACGIH Biological Exposure Indices (BEI): 30 ug/100ml, notation B (see actual Indices for more information).
For lead, inorganic:
-NIOSH Recommended Exposure Limit (REL): 0.1 mg/m3 (TWA)
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face high efficiency particulate respirator (NIOSH type N100 filter) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece high efficiency particulate respirator (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.
Other Control Measures:
Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing lead compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1025).

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9. Physical and Chemical Properties

Appearance:
Small, white to blue-gray metallic shot or granules.
Odor:
Odorless.
Solubility:
Insoluble in water.
Density:
11.34
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
1740C (3164F)
Melting Point:
327.5C (622F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
1.77 @ 1000C (1832F)
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Does not decompose but toxic lead or lead oxide fumes may form at elevated temperatures.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Ammonium nitrate, chlorine trifluoride, hydrogen peroxide, sodium azide, zirconium, disodium acetylide, sodium acetylide and oxidants.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

---

11. Toxicological Information

Toxicological Data:
Investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
Lead and other smelter emissions are human reproductive hazards. (Chemical Council on

Environmental Quality; Chemical Hazards to Human Reproduction, 1981).
Carcinogenicity:
EPA / IRIS classification: Group B2 - Probable human carcinogen, sufficient animal evidence.

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--------\Cancer Lists\-------------------------------------------------------
                                        ---NTP Carcinogen---
Ingredient                              Known    Anticipated    IARC Category
-------------------------------------   -----    -----------    -------------
Lead (7439-92-1)                         No          No             2B
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12. Ecological Information

Environmental Fate:
When released into the soil, this material is not expected to leach into groundwater. This material may bioaccumulate to some extent.
Environmental Toxicity:
No information found.

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13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

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14. Transport Information

Not regulated.

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15. Regulatory Information

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--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                        TSCA  EC   Japan  Australia
----------------------------------------------   ----  ---  -----  ---------
Lead (7439-92-1)                                  Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                            --Canada--
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Ingredient	Korea	DSL	NDSL	Phil.
Lead (7439-92-1)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Lead (7439-92-1)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Lead (7439-92-1)	10	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

WARNING:
THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: None allocated.
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **3** Flammability: **1** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not

breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **M1599** * * * * * *Effective Date:* ***12/19/05*** * * * * * *Supercedes:* ***08/10/04***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

MERCURY

1. Product Identification

Synonyms: Quicksilver; hydrargyrum; Liquid Silver
CAS No.: 7439-97-6
Molecular Weight: 200.59
Chemical Formula: Hg
Product Codes:
J.T. Baker: 2564, 2567, 2569
Mallinckrodt: 1278, 1280, 1288

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Mercury	7439-97-6	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Life)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Mercury vapor is highly toxic via this route. Causes severe respiratory tract damage. Symptoms include sore throat, coughing, pain, tightness in chest, breathing difficulties, shortness of breath, headache, muscle weakness, anorexia, gastrointestinal disturbance, ringing in the ear, liver changes, fever, bronchitis and pneumonitis. Can be absorbed through inhalation with symptoms similar to ingestion.
Ingestion:
May cause burning of the mouth and pharynx, abdominal pain, vomiting, corrosive ulceration, bloody diarrhea. May be followed by a rapid and weak pulse, shallow breathing, paleness, exhaustion, tremors and collapse. Delayed death may occur from renal failure. Gastrointenstinal uptake of mercury is less than 5% but its ability to penetrate tissues presents some hazard. Initial symptoms may be thirst, possible abdominal discomfort.
Skin Contact:
Causes irritaton and burns to skin. Symptoms include redness and pain. May cause skin allergy and sensitization. Can be absorbed through the skin with symptoms to parallel ingestion.
Eye Contact:
Causes irritation and burns to eyes. Symptoms include redness, pain, blurred vision; may cause serious and permanent eye damage.
Chronic Exposure:
Chronic exposure through any route can produce central nervous system damage. May cause muscle tremors, personality and behavior changes, memory loss, metallic taste, loosening of the teeth, digestive disorders, skin rashes, brain damage and kidney damage. Can cause skin allergies and accumulate in the body. Repeated skin contact can cause the skin to turn gray in color. A suspected reproductive hazard; may damage the developing fetus and decrease fertility in males and females.
Aggravation of Pre-existing Conditions:
Persons with nervous disorders, or impaired kidney or respiratory function, or a history of allergies or a known sensitization to mercury may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Undergoes hazardous reactions in the presence of heat and sparks or ignition. Smoke may contain toxic mercury or mercuric oxide. Smoke may contain toxic mercury or mercuric oxide.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Clean-up personnel require protective clothing and respiratory protection from vapor.

Spills: Pick up and place in a suitable container for reclamation or disposal in a method that does not generate misting. Sprinkle area with sulfur or calcium polysulfide to suppress mercury. Do not flush to sewer. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker CINNASORB® and RESISORB® are recommended for spills of this product.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Do not use or store on porous work surfaces (wood, unsealed concrete, etc.). Follow strict hygiene practices. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Acceptable Ceiling Concentration:
mercury and mercury compounds: 0.1 mg/m3 (TWA), skin
- ACGIH Threshold Limit Value (TLV):
inorganic and metallic mercury, as Hg: 0.025 mg/m3 (TWA) skin, A4 Not classifiable as a human carcinogen.
- ACGIH Biological Exposure Indices:
total inorganic mercury in urine (preshift): 35 ug/g creatinine;
total inorganic mercury in blood (end of shift): 15 ug/l.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face respirator with a mercury vapor or chlorine gas cartridge may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with a mercury vapor or chlorine gas cartridge may be worn up to 50 times the exposure limit, or the maximum use concentraiton specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Silver-white, heavy, mobile, liquid metal.
Odor:
Odorless.
Solubility:
Insoluble in water.
Density:
13.55
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
356.7C (675F)
Melting Point:
-38.87C (-38F)
Vapor Density (Air=1):
7.0
Vapor Pressure (mm Hg):
0.0018 @ 25C (77F)
Evaporation Rate (BuAc=1):
4

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
At high temperatures, vaporizes to form extremely toxic fumes.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Acetylenes, ammonia, ethylene oxide, chlorine dioxide, azides, metal oxides, methyl silane, lithium, rubidium, oxygen, strong oxidants, metal carbonyls.
Conditions to Avoid:
Heat, flames, ignition sources, metal surfaces and incompatibles.

---

11. Toxicological Information

Toxicological Data:
Investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
All forms of mercury can cross the placenta to the fetus, but most of what is known has

been learned from experimental animals. See Chronic Health Hazards.
Carcinogenicity:
EPA / IRIS classification: Group D1 - Not classifiable as a human carcinogen.

```
--------\Cancer Lists\-------------------------------------------------------
                                        ---NTP Carcinogen---
Ingredient                              Known    Anticipated    IARC Category
------------------------------------    -----    -----------    -------------
Mercury (7439-97-6)                      No          No              3
```

12. Ecological Information

Environmental Fate:
This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This material is expected to significantly bioaccumulate.
Environmental Toxicity:
This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are less than 1 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: RQ, MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 1LB

International (Water, I.M.O.)

Proper Shipping Name: MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 1LB

International (Air, I.C.A.O.)

Proper Shipping Name: MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 1LB

---

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                        TSCA  EC   Japan  Australia
----------------------------------------------  ----  ---  -----  ---------
Mercury (7439-97-6)                               Yes  Yes   No       Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                         --Canada--
Ingredient                                        Korea  DSL   NDSL  Phil.
----------------------------------------------  -----  ---   ----  -----
Mercury (7439-97-6)                               Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                            -SARA 302-    ------SARA 313------
Ingredient                                  RQ    TPQ     List  Chemical Catg.
----------------------------------------  ---   -----   ----  --------------
Mercury (7439-97-6)                         No    No      Yes        No

