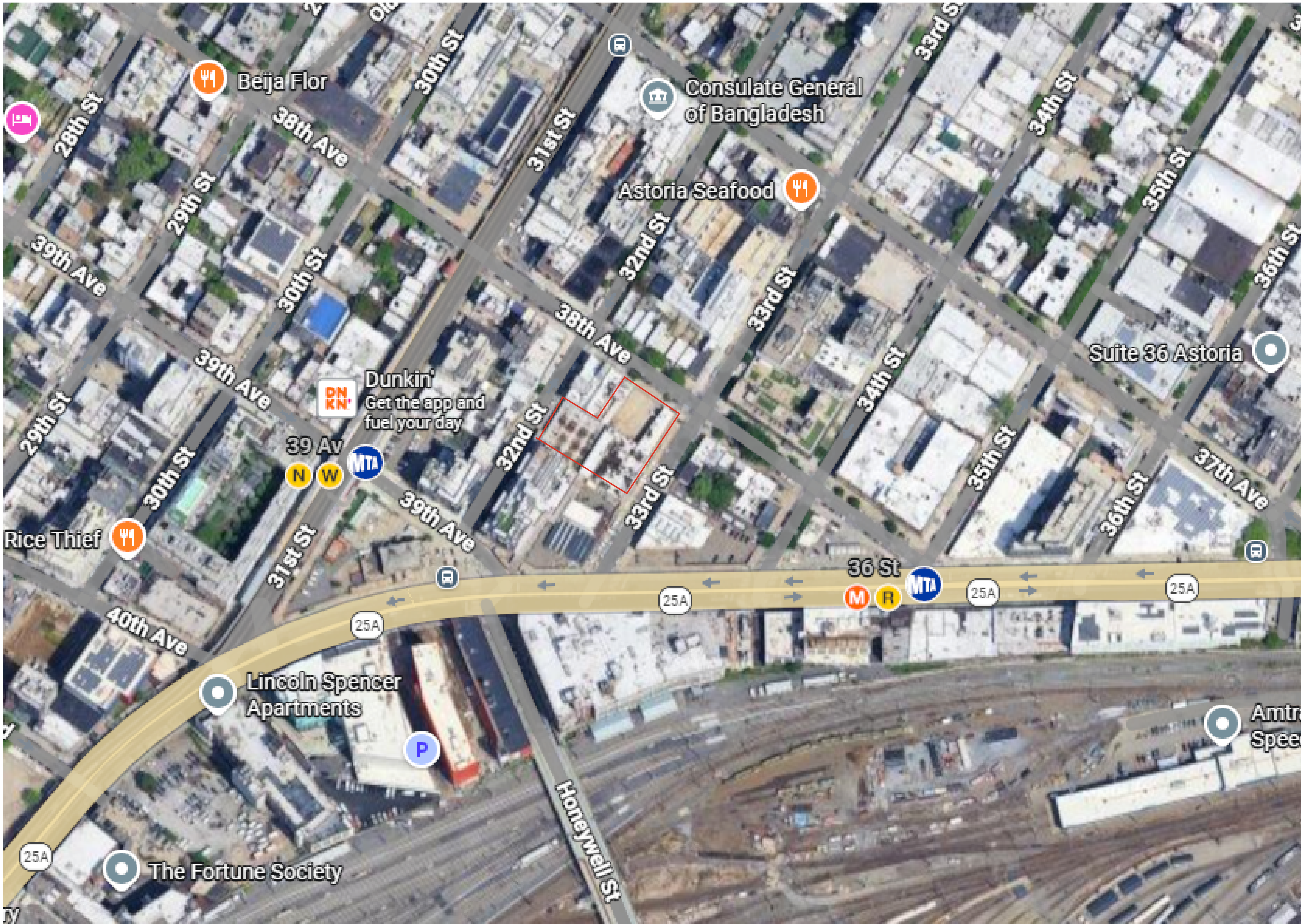
FIGURES



vEKtor consultants

t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

Legend:

Approximate BCP Site Boundary

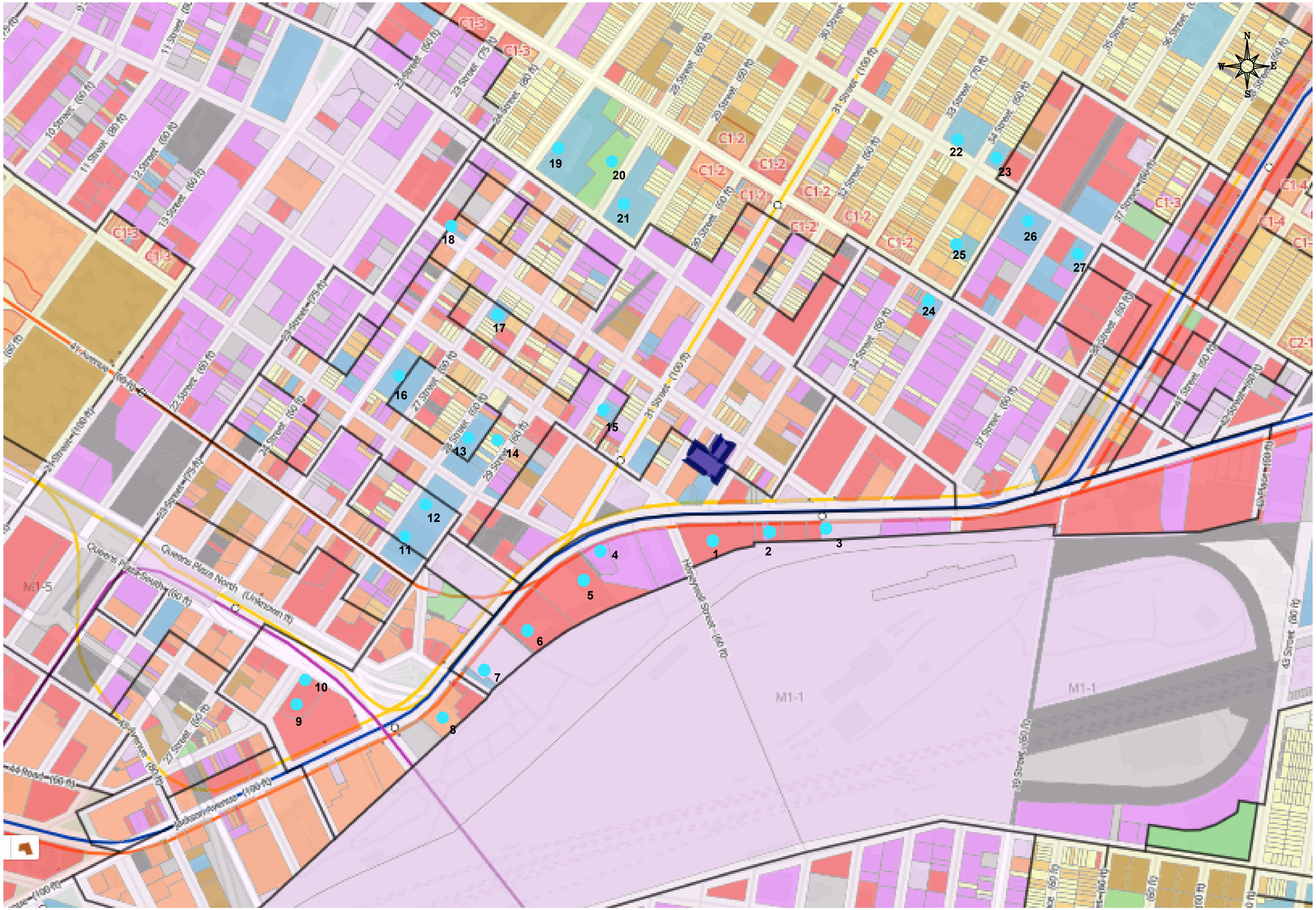
Notes:

1. Base Map provided by Google Earth

Scale:

NOT TO SCALE

Figure No.	1
Figure Name:	SITE LOCATION MAP
Report:	RAWP
Date:	3/20/2026
Drawn By:	KB
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK



vEKtor consultants
t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

Legend:

- One and Two Family Buildings
- Multi-Family Walk-Up Buildings
- Multi-Family Elevator Buildings
- Mixed Residential and Commercial Buildings
- Commercial and Office Buildings
- Industrial and Manufacturing
- Transportation and Utility
- Public Facilities and Institutions
- Open Space and Outdoor Recreation
- Parking Facilities
- Vacant Land
- Other
- Mandatory Inclusionary Housing Areas
- X Sensitive Receptors and ID
- Site Boundary

Base map provided by NYC Planning

Scale:

0 600' 1,200'

Figure No.	2
Figure Name:	SITE BOUNDARY & SURROUNDING LAND USE
Report:	RAWP
Date:	3/20/25
Drawn By:	DK
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK

vEKtor consultants