--------\Federal, State & International Regulations - Part 2\----------------
                                                         -RCRA-    -TSCA-
Ingredient                                  CERCLA     261.33     8(d)
----------------------------------------  ------     ------    ------
Mercury (7439-97-6)                         1          U151       No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Pure / Liquid)
```

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 2Z
Poison Schedule: S7
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3.
Disclaimer:
****

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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Material Safety Data Sheet

Phenanthrene, 90%

ACC# 59921

Section 1 - Chemical Product and Company Identification

MSDS Name: Phenanthrene, 90%
Catalog Numbers: AC130100000, AC130100010, AC130102500
Synonyms:
Company Identification:
Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
85-01-8	Phenanthrene	90.0	201-581-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: brown solid.
Caution! Powdered material may form explosive dust-air mixtures. May cause allergic skin reaction. May cause eye and skin irritation. May cause respiratory tract irritation. Cancer suspect agent.
Target Organs: None.

Potential Health Effects
Eye: May cause eye irritation.
Skin: May cause skin irritation. May cause photosensitive skin reactions in certain individuals.
Ingestion: May cause irritation of the digestive tract.
Inhalation: Inhalation of dust may cause respiratory tract irritation.
Chronic: No information found.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid imme diately.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media: Use water spray or dry chemical.
Flash Point: Not available.
Autoignition Temperature: Not available.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 1; Flammability: 1; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation. Do not let this chemical enter the environment.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.
Storage: Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use adequate ventilation to keep airborne concentrations low.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Phenanthrene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches).	0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Phenanthrene: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance: brown
Odor: none reported
pH: Not available.
Vapor Pressure: 1 mm Hg @116c
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 340 deg C
Freezing/Melting Point:101 deg C
Decomposition Temperature: Not available.
Solubility: insoluble
Specific Gravity/Density:1.0630g/cm3
Molecular Formula:C14H10
Molecular Weight:178.23

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, dust generation, strong oxidants.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 85-01-8: SF7175000
LD50/LC50:
CAS# 85-01-8:
Oral, mouse: LD50 = 700 mg/kg;
Oral, rat: LD50 = 1.8 gm/kg;
.

Carcinogenicity:
CAS# 85-01-8:

- **ACGIH:** A1 - Confirmed Human Carcinogen (as benzene soluble aerosol) (listed as 'Coal tar pitches').
- **California:** Not listed.
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No data available.
Teratogenicity: No data available.
Reproductive Effects: No data available.
Mutagenicity: No data available.
Neurotoxicity: No data available.
Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 85-01-8 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 85-01-8: 5000 lb final RQ; 2270 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 85-01-8: immediate.
Section 313
This material contains Phenanthrene (CAS# 85-01-8, 90.0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 85-01-8 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 85-01-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as Coal tar pitches), Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European / International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols:
T
Risk Phrases:
R 45 May cause cancer.

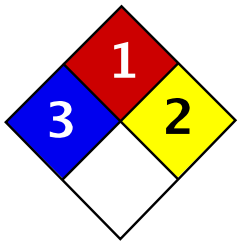
Safety Phrases:
S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)
CAS# 85-01-8: No information available.
Canada - DSL/NDSL
CAS# 85-01-8 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
Canadian Ingredient Disclosure List
CAS# 85-01-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 7/14/1998
Revision #3 Date: 10/03/2005

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.



Health	3
Fire	1
Reactivity	2
Personal Protection	E

Material Safety Data Sheet
Arsenic MSDS

Section 1: Chemical Product and Company Identification

Product Name: Arsenic

Catalog Codes: SLA1006

CAS#: 7440-38-2

RTECS: CG0525000

TSCA: TSCA 8(b) inventory: Arsenic

CI#: Not applicable.

Synonym:

Chemical Name: Arsenic

Chemical Formula: As

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Arsenic	7440-38-2	100

Toxicological Data on Ingredients: Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to kidneys, lungs, the nervous system, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits highly toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not

present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 from ACGIH (TLV) [United States] [1995]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 74.92 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: Not available.

Melting Point: Sublimation temperature: 615°C (1139°F)

Critical Temperature: Not available.

Specific Gravity: 5.72 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 145 mg/kg [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.
Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion, of inhalation.
Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Arsenic UNNA: UN1558 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Arsenic
Pennsylvania RTK: Arsenic
Massachusetts RTK: Arsenic
TSCA 8(b) inventory: Arsenic

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R22- Harmful if swallowed.
R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.
-Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 04:16 PM

Last Updated: 10/09/2005 04:16 PM

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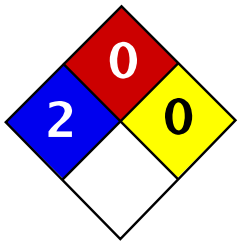

Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to skin.
The substance may be toxic to kidneys, lungs, liver, upper respiratory tract.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:
Material in powder form, capable of creating a dust explosion.
Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.
Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.
Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation Respirable.
TWA: 0.5 (mg/m3) [United Kingdom (UK)]
TWA: 1 (mg/m3) from OSHA (PEL) [United States] InhalationConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid. Lustrous solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water.
Insoluble in Ammonia.
Soluble in dilute Nitric Acid.
Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + indusorial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
Causes damage to the following organs: skin.
May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose/Conc:
LDL [Rat] - Route: Oral; Dose: 5000 mg/kg
LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Nickel dust and fume can irritate skin.
Eyes: Nickel dust and fume can irritate eyes.
Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.
Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased cornary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).
Chronic Potential Health Effects:
Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.
Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).
Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of NIckel may also affect respiration and cause pneumoconiosis or fibrosis.
Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal
Connecticut hazardous material survey.: Nickel metal
Illinois toxic substances disclosure to employee act: Nickel metal
Illinois chemical safety act: Nickel metal
New York release reporting list: Nickel metal
Rhode Island RTK hazardous substances: Nickel metal
Pennsylvania RTK: Nickel metal
Michigan critical material: Nickel metal
Massachusetts RTK: Nickel metal
Massachusetts spill list: Nickel metal
New Jersey: Nickel metal
New Jersey spill list: Nickel metal
Louisiana spill reporting: Nickel metal
California Director's List of Hazardous Substances: Nickel metal
TSCA 8(b) inventory: Nickel metal

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects.
R43- May cause sensitization by skin contact.
S22- Do not breathe dust.
S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 10/10/2005 08:42 PM

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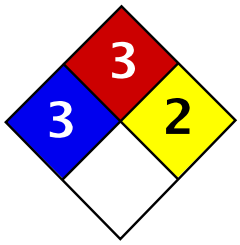

Health	3
Fire	3
Reactivity	2
Personal Protection	J

Material Safety Data Sheet
Calcium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Calcium

Catalog Codes: SLC2782

CAS#: 7440-70-2

RTECS: EV8040000

TSCA: TSCA 8(b) inventory: Calcium

CI#: Not available.

Synonym:

Chemical Formula: Ca

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Calcium	7440-70-2	100

Toxicological Data on Ingredients: Calcium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to lungs, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Corrosive solid. Flammable solid that, in contact with water, emits flammable gases.
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:
Keep under inert atmosphere. Keep container dry. Do not breathe dust. Never add water to this product Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes Keep away from incompatibles such as acids, moisture.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 40.08 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 1484°C (2703.2°F)

Melting Point: 839°C (1542.2°F)

Critical Temperature: Not available.

Specific Gravity: 1.54 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Not available.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances:
Highly reactive with acids.
Reactive with moisture.
The product reacts violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.3: Material that emits flammable gases on contact with water.

Identification: : Calcium : UN1401 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Calcium
Massachusetts RTK: Calcium
TSCA 8(b) inventory: Calcium

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-6: Reactive and very flammable material.
CLASS E: Corrosive solid.

DSCL (EEC): R36/38- Irritating to eyes and skin.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 3

Reactivity: 2

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 3

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 11:30 AM

Last Updated: 11/06/2008 12:00 PM

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Health	3
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Cadmium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Cadmium

Catalog Codes: SLC3484, SLC5272, SLC2482

CAS#: 7440-43-9

RTECS: EU9800000

TSCA: TSCA 8(b) inventory: Cadmium

CI#: Not applicable.

Synonym:

Chemical Name: Cadmium

Chemical Formula: Cd

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Cadmium	7440-43-9	100

Toxicological Data on Ingredients: Cadmium: ORAL (LD50): Acute: 2330 mg/kg [Rat.]. 890 mg/kg [Mouse]. DUST (LC50): Acute: 50 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant). Severe over-exposure can result in death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to kidneys, lungs, liver.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:
Non-flammable in presence of open flames and sparks, of heat, of oxidizing materials, of reducing materials, of combustible materials, of moisture.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 (ppm)
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 112.4 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 765°C (1409°F)

Melting Point: 320.9°C (609.6°F)

Critical Temperature: Not available.

Specific Gravity: 8.64 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity: Reacts violently with potassium.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 890 mg/kg [Mouse].
Acute toxicity of the dust (LC50): 229.9 mg/m3 4 hour(s) [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP.
The substance is toxic to kidneys, lungs, liver.

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: An allergen. 0047 Animal: embryotoxic, passes through the placental barrier.

Special Remarks on other Toxic Effects on Humans: May cause allergic reactions, exzema and/or dehydration of the skin.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

Identification:

Special Provisions for Transport:

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Cadmium
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Cadmium
Pennsylvania RTK: Cadmium
Massachusetts RTK: Cadmium
TSCA 8(b) inventory: Cadmium
SARA 313 toxic chemical notification and release reporting: Cadmium
CERCLA: Hazardous substances.: Cadmium

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R26- Very toxic by inhalation.
R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.
-Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

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Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Copper MSDS

Section 1: Chemical Product and Company Identification

Product Name: Copper

Catalog Codes: SLC4939, SLC2152, SLC3943, SLC1150, SLC2941, SLC4729, SLC1936, SLC3727, SLC5515

CAS#: 7440-50-8

RTECS: GL5325000

TSCA: TSCA 8(b) inventory: Copper

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Cu

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Copper	7440-50-8	100

Toxicological Data on Ingredients: Copper LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to lungs, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If you feel unwell, seek medical attention and show the label when possible.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (mg/m3) from ACGIH [1990]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 63.54 g/mole

Color: Not available.

pH (1% soln/water): Not applicable.

Boiling Point: 2595°C (4703°F)

Melting Point: 1083°C (1981.4°F)

Critical Temperature: Not available.

Specific Gravity: 8.94 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion.
Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Human: passes through the placenta, excreted in maternal milk.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Copper
Massachusetts RTK: Copper
TSCA 8(b) inventory: Copper
CERCLA: Hazardous substances.: Copper

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R36- Irritating to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator

when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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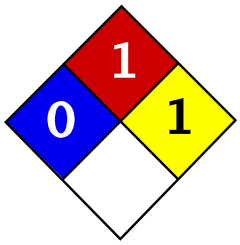

Health	1
Fire	3
Reactivity	2
Personal Protection	E

Material Safety Data Sheet
Magnesium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Magnesium

Catalog Codes: SLM4408, SLM2263, SLM3637

CAS#: 7439-95-4

RTECS: OM2100000

TSCA: TSCA 8(b) inventory: Magnesium

CI#: Not applicable.

Synonym: Magnesium ribbons, turnings or sticks

Chemical Name: Magnesium

Chemical Formula: Mg

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

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1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Magnesium	7439-95-4	100

Toxicological Data on Ingredients: Magnesium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at

least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Flammable in presence of acids, of moisture.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Explosive in presence of acids, of moisture.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Magnesium turnings, chips or granules, ribbons, are flammable. They can be easily ignited. They may reignite after fire is extinguished. Produces flammable gases on contact with water and acid. May ignite on contact with water or moist air.
Magnesium fires do not flare up violently unless moisture is present.

Special Remarks on Explosion Hazards: Reacts with acids and water to form hydrogen gas with is highly flammable and eplosive

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Flammable solid.
Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage:
Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Moisture sensitive. Dangerous when wet.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 24.31 g/mole

Color: Silver-white

pH (1% soln/water): Not applicable.

Boiling Point: 1100°C (2012°F)

Melting Point: 651°C (1203.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.74 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Very slightly soluble in hot water.
Insoluble in cold water.
Insoluble in chromium trioxides, and mineral acids, alkalies.
Slightly soluble with decomposition in hot water.
Soluble in concentrated hydrogen fluoride, and ammonium salts.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, incompatible materials, water or moisture, moist air.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Violent chemical reaction with oxidizing agents.
Reacts with water to create hydrogen gas and heat. Must be kept dry.
Reacts with acids to form hydrogen gas which is highly flammable and explosive.
Magnesium forms hazardous or explosive mixtures with aluminum and potassium perchlorate; ammonium nitrate; barium nitrate, barium dioxide and zinc; beryllium oxide; boron phosphodiiodide; bromobenzyl trifluoride; cadmium cyanide; cadmium oxide; calcium carbide; carbonates; carbon tetrachloride; chlorine; chlorine trifluoride; chloroform; cobalt cyanide; copper cyanide; copper sulfate(anhydrous), ammonium nitrate, potassium chlorate and water; cupric oxide; cupric sulfate; fluorine; gold cyanide; hydrogen and calcium carbonate; hydrogen iodide; hydrogen peroxide; iodine; lead cyanide; mercuric oxide; mercury cyanide; methyl chloride; molybdenum trioxide; nickel cyanide; nitric acid; nitrogen dioxide; oxygen (liquid); performic acid; phosphates; potassium chlorate; potassium perchlorate; silver nitrate; silver oxide; sodium perchlorate; sodium peroxide; sodium peroxide and carbon dioxide; stannic oxide; sulfates; trichloroethylene; zinc cyanide; zinc oxide.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause skin irritation by mechanical action. May get mechanical injury or embedding of chips/particles in skin. The particles that are embedded in the wounds may retard healing.
Eyes: May cause eye irritation by mechanical action. Mechanical injury may occur. Particles or chips may embed in eye and retard healing.
Inhalation: Low hazard for ususal industrial handling. It may cause respiratory tract irritation. However, it is unlikely due to physical form. When Magnesium metal is heated during welding or smelting process, Metal Fume Fever may result from inhalation of magnesium fumes. Metal Fume Fever is a flu-like condition consisting of fever, chills, sweating, aches, pains, cough, weakness, headache, nausea, vomiting, and breathing difficulty. Other symptoms may include metallic taste, increased white blood cell count. There is no permanent ill-effect.
Ingestion: Low hazard for usual industrial handling. There are no known reports of serious industrial poisonings with Magnesium. Ingeston of large amounts of chips, turnings or ribbons may cause gastrointestinal tract irritation with nausea, vomiting, and diarrhea. Acute ingestion may also result in Hypermagnesia. Hypermagnesia may cause hypotension, bradycardia, CNS depression, respiratory depression, and impairment of neuromuscular transmission (hyporeflexia, paralysis).

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Magnesium UNNA: 1869 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Magnesium
Rhode Island RTK hazardous substances: Magnesium
Pennsylvania RTK: Magnesium

Massachusetts RTK: Magnesium
Massachusetts spill list: Magnesium
New Jersey: Magnesium
TSCA 8(b) inventory: Magnesium

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-4: Flammable solid.
CLASS B-6: Reactive and very flammable material.

DSCL (EEC):
R11- Highly flammable.
R15- Contact with water liberates extremely flammable gases.
S7/8- Keep container tightly closed and dry.
S43- In case of fire, use dry chemical. Never use water.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 3

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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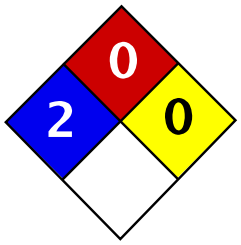

Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to skin.
The substance may be toxic to kidneys, lungs, liver, upper respiratory tract.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:
Material in powder form, capable of creating a dust explosion.
Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.
Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.
Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation Respirable.
TWA: 0.5 (mg/m3) [United Kingdom (UK)]
TWA: 1 (mg/m3) from OSHA (PEL) [United States] InhalationConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid. Lustrous solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water.
Insoluble in Ammonia.
Soluble in dilute Nitric Acid.
Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + indusorial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
Causes damage to the following organs: skin.
May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose/Conc:
LDL [Rat] - Route: Oral; Dose: 5000 mg/kg
LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Nickel dust and fume can irritate skin.
Eyes: Nickel dust and fume can irritate eyes.
Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.
Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased cornary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).
Chronic Potential Health Effects:
Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.
Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).
Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of NIckel may also affect respiration and cause pneumoconiosis or fibrosis.
Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal
Connecticut hazardous material survey.: Nickel metal
Illinois toxic substances disclosure to employee act: Nickel metal
Illinois chemical safety act: Nickel metal
New York release reporting list: Nickel metal
Rhode Island RTK hazardous substances: Nickel metal
Pennsylvania RTK: Nickel metal
Michigan critical material: Nickel metal
Massachusetts RTK: Nickel metal
Massachusetts spill list: Nickel metal
New Jersey: Nickel metal
New Jersey spill list: Nickel metal
Louisiana spill reporting: Nickel metal
California Director's List of Hazardous Substances: Nickel metal
TSCA 8(b) inventory: Nickel metal

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects.
R43- May cause sensitization by skin contact.
S22- Do not breathe dust.
S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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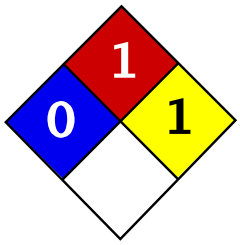

Health	1
Fire	1
Reactivity	1
Personal Protection	E

Material Safety Data Sheet
Zinc Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Zinc Metal

Catalog Codes: SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204

CAS#: 7440-66-6

RTECS: ZG8600000

TSCA: TSCA 8(b) inventory: Zinc Metal

CI#: Not applicable.

Synonym: Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips

Chemical Name: Zinc Metal

Chemical Formula: Zn

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Zinc Metal	7440-66-6	100

Toxicological Data on Ingredients: Zinc Metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances:
Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials, of acids, of alkalis, of moisture.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Zinc + NaOH causes ignition.
Oxidation of zinc by potassium proceeds with incandescence.
Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper.
Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined.
When hydrazine mononitrate is heated in contact with zinc, a flamming decomposition occurs at temperatures a little above its melting point.
Contact with acids and alkali hydroxides (sodium hydroxide, postasium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas.
Zinc foil ignites if traces of moisture are present.
It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or

moist air.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Flammable solid that, in contact with water, emits flammable gases.
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid. Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 65.39 g/mole

Color: Bluish-grey

pH (1% soln/water): Not applicable.

Boiling Point: 907°C (1664.6°F)

Melting Point: 419°C (786.2°F)

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials, moisture

Incompatibility with various substances:
Reactive with oxidizing agents, acids, alkalis.
Slightly reactive to reactive with moisture.
The product may react violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with acids, halogenated hydrocarbons, NH_4NO_3, barium oxide, $Ba(NO_3)_2$, Cadmium, CS_2, chlorates, Cl_2, CrO_3, F_2, Hydroxylamine, $Pb(N_3)_2$, $MnCl_2$, HNO_3, performic acid, $KClO_3$, KNO_3, N_2O_2, Selenium, $NaClO_3$, Na_2O_2, Sulfur, Te, water, $(NH_4)_2S$, As_2O_3, CS_2, $CaCl_2$, chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl, H_2SO_4, (Mg +$Ba(NO_3)_2$ +BaO_2), (ethyl acetoacetate +tribromoneopentyl alcohol.
Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen.
Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide.
May react with water.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.
LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss.
Eyes: May cause eye irritation.
Ingestion: May be harmul if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain. fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derrangement in cerebellar function, lightheadness, dizzness, irritability, muscular stiffness, and pain. May also affect blood.
Inhalation: Inhalation of zinc dust or fumes may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headached fever, maliase, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis.
The toxicological properties of this substance have not been fully investisgated.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

New York release reporting list: Zinc Metal
Rhode Island RTK hazardous substances: Zinc Metal
Pennsylvania RTK: Zinc Metal
Florida: Zinc Metal
Michigan critical material: Zinc Metal
Massachusetts RTK: Zinc Metal
New Jersey: Zinc Metal
California Director's List of Hazardous Substances: Zinc Metal
TSCA 8(b) inventory: Zinc Metal
TSCA 12(b) one time export: Zinc Metal
SARA 313 toxic chemical notification and release reporting: Zinc Metal
CERCLA: Hazardous substances.: Zinc Metal: 1000 lbs. (453.6 kg)

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not Available

DSCL (EEC):
R15- Contact with water liberates
extremely flammable gases.
R17- Spontaneously flammable in air.
S7/8- Keep container tightly closed and dry.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 1

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an
approved/certified respirator or
equivalent.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Department of Health and Human Services
Agency for Toxic Substances & Disease Registry

ToxFAQs™: Chemical Agent Briefing Sheets (CABS)

Lead

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January 2006

PDF Version

- What is lead?
- What are the forms of lead?
- What are the common uses of lead?
- What are the routes of exposure for lead?
- Who are the populations most at risk and how are they usually exposed?
- What are the possible toxic effects of lead?
- How can I reduce the risk of exposure to lead?
- What are the safety guidelines for lead exposure?
- What are the most important or common mediating factors?
- Is there a test to see if my child or I have been exposed to lead?
- Future Research Needs
- For more information

What is lead?

Lead is a heavy, bluish-gray metal that has a low melting point. It occurs naturally in the Earth's crust, but it is not a particularly abundant element. It is rarely found naturally as a metal, but rather in its divalent (2+) oxidative state in ore deposits widely distributed throughout the world. The most important lead containing ores are galena (PbS), anglesite ($PbSO_4$), and cerussite ($PbCO_3$). Natural lead is a mixture of four stable isotopes: ^{208}Pb (51%–53%), ^{206}Pb (23.5%–27%), ^{207}Pb (20.5%–23%), and ^{204}Pb (1.35%–1.5%).

What are the forms of lead?

- Metallic lead
- Inorganic lead and lead compounds (or lead salts)
- Organic lead (containing carbon)

What are the common uses of lead?

The largest use for lead is in storage batteries in cars and other vehicles. Lead may be used as a pure metal, alloyed with other metals, or as chemical compounds.

Lead used by industry comes from mined ores ("primary") or from recycled scrap metal or batteries ("secondary"). However, most lead today is obtained from recovery of recycled scrap, mostly lead-acid batteries.

Human activities, such as lead mining and smelting operations and manufacturing and use of lead products (*e.g.*, leaded gasoline, lead-based paint), have resulted in the contamination of many industrial and residential areas with lead.

Form	Uses
Metallic lead	Certain uses of lead, such as leaded gasoline, lead-based paints for domestic use, lead-based solder in food cans and water pipes, lead sinkers, and ammunition, have been reduced or banned to minimize lead's harmful effects on people and animals.
Lead and lead compounds (or lead salts), such as • **lead acetate** • **lead chloride** • **lead nitrate** • **lead oxide** • **lead phosphate** • **lead acetate**	• **Cosmetics and hair dye** - Some hair dyes and some non-Western cosmetics, such as kohl and surma, contain lead. • **Fishing equipment** - Most fishing weights and sinkers are made from lead. • **Folk remedies** - Many non-Western folk remedies used to treat diarrhea or other ailments may contain substantial amounts of lead. Examples of these include alarcon, ghasard, alkohl, greta, azarcon,

• **lead sulfate** • **lead sulfide**	liga, bali goli, pay-loo-ah, coral, and rueda. • **Glazing** - Applied to some ceramicware can contain lead. • **Lead based paint** - Although the sale of residential lead-based paint was banned in the United States in 1978, it remains a major source of lead exposure for young children residing in older houses. • **Lead batteries** - Production of lead-acid batteries is the major use of lead. • **Lead-based solder** - Has been banned for use in water distribution systems, but many buildings and homes contain lead pipes or lead-based solder. Lead-based solder also is used for electrical circuitry applications. • **Lead-shot** and **ammunition** - It is the second highest production use of lead. • Other uses of lead include the production of lead alloys, soldering materials, shielding for x-ray machines, and manufacturing of corrosion- and acid-resistant materials used in the building industry.
Organic • **tetraethyl lead** • **tetramethyl lead**	The use of lead in gasoline was phased out in the 1980s, and has been banned since January 1, 1996. The use of lead in gasoline has contributed to its dispersion throughout the environment. During the combustion of gasoline containing these alkyllead compounds, significant amounts of inorganic lead can be released to the surrounding areas. **Current Uses** • Gasoline for off-road vehicles, farm equipment, and airplanes **Past Uses** • Gasoline additives (to increase octane rating)

What are the routes of exposure for lead?

People are most likely to be exposed to lead by consuming contaminated food and drinking water. Exposure can also occur by inadvertently ingesting contaminated soil, dust, or lead-based paint.

Form	Routes of Exposure
Metallic lead **Lead and lead compounds (or lead salts), such as** • **lead acetate** • **lead chloride** • **lead nitrate** • **lead oxide** • **lead phosphate** • **lead subacetate** • **lead sulfate** • **lead sulfide**	• Ingestion is the primary source of exposure to the general population. • Lead paint is a major source of environmental exposure for children who ingest flaking paint, paint chips, and weathered powdered paint (mostly from deteriorated housing units in urban areas). Lead paint can also contribute to soil/dust lead which can be inadvertently ingested via hand-to-mouth activity of young children. • Lead can leach into drinking water from lead-based solder used in water pipes. • Lead can leach into foods or liquids stored in ceramic containers made with lead glazing. • Engaging in hobbies such as casting ammunition, making fishing weights, and stained glass can result in exposure to lead. • Exposure by inhalation can result during activities such as soldering with lead solder or sanding or sandblasting lead-based paint.
Organic • **tetraethyl lead** • **tetramethyl lead**	• Inhalation • Dermal studies in animals have shown that organic lead is well absorbed through the skin

Who are the populations most at risk and how are they usually exposed?

People living near hazardous waste sites, lead smelters or refineries, battery recycling or crushi ng centers, or other industrial lead sources may be exposed to lead and chemicals that contain lead. Workers in occupations that have sources of lead exposure (*e.g.*, plumbers, miners, mechanics, and lead smelter or refinery workers).

Certain hobbies, folk remedies, home activities, and car repairs (*e.g.*, radiator repair) can contribute to lead exposure. Smoking cigarettes or breathing second-hand smoke increases exposure because tobacco smoke contains small amounts of lead.

Pregnant women, the developing fetuses, and young children are particularly vulnerable to the effe cts of lead. Young children are more likely to play in dirt and to place their hands and other objects in their

mouths, thereby increasing the opportunity for exposure via ingestion of lead-contaminated soil an d dust.

What are the possible toxic effects of lead?

The most sensitive targets for lead toxicity are the developing nervous system, the hematological and cardiovascular systems, and the kidney. However, because of lead's many modes of action in biologi cal systems, lead could potentially affect any system or organs in the body. The effects are the same whether it is breathed or swallowed.

Blood Lead Concentrations Corresponding to Adverse Health Effects

Life Stage	Effect	Blood lead (µg/dL)
Children	Depressed ALAD* activity	<5
	Neurodevelopmental effects	<10
	Sexual maturation	<10
	Depressed vitamin D	>15
	Elevated EP**	>15
	Depressed NCV***	>30
	Depressed hemoglobin	>40
	Colic	>60
Adults	Depressed GFR****	<10
	Elevated blood pressure	<10
	Elevated EP (females)	>20
	Enzymuria/proteinuria	>30
	Peripheral neuropathy	>40
	Neurobehavioral effects	>40
	Altered thyroid hormone	>40
	Reduced fertility	>40
	Depressed hemoglobin	>50
Elderly adults	Depressed ALAD*	<5
	Neurobehavioral effects	>4

*aminolevulinic acid dehydratase (ALAD)

**erythrocyte porphyrin (EP)

***nerve conduction velocity (NCV)

****glomerular filtration rate (GFR)

Source: ATSDR Toxicological Profile for Lead (Draft for Public Comment), 2005.

How can I reduce the risk of exposure to lead?

- Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint (homes built before 1978).
- If you have a water lead problem, the U.S. Environmental Protection Agency (EPA) recommends that you flush your cold water pipes if they have not been used in over 6 hours by running water until it is cold (5 seconds to 2 minutes) before drinking or cooking with it.
- Avoid some types of paints and pigments that contain lead and are used as make-up or hair coloring; keep these kinds of products away from children.
- Hire a professional contractor, who is required to follow certain health safety requirements for remediation or renovation involving lead-based paint, (www.epa.gov/lead/pubs/leadinfo.htm#remodeling).
- Wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

What are the safety guidelines for lead exposure?

Air

- National Institute for Occupational Safety and Health (NIOSH)

  Recommended exposure limit (REL) time-weighted average (TWA) - 0.05 mg/m^3
  Immediately dangerous to life or health (IDLH) - 100 mg/m^3

- Occupational Safety and Health Administration (OSHA)

  Air - workplace 50 $\mu g/m^3$
  Action level - 40 µg/100 g of whole blood

- The American Conference of Governmental Industrial Hygienists (ACGIH)

Threshold limit values (TLV)/(TWA) - 0.05 mg/m^3
TLV/TWA guideline for lead arsenate - 150 µg/m^3
TLV/TWA guideline for other forms of lead - 50 µg lead/m^3

- U.S. Environmental Protection Agency (EPA)

  National Primary and Secondary Ambient Air Quality Standards - 1.5 µg/m^3

- World Health Organization (WHO)

  Air quality guidelines -- 0.5 µg/m^3

Water

- EPA

  Maximum contaminant level (MCL) - action level 0.015 mg/L
  Action level for public supplies - 15 µg/L

- WHO

  Drinking Water Quality Guidelines - 0.01 mg/L

Blood

- Centers for Disease Control and Prevention (CDC)

  Level of concern for children - 10 µg/dL

- OSHA

  Cause for written notification and medical exam - 40 µg/dL
  Cause for medical removal from exposure - 50 µg/dL

- ACGIH

  Advisory; biological exposure index - 30 µg/dL

Food

- Food and Drug Administration (FDA)

  Bottled drinking water - 0.005 mg/L

Other

- ACGIH

  Biological exposure indices (lead in blood) - 30 µg/100 mL

- Consumer Product Safety Commission

  Paint - 600 ppm

- FDA

  Ceramicware (µg/mL leaching solution) - 0.5-3.0 µg/mL

µg/m^3: micrograms per cubic meter
µg/dL: micrograms per deciliter
µg/L: micrograms per liter
g: gram
mg/L: milligrams per liter
mL: milliliter
ppm: parts per million

What are the most important or common mediating factors?

Factors that determine the severity of the health effects from lead exposure include

- Dose
- Age of the person exposed
  - the developing nervous system is the most sensitive system to the effects of lead
  - the efficiency of lead absorption from the gastrointestinal tract is greater in children than in adults
- Life stages of women (childbirth, lactating, menopause)
- Occupational exposures
- Duration of exposure
- Health and lifestyle of the person exposed
- Nutritional status of the person exposed
  - a diet adequate in calcium and iron may decrease lead absorption

The toxic effects of lead exposure may be worse in individuals with inherited genetic diseases or gene polymorphisms such as thalassemia, individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency, and carriers of certain gene polymorphic forms (*e.g.*, ALAD and vitamin D receptor). Research continues about this topic.

Is there a test to see if my child or I have been exposed to lead?

Blood	• The screening test of choice is blood lead levels. • Blood tests are commonly used to screen children for lead poisoning. • Analysis of lead in whole blood is the most common and accurate method of assessing lead exposure. • 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).
Bone and Teeth	• X-ray fluorescence techniques have been used to determine lead concentration in bones and teeth. It is not widely available and is used mostly in research. • Lead partitions to bone over a lifetime of exposure; therefore, bone lead measurements may be a better indicator of cumulative exposure than blood lead.
Urine	• Measurements of urinary lead levels have been used to assess lead exposure. • The measurement of lead excreted in urine following chelation with calcium disodium EDTA (EDTA provocation) has been used to detect elevated body burden of lead in adults and children.
Hair and Nails	• These are not reliable for testing due to errors external contamination. They are relatively poor predictors of blood lead, particularly at low concentrations.

Future Research Needs

To close current gaps in the scientific database on the health effects of lead, a long–term resear ch program is needed that might include the following:

- Further short-term studies or studies in vitro designed to clarify mechanisms of action for the various toxicities might be useful.
- Studies identifying exposures during different developmental periods can help identify critical periods of vulnerability for immunocompetence, development of sex organs, or neurobehavioral parameters.
- Chronic-duration exposure studies in animals would expand information on the toxicity of lead. Special studies that examine biochemical and morphological effects of lead may provide new information on mechanisms of action of lead, particularly for the effects of greatest concern such as neurobehavioral changes in children.
- Development of new and more sensitive tests of specific neuropsychological functions.
- Further investigation of links between lead and amyotrophic lateral sclerosis, essential tremor, schizophrenia, and Parkinson's disease.
- Epidemiological studies designed in a manner that permits more rigorous assessments of effect modification.
- Studies about the long-term consequences of lead-related neurobehavioral deficits detected in infants and children and the manifestation of chronic neurobehavioral problems in adolescence and adulthood.
- Further characterization of bone lead concentration as a biomarker of exposure for various effect end points (*e.g.*, blood pressure and renal effects).
- Studies of the potential prevalence of elevated bone lead stores in women of reproductive age and the associated risk that this poses to fetal development by mobilization of maternal bone stores during pregnancy.
- Further clarification of the role of some genetic polymorphisms.
- Evaluation of cohorts from prospective studies into adulthood for potential late-appearing effects including cancer.

For more information

- Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Lead

  http://www.atsdr.cdc.gov/toxprofiles/tp13.html

- ATSDR ToxFAQs™ for Lead

  http://www.atsdr.cdc.gov/tfacts13.html

- ATSDR Case Studies in Environmental Medicine Lead Toxicity

  http://www.atsdr.cdc.gov/csem/lead/

- ATSDR Interaction Profile for Chemical Mixtures for Arsenic, Cadmium, Chromium, and Lead

  http://www.atsdr.cdc.gov/interactionprofiles/ip04.html

- ATSDR Interaction Profile for Chemical Mixtures for Lead, Manganese, Zinc, and Copper

  http://www.atsdr.cdc.gov/interactionprofiles/ip06.html

- ATSDR Interaction Profile for Chemical Mixtures for Chlorpyrifos, Lead, Mercury, and Methylmercury

  http://www.atsdr.cdc.gov/interactionprofiles/ip11.html

- Centers for Disease Control and Prevention Lead Web Page

  http://www.cdc.gov/lead/

- U.S. Environmental Protection Agency Lead Web Page

  http://www.epa.gov/lead/

- U.S. Department of Labor, Occupational Safety & Health Administration

  http://www.osha.gov/SLTC/lead/

For more information, contact:

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-CDC-INFO (800-232-4636)
TTY 888-232-6348

FAX: (770)-488-4178
Email: CDCINFO@cdc.gov

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Mercury

Mercury is a naturally occurring metal found in air, water, and soil. It exists in several forms, including elemental (or metallic) mercury, inorganic mercury compounds, and organic mercury compounds:

- **Elemental mercury** is liquid at room temperature and is used in thermometers, fluorescent light bulbs, some electrical switches, and some industrial processes.
- **Inorganic mercury** compounds are formed when mercury combines with other elements to form salts, which are usually powders or crystals. Inorganic mercury compounds are found naturally in the environment. Some forms of inorganic mercury have been used in antiseptic creams, ointments, and preservatives.
- **Organic mercury** compounds are formed when mercury combines with carbon. Microscopic organisms can produce organic mercury compounds (methylmercury) in contaminated water and soil, which can accumulate in the food chain. Other special types of organomercurials have been used as medical preservatives and medicines.

How People Are Exposed to Mercury

- Eating fish or shellfish that is contaminated with methylmercury, which is the main source of general human exposures to mercury;
- Breathing air contaminated with elemental mercury vapors (e.g., in workplaces such as dental offices and industries that use mercury or in locations where a mercury spill or release has occurred);
- Having dental fillings that contain mercury; and
- Practicing cultural or religious rituals that use mercury.

How Mercury Affects People's Health

- Short-term exposure to extremely high levels of elemental mercury vapors can result in lung damage, nausea, diarrhea, increases in blood pressure or heart rate, skin rashes, eye irritation, and injury to the nervous system.
- Prolonged exposure to lower levels of elemental mercury can permanently damage the brain and kidneys.
- The developing brain of a fetus can be injured if the mother is exposed to methylmercury.

Levels of Mercury in U.S. Population

Scientists tested levels of mercury in the blood of 16,780 participants who took part in CDC's national study known as the National Health and Nutrition Examination Survey (NHANES). These findings are based on total blood mercury levels in the U.S. general

population for persons aged 1 year and older who participated in NHANES during 2003-2006, as well as trends in the total mercury of children aged 1–5 and females aged 16–49 during 1999–2006.

- In the total population during 2003–2006, the total blood mercury levels for non–Hispanic blacks and non–Hispanic whites were higher than those for Mexican Americans.
- Across the age groups in the total population during 2003-2006, total blood mercury levels increased with age, peaked at the fifth or sixth decade, depending on race/ethnicity, and then declined.
- In the most recent survey period of 2005–2006, the 95th percentile levels for total blood mercury in children aged 1-5 years and females aged 16-49 years were 1.43 µg/L and 4.48 µg/L, respectively. The 95th percentile means that 95 percent of the U.S. population's exposure is below this estimated level. Conversely, only 5 percent of the population will have values at this level or higher.
- Over the four survey periods from 1999-2006, blood mercury levels increased slightly for non–Hispanic white children and decreased slightly for non–Hispanic black and Mexican American children. Female children had slightly higher blood mercury levels than male children.

For More Information

- Agency for Toxic Substances and Disease Registry
  Detailed information about mercury and public health is available at http://www.atsdr.cdc.gov/alerts/970626.html and http://www.atsdr.cdc.gov/cabs/mercury/index.html
- CDC Emergency Preparedness and Response
  Case definitions of mercury, toxicology FAQs, and toxicological profile at http://emergency.cdc.gov/agent/mercury/

May 2009

The Centers for Disease Control and Prevention (CDC) protects people's health and safety by preventing and controlling diseases and injuries; enhances health decisions by providing credible information on critical health issues; and promotes healthy living through strong partnerships with local, national, and international organizations.

Department of Health and Human Services
Agency for Toxic Substances & Disease Registry

ATSDR Home › ToxFAQs™ Arsenic

ToxFAQs™

ToxFAQs™
for
Arsenic
(*Arsénico*)
August 2007

PDF Version, 92 KB

CAS#: 7440-38-2

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. 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
- What is arsenic?
- What happens to arsenic when it enters the environment?
- How might I be exposed to arsenic?
- How can arsenic affect my health?
- How likely is arsenic to cause cancer?
- How does arsenic affect children?
- How can families reduce their risk for exposure to arsenic?
- Is there a medical test to show whether I've been exposed to arsenic?
- Has the federal government made recommendations to protect human health?
- References
- Contact Information

Highlights

Exposure to higher than average levels of arsenic occur 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 in at least 1,149 of the 1,684 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. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

What happens to arsenic when it enters the environment?

- Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
- Arsenic cannot be destroyed in the environment. It can only change its form.
- Rain and snow remove arsenic dust particles from the air.
- Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
- Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

- Ingesting small amounts present in your food and water or breathing air containing arsenic.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.
- Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause naus ea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of “pins an d needles” in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of th e 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.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies i n animals show that some simple organic arsenic compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cance r and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for R esearch on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

How does arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ score s. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant fem ales, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal ti ssues. Arsenic is found at low levels in breast milk.

How can families reduce their risk for exposure to arsenic?

- If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protecti ve 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 source s of water and limit contact with soil.
- If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on y our clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

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

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

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environ ment and has restricted or cancelled many of the 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 (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

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

Where can I get more information?

For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-62
Atlanta, GA 30333
Phone: 1-800-CDC-INFO • 888-232-6348 (TTY)
FAX: 770-488-4178
Email: cdcinfo@cdc.gov

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 heal th or environmental quality department if you have any more questions or concerns.

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U.S. Environmental Protection Agency

Pesticides: Topical & Chemical Fact Sheets

Assessing Health Risks from Pesticides

January 1999
735-F-99-002

The Federal Government, in cooperation with the States, carefully regulates pesticides to ensure that they do not pose unreasonable risks to human health or the environment. As part of that effort, the Environmental Protection Agency (EPA) requires extensive test data from pesticide producers that demonstrate pesticide products can be used without posing harm to human health and the environment. EPA scientists and analysts carefully review these data to determine whether to register (license) a pesticide product or a use and whether specific restrictions are necessary. This fact sheet is a brief overview of EPA's process for assessing potential risks to human health when evaluating pesticide products.

Background

There are more than 865 active ingredients registered as pesticides, which are formulated into thousands of pesticide products that are available in the marketplace. About 350 pesticides are used on the foods we eat, and to protect our homes and pets.

EPA plays a critical role in evaluating these chemicals prior to registration, and in reevaluating older pesticides already on the market, to ensure that they can be used with a reasonable certainty of no harm. The process EPA uses for evaluating the health impacts of a pesticide is called risk assessment.

EPA uses the National Research Council's four-step process for human health risk assessment:

Step One: Hazard Identification
Step Two: Dose-Response Assessment
Step Three: Exposure Assessment
Step Four: Risk Characterization

Step One: Hazard Identification (Toxicology)

The first step in the risk assessment process is to identify potential health effects that may occur from different types of pesticide exposure. EPA considers the full spectrum of a pesticide's potential health effects.

Generally, for human health risk assessments, many toxicity studies are conducted on animals by pesticide companies in independent laboratories and evaluated for acceptability by EPA scientists. EPA evaluates pesticides for a wide range of adverse effects, from eye and skin irritation to cancer and birth defects in laboratory animals. EPA may also consult the public literature or other sources of supporting information on any aspect of the chemical.

Step Two: Dose-Response Assessment

Paracelsus, the Swiss physician and alchemist, the "father" of modern toxicology (1493-1541) said,

> "The dose makes the poison."

In other words, **the amount of a substance a person is exposed to** is as important as **how toxic the chemical might be**. For example, small doses of aspirin can be beneficial to people, but at very high doses, this common medicine can be deadly. In some individuals, even at very low doses, aspirin may be deadly.

Dose-response assessment involves considering the dose levels at which adverse effects were observed in test animals, and using these dose levels to calculate an equal dose in humans.

Step Three: Exposure Assessment

People can be exposed to pesticides in three ways:

1. Inhaling pesticides (inhalation exposure),
2. Absorbing pesticides through the skin (dermal exposure), and
3. Getting pesticides in their mouth or digestive tract (oral exposure).

Depending on the situation, pesticides could enter the body by any one or all of these routes. Typical sources of pesticide exposure include:

- **Food**
  Most of the foods we eat have been grown with the use of pesticides. Therefore, pesticide residues may be present inside or on the surfaces of these foods.

- **Home and Personal Use Pesticides**
  You might use pesticides in and around your home to control insects, weeds, mold, mildew, bacteria, lawn and garden pests and to protect your pets from pests such as fleas. Pesticides may also be used as insect repellants which are directly applied to the skin or clothing.

- **Pesticides in Drinking Water**
  Some pesticides that are applied to farmland or other land structures can make their way in small amounts to the ground water or surface water systems that feed drinking water supplies.

- **Worker Exposure to Pesticides**
  Pesticide applicators, vegetable and fruit pickers and others who work around pesticides can be exposed due to the nature of their jobs. To address the unique risks workers face from occupational exposure, EPA evaluates occupational exposure through a separate program. All pesticides registered by EPA have been shown to be safe when used properly.

Step Four: Risk Characterization

Risk characterization is the final step in assessing human health risks from pesticides. It is the process of combining the hazard, dose-response and exposure assessments to describe the overall risk from a pesticide. It explains the assumptions used in assessing exposure as well as the uncertainties that are built into the dose-response assessment. The strength of the overall database is considered, and broad

conclusions are made. EPA's role is to evaluate both toxicity and exposure and to determine the risk associated with use of the pesticide.

Simply put,

RISK = TOXICITY x EXPOSURE.

This means that the risk to human health from pesticide exposure depends on both the toxicity of the pesticide and the likelihood of people coming into contact with it. At least *some* exposure and *some* toxicity are required to result in a risk. For example, if the pesticide is very poisonous, but no people are exposed, there is no risk. Likewise, if there is ample exposure but the chemical is non-toxic, there is no risk. However, usually when pesticides are used, there is some toxicity and exposure, which results in a potential risk.

EPA recognizes that effects vary between animals of different species and from person to person. To account for this variability, *uncertainty factors* are built into the risk assessment. These uncertainty factors create an additional margin of safety for protecting people who may be exposed to the pesticides. FQPA requires EPA to use an extra 10-fold safety factor, if necessary, to protect infants and children from effects of the pesticide.

Types of Toxicity Tests EPA Requires for Human Health Risk Assessments

EPA evaluates studies conducted over different periods of time and that measure specific types of effects. These tests are evaluated to screen for potential health effects in infants, children and adults.

Acute Testing: Short-term exposure; a single exposure (dose).

- Oral, dermal (skin), and inhalation exposure
- Eye irritation
- Skin irritation
- Skin sensitization
- Neurotoxicity

Sub-chronic Testing: Intermediate exposure; repeated exposure over a longer period of time (i.e., 30-90 days).

- Oral, dermal (skin), and inhalation
- Neurotoxicity (nerve system damage)

Chronic Toxicity Testing: Long-term exposure; repeated exposure lasting for most of the test animal's life span. Intended to determine the effects of a pesticide after prolonged and repeated exposures.

- Chronic effects (non-cancer)
- Carcinogenicity (cancer)

Developmental and Reproductive Testing: Identify effects in the fetus of an exposed pregnant female (birth defects) and how pesticide exposure affects the ability of a test animal to successfully reproduce.

Mutagenicity Testing: Assess a pesticide's potential to affect the cell's genetic components.

Hormone Disruption: Measure effects for their potential to disrupt the endocrine system. The endocrine system consists of a set of glands and the hormones they produce that help guide the development, growth, reproduction, and behavior of animals including humans.

Risk Management

Once EPA completes the risk assessment process for a pesticide, we use this information to determine if (when used according to label directions), there is a reasonable certainty that the pesticide will not harm a person's health.

Using the conclusions of a risk assessment, EPA can then make a more informed decision regarding whether to approve a pesticide chemical or use, as proposed, or whether additional protective measures are necessary to limit occupational or non-occupational exposure to a pesticide. For example, EPA may prohibit a pesticide from being used on certain crops because consuming too much food treated with the pesticide may result in an unacceptable risk to consumers. Another example of protective measures is requiring workers to wear personal protective equipment (PPE) such as a respirator or chemical resistant gloves, or not allowing workers to enter treated crop fields until a specific period of time has passed.

If, after considering all appropriate risk reduction measures, the pesticide still does not meet EPA's safety standard, the Agency will not allow the proposed chemical or use. Regardless of the specific measures enforced, EPA's primary goal is to ensure that legal uses of the pesticide are protective of human health, especially the health of children, and the environment.

Human Health Risk Assessment and the Law

Federal law requires detailed evaluation of pesticides to protect human health and the environment. In 1996, Congress made significant changes to strengthen pesticide laws through the Food Quality Protection Act (FQPA). Many of these changes are key elements of the current risk assessment process. FQPA required that EPA consider:

- **A New Safety Standard**: FQPA strengthened the safety standard that pesticides must meet before being approved for use. EPA must ensure with a reasonable certainty that no harm will result from the legal uses of the pesticide.
- **Exposure from All Sources**: In evaluating a pesticide, EPA must estimate the combined risk from that pesticide from all non-occupational sources, such as:
  - Food Sources
  - Drinking Water Sources
  - Residential Sources
- **Cumulative Risk**: EPA is required to evaluate pesticides in light of similar toxic effects that different pesticides may share, or "a common mechanism of toxicity." At this time, EPA is developing a methodology for this type of assessment.
- **Special Sensitivity of Children to Pesticides**: EPA must ascertain whether there is an increased susceptibility from exposure to the pesticide to infants and children. EPA must build an additional 10-fold safety factor into risk assessments to ensure the protection of infants and children, unless it is determined that a lesser margin of safety will be safe for infants and children.

For More Information

If you would like more information about EPA's pesticide programs, contact the Communication Service Branch at (703) 305-5017 or visit the Pesticides Web site.

For more information on specific pesticides, or to inquire about the symptoms of pesticide poisoning, call the National Pesticide Information Center (NPIC), a toll-free hotline information at: 1-800-858-7378, or visit their Web site EXIT Disclaimer .

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

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References

February 2001

ToxFAQs™ for Polychlorinated Biphenyls (PCBs)

(Bifenilos Policlorados (BPCs))

This fact sheet answers the most frequently asked health questions about polychlorinated biphenyls (PCBs). For more information, you may 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: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls (PCBs)?

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

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

Contact Information

RELATED RESOURCES

ToxFAQ™ 35k

ToxFAQ™ en Español 32k

Public Health Statement 125k

Public Health Statement en Español 321k

Toxicological Profile 13.6MB

A-Z INDEX

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ATSDR RESOURCES

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MMGs

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Priority List of Hazardous Substances

Division of Toxicology

and old microscope and hydraulic oils.

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What happens to polychlorinated biphenyls (PCBs) when they enter the environment?

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

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How might I be exposed to polychlorinated biphenyls (PCBs)?

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

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How can polychlorinated biphenyls (PCBs) affect my health?

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

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

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How likely are polychlorinated biphenyls (PCBs) to cause cancer?

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

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How do polychlorinated biphenyls (PCBs) affect children?

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

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How can families reduce the risk of exposure to polychlorinated biphenyls (PCBs)?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.
- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

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Is there a medical test to show whether I've been exposed to polychlorinated biphenyls (PCBs)?

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

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Has the federal government made recommendations to protect human health?

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

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References

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

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Where can I get more information?

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.

For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
Phone: 1-888-42-ATSDR (1-888-422-8737)
FAX: (770)-488-4178
Email: ATSDRIC@cdc.gov

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ATSDR Department of Health and Human Services
Agency for Toxic Substances & Disease Registry

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2007 CERCLA Priority List of Hazardous Substances

2007 RANK	SUBSTANCE NAME	TOTAL POINTS	2005 RANK	CAS #
1	ARSENIC	1672.58	1	007440-38-2
2	LEAD	1534.07	2	007439-92-1
3	MERCURY	1504.69	3	007439-97-6
4	VINYL CHLORIDE	1387.75	4	000075-01-4
5	POLYCHLORINATED BIPHENYLS	1365.78	5	001336-36-3
6	BENZENE	1355.96	6	000071-43-2
7	CADMIUM	1324.22	8	007440-43-9
8	POLYCYCLIC AROMATIC HYDROCARBONS	1316.98	7	130498-29-2
9	BENZO(A)PYRENE	1312.45	9	000050-32-8
10	BENZO(B)FLUORANTHENE	1266.55	10	000205-99-2
11	CHLOROFORM	1223.03	11	000067-66-3
12	DDT, P,P'-	1193.36	12	000050-29-3
13	AROCLOR 1254	1182.63	13	011097-69-1
14	AROCLOR 1260	1177.77	14	011096-82-5
15	DIBENZO(A,H)ANTHRACENE	1165.88	15	000053-70-3
16	TRICHLOROETHYLENE	1154.73	16	000079-01-6
17	DIELDRIN	1150.91	17	000060-57-1
18	CHROMIUM, HEXAVALENT	1149.98	18	018540-29-9
19	PHOSPHORUS, WHITE	1144.77	19	007723-14-0
20	CHLORDANE	1133.21	21	000057-74-9
21	DDE, P,P'-	1132.49	20	000072-55-9
22	HEXACHLOROBUTADIENE	1129.63	22	000087-68-3
23	COAL TAR CREOSOTE	1124.32	23	008001-58-9
24	ALDRIN	1117.22	25	000309-00-2
25	DDD, P,P'-	1114.83	24	000072-54-8
26	BENZIDINE	1114.24	26	000092-87-5
27	AROCLOR 1248	1112.20	27	012672-29-6
28	CYANIDE	1099.48	28	000057-12-5
29	AROCLOR 1242	1093.14	29	053469-21-9
30	AROCLOR	1091.52	62	012767-79-2
31	TOXAPHENE	1086.65	30	008001-35-2
32	HEXACHLOROCYCLOHEXANE, GAMMA-	1081.63	32	000058-89-9
33	TETRACHLOROETHYLENE	1080.43	31	000127-18-4
34	HEPTACHLOR	1072.67	33	000076-44-8
35	1,2-DIBROMOETHANE	1064.06	34	000106-93-4
36	HEXACHLOROCYCLOHEXANE, BETA-	1060.22	37	000319-85-7
37	ACROLEIN	1059.07	36	000107-02-8
38	DISULFOTON	1058.85	35	000298-04-4
39	BENZO(A)ANTHRACENE	1057.96	38	000056-55-3
40	3,3'-DICHLOROBENZIDINE	1051.61	39	000091-94-1

41	ENDRIN	1048.57	41	000072-20-8
42	BERYLLIUM	1046.12	40	007440-41-7
43	HEXACHLOROCYCLOHEXANE, DELTA-	1038.27	42	000319-86-8
44	1,2-DIBROMO-3-CHLOROPROPANE	1035.55	43	000096-12-8
45	PENTACHLOROPHENOL	1028.01	45	000087-86-5
46	HEPTACHLOR EPOXIDE	1027.12	44	001024-57-3
47	CARBON TETRACHLORIDE	1023.32	46	000056-23-5
48	AROCLOR 1221	1018.41	47	011104-28-2
49	COBALT	1015.57	50	007440-48-4
50	DDT, O,P'-	1014.71	49	000789-02-6
51	AROCLOR 1016	1014.33	48	012674-11-2
52	DI-N-BUTYL PHTHALATE	1007.49	52	000084-74-2
53	NICKEL	1005.40	55	007440-02-0
54	ENDOSULFAN	1004.65	54	000115-29-7
55	ENDOSULFAN SULFATE	1003.56	53	001031-07-8
56	DIAZINON	1002.08	57	000333-41-5
57	ENDOSULFAN, ALPHA	1001.30	58	000959-98-8
58	XYLENES, TOTAL	996.07	59	001330-20-7
59	CIS-CHLORDANE	995.08	51	005103-71-9
60	DIBROMOCHLOROPROPANE	994.87	60	067708-83-2
61	METHOXYCHLOR	994.47	61	000072-43-5
62	BENZO(K)FLUORANTHENE	981.26	63	000207-08-9
63	ENDRIN KETONE	978.99	64	053494-70-5
64	TRANS-CHLORDANE	973.99	56	005103-74-2
65	CHROMIUM(VI) OXIDE	969.58	66	001333-82-0
66	METHANE	959.78	67	000074-82-8
67	ENDOSULFAN, BETA	959.19	65	033213-65-9
68	AROCLOR 1232	955.64	68	011141-16-5
69	ENDRIN ALDEHYDE	954.86	69	007421-93-4
70	BENZOFLUORANTHENE	951.48	70	056832-73-6
71	TOLUENE	947.50	71	000108-88-3
72	2-HEXANONE	942.02	72	000591-78-6
73	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	938.11	73	001746-01-6
74	ZINC	932.89	74	007440-66-6
75	DIMETHYLARSINIC ACID	922.06	75	000075-60-5
76	DI(2-ETHYLHEXYL)PHTHALATE	919.02	76	000117-81-7
77	CHROMIUM	908.52	77	007440-47-3
78	NAPHTHALENE	896.67	78	000091-20-3
79	1,1-DICHLOROETHENE	891.19	79	000075-35-4
80	METHYLENE CHLORIDE	888.96	81	000075-09-2
81	AROCLOR 1240	888.11	80	071328-89-7
82	2,4,6-TRINITROTOLUENE	883.59	82	000118-96-7
83	BROMODICHLOROETHANE	870.00	83	000683-53-4
84	HYDRAZINE	864.41	85	000302-01-2
85	1,2-DICHLOROETHANE	863.99	84	000107-06-2
86	2,4,6-TRICHLOROPHENOL	863.71	86	000088-06-2
87	2,4-DINITROPHENOL	860.45	87	000051-28-5
88	BIS(2-CHLOROETHYL) ETHER	859.88	88	000111-44-4
89	THIOCYANATE	849.21	89	000302-04-5
90	ASBESTOS	841.54	90	001332-21-4
91	CHLORINE	840.37	92	007782-50-5
92	CYCLOTRIMETHYLENETRINITRAMINE (RDX)	840.28	91	000121-82-4
93	HEXACHLOROBENZENE	838.34	93	000118-74-1

94	2,4-DINITROTOLUENE	837.88	96	000121-14-2
95	RADIUM-226	835.93	94	013982-63-3
96	ETHION	834.03	97	000563-12-2
97	1,1,1-TRICHLOROETHANE	833.81	95	000071-55-6
98	URANIUM	833.41	98	007440-61-1
99	ETHYLBENZENE	832.13	99	000100-41-4
100	RADIUM	828.07	100	007440-14-4
101	THORIUM	825.17	101	007440-29-1
102	4,6-DINITRO-O-CRESOL	822.78	102	000534-52-1
103	1,3,5-TRINITROBENZENE	820.17	103	000099-35-4
104	CHLOROBENZENE	819.69	105	000108-90-7
105	RADON	817.89	104	010043-92-2
106	RADIUM-228	816.76	106	015262-20-1
107	THORIUM-230	814.72	107	014269-63-7
107	URANIUM-235	814.72	107	015117-96-1
109	BARIUM	813.46	109	007440-39-3
110	FLUORANTHENE	812.40	113	000206-44-0
111	URANIUM-234	812.11	110	013966-29-5
112	N-NITROSODI-N-PROPYLAMINE	811.05	111	000621-64-7
113	THORIUM-228	810.36	112	014274-82-9
114	RADON-222	809.78	114	014859-67-7
115	HEXACHLOROCYCLOHEXANE, ALPHA-	809.56	116	000319-84-6
116	1,2,3-TRICHLOROBENZENE	808.41	143	000087-61-6
117	MANGANESE	807.90	115	007439-96-5
118	COAL TARS	807.07	117	008007-45-2
119	CHRYSOTILE ASBESTOS	806.68	119	012001-29-5
119	STRONTIUM-90	806.68	119	010098-97-2
121	PLUTONIUM-239	806.67	118	015117-48-3
122	POLONIUM-210	806.39	122	013981-52-7
123	METHYLMERCURY	806.39	121	022967-92-6
124	PLUTONIUM-238	806.01	123	013981-16-3
125	LEAD-210	805.90	124	014255-04-0
126	PLUTONIUM	805.23	125	007440-07-5
127	CHLORPYRIFOS	804.93	125	002921-88-2
128	COPPER	804.86	133	007440-50-8
129	AMERICIUM-241	804.55	128	086954-36-1
130	RADON-220	804.54	127	022481-48-7
131	AMOSITE ASBESTOS	804.07	129	012172-73-5
132	IODINE-131	803.48	130	010043-66-0
133	HYDROGEN CYANIDE	803.08	132	000074-90-8
134	TRIBUTYLTIN	802.61	131	000688-73-3
135	GUTHION	802.32	134	000086-50-0
136	NEPTUNIUM-237	802.13	135	013994-20-2
137	CHRYSENE	802.10	139	000218-01-9
138	CHLORDECONE	801.64	136	000143-50-0
138	IODINE-129	801.64	136	015046-84-1
138	PLUTONIUM-240	801.64	136	014119-33-6
141	S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	797.88	140	000078-48-8
142	BROMINE	789.15	142	007726-95-6
143	POLYBROMINATED BIPHENYLS	789.11	141	067774-32-7
144	DICOFOL	787.56	144	000115-32-2
145	PARATHION	784.14	145	000056-38-2
146	1,1,2,2-TETRACHLOROETHANE	782.15	146	000079-34-5

147	SELENIUM	778.98	147	007782-49-2	
148	HEXACHLOROCYCLOHEXANE, TECHNICAL GRADE	774.91	148	000608-73-1	
149	TRICHLOROFLUOROETHANE	770.74	149	027154-33-2	
150	TRIFLURALIN	770.12	150	001582-09-8	
151	DDD, O,P'-	768.73	151	000053-19-0	
152	4,4'-METHYLENEBIS(2-CHLOROANILINE)	766.66	152	000101-14-4	
153	HEXACHLORODIBENZO-P-DIOXIN	760.42	153	034465-46-8	
154	HEPTACHLORODIBENZO-P-DIOXIN	754.47	154	037871-00-4	
155	PENTACHLOROBENZENE	753.58	155	000608-93-5	
156	1,3-BUTADIENE	747.31	201	000106-99-0	
157	AMMONIA	745.55	156	007664-41-7	
158	2-METHYLNAPHTHALENE	743.24	157	000091-57-6	
159	1,4-DICHLOROBENZENE	737.32	159	000106-46-7	
160	1,1-DICHLOROETHANE	736.23	158	000075-34-3	
161	ACENAPHTHENE	731.25	160	000083-32-9	
162	1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	726.14	161	039001-02-0	
163	1,1,2-TRICHLOROETHANE	724.96	162	000079-00-5	
164	TRICHLOROETHANE	723.32	163	025323-89-1	
165	HEXACHLOROCYCLOPENTADIENE	719.01	164	000077-47-4	
166	HEPTACHLORODIBENZOFURAN	718.58	165	038998-75-3	
167	1,2-DIPHENYLHYDRAZINE	713.90	166	000122-66-7	
168	2,3,4,7,8-PENTACHLORODIBENZOFURAN	710.71	167	057117-31-4	
169	TETRACHLOROBIPHENYL	709.21	168	026914-33-0	
170	CRESOL, PARA-	707.83	169	000106-44-5	
171	OXYCHLORDANE	706.32	170	027304-13-8	
172	1,2-DICHLOROBENZENE	704.91	171	000095-50-1	
173	1,2-DICHLOROETHENE, TRANS-	704.04	178	000156-60-5	
174	INDENO(1,2,3-CD)PYRENE	703.30	180	000193-39-5	
175	GAMMA-CHLORDENE	702.59	172	056641-38-4	
176	CARBON DISULFIDE	702.55	174	000075-15-0	
177	TETRACHLOROPHENOL	702.54	173	025167-83-3	
178	AMERICIUM	701.62	175	007440-35-9	
178	URANIUM-233	701.62	175	013968-55-3	
180	PALLADIUM	700.66	177	007440-05-3	
181	HEXACHLORODIBENZOFURAN	700.56	179	055684-94-1	
182	PHENOL	696.96	183	000108-95-2	
183	CHLOROETHANE	693.90	182	000075-00-3	
184	ACETONE	693.31	181	000067-64-1	
185	P-XYLENE	690.20	185	000106-42-3	
186	DIBENZOFURAN	689.19	187	000132-64-9	
187	ALUMINUM	688.13	186	007429-90-5	
188	2,4-DIMETHYLPHENOL	685.76	189	000105-67-9	
189	CARBON MONOXIDE	684.49	188	000630-08-0	
190	TETRACHLOROETHANE	677.97	190	025322-20-7	
191	HYDROGEN SULFIDE	676.51	193	007783-06-4	
192	PENTACHLORODIBENZOFURAN	673.21	192	030402-15-4	
193	CHLOROMETHANE	670.19	191	000074-87-3	
194	BIS(2-METHOXYETHYL) PHTHALATE	666.08	194	034006-76-3	
195	BUTYL BENZYL PHTHALATE	659.38	195	000085-68-7	
196	CRESOL, ORTHO-	658.66	196	000095-48-7	
197	HEXACHLOROETHANE	653.10	199	000067-72-1	
198	VANADIUM	651.70	198	007440-62-2	

199	N-NITROSODIMETHYLAMINE	650.71	200	000062-75-9
200	1,2,4-TRICHLOROBENZENE	647.30	203	000120-82-1
201	BROMOFORM	643.53	202	000075-25-2
202	TETRACHLORODIBENZO-P-DIOXIN	635.74	204	041903-57-5
203	1,3-DICHLOROBENZENE	631.41	205	000541-73-1
204	PENTACHLORODIBENZO-P-DIOXIN	625.12	207	036088-22-9
205	N-NITROSODIPHENYLAMINE	624.79	208	000086-30-6
206	1,2-DICHLOROETHYLENE	622.49	206	000540-59-0
207	2,3,7,8-TETRACHLORODIBENZOFURAN	622.15	210	051207-31-9
208	2-BUTANONE	620.01	209	000078-93-3
209	2,4-DICHLOROPHENOL	616.45	212	000120-83-2
210	1,4-DIOXANE	616.29	215	000123-91-1
211	FLUORINE	613.28	214	007782-41-4
212	NITRITE	612.64	216	014797-65-0
213	CESIUM-137	612.50	217	010045-97-3
214	SILVER	612.19	213	007440-22-4
215	CHROMIUM TRIOXIDE	610.85	218	007738-94-5
216	NITRATE	610.66	219	014797-55-8
217	POTASSIUM-40	608.91	220	013966-00-2
218	DINITROTOLUENE	607.65	221	025321-14-6
219	ANTIMONY	605.37	222	007440-36-0
220	COAL TAR PITCH	605.33	224	065996-93-2
221	THORIUM-227	605.32	223	015623-47-9
222	2,4,5-TRICHLOROPHENOL	604.83	225	000095-95-4
223	ARSENIC ACID	604.45	226	007778-39-4
224	ARSENIC TRIOXIDE	604.36	227	001327-53-3
225	PHORATE	603.10	228	000298-02-2
226	BENZOPYRENE	603.00	230	073467-76-2
227	CRESOLS	602.74	229	001319-77-3
228	CHLORDANE, TECHNICAL	602.62	231	012789-03-6
229	DIMETHOATE	602.61	232	000060-51-5
230	ACTINIUM-227	602.57	233	014952-40-0
230	STROBANE	602.57	233	008001-50-1
232	4-AMINOBIPHENYL	602.51	235	000092-67-1
232	PYRETHRUM	602.51	235	008003-34-7
234	ARSINE	602.42	237	007784-42-1
235	NALED	602.32	238	000300-76-5
236	DIBENZOFURANS, CHLORINATED	602.13	239	042934-53-2
236	ETHOPROP	602.13	239	013194-48-4
238	ALPHA-CHLORDENE	601.94	241	056534-02-2
238	CARBOPHENOTHION	601.94	241	000786-19-6
240	DICHLORVOS	601.64	243	000062-73-7
241	CALCIUM ARSENATE	601.45	244	007778-44-1
241	MERCURIC CHLORIDE	601.45	244	007487-94-7
241	SODIUM ARSENITE	601.45	244	007784-46-5
244	FORMALDEHYDE	599.64	247	000050-00-0
245	2-CHLOROPHENOL	599.62	248	000095-57-8
246	PHENANTHRENE	597.68	249	000085-01-8
247	HYDROGEN FLUORIDE	588.03	250	007664-39-3
248	2,4-D ACID	584.47	251	000094-75-7
249	DIBROMOCHLOROMETHANE	580.59	252	000124-48-1
250	DIURON	579.16	253	000330-54-1
251	BUTYLATE	578.43	254	002008-41-5

252	DIMETHYL FORMAMIDE	578.23	255	000068-12-2
253	PYRENE	577.95	256	000129-00-0
254	DICHLOROBENZENE	577.70	211	025321-22-6
255	ETHYL ETHER	572.47	257	000060-29-7
256	DICHLOROETHANE	570.46	258	001300-21-6
257	4-NITROPHENOL	567.79	259	000100-02-7
258	1,3-DICHLOROPROPENE, CIS-	561.82	184	010061-01-5
259	PHOSPHINE	559.74	260	007803-51-2
260	TRICHLOROBENZENE	557.96	261	012002-48-1
261	2,6-DINITROTOLUENE	555.20	262	000606-20-2
262	FLUORIDE ION	549.64	263	016984-48-8
263	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	547.90	264	035822-46-9
264	METHYL PARATHION	545.83	265	000298-00-0
265	PENTAERYTHRITOL TETRANITRATE	545.59	266	000078-11-5
266	1,3-DICHLOROPROPENE, TRANS-	543.37	267	010061-02-6
267	BIS(2-ETHYLHEXYL)ADIPATE	540.20	268	000103-23-1
268	CARBAZOLE	534.52	269	000086-74-8
269	METHYL ISOBUTYL KETONE	533.24	271	000108-10-1
270	1,2-DICHLOROETHENE, CIS-	533.15	270	000156-59-2
271	STYRENE	532.70	272	000100-42-5
272	CARBARYL	530.98	273	000063-25-2
273	1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	529.45	274	067562-39-4
274	ACRYLONITRILE	528.28	275	000107-13-1
275	1-METHYLNAPHTHALENE	526.51	NEW	

Substances were assigned the same rank when two (or more) substances received equivalent total point scores.

CAS #= Chemical Abstracts Service Registry Number

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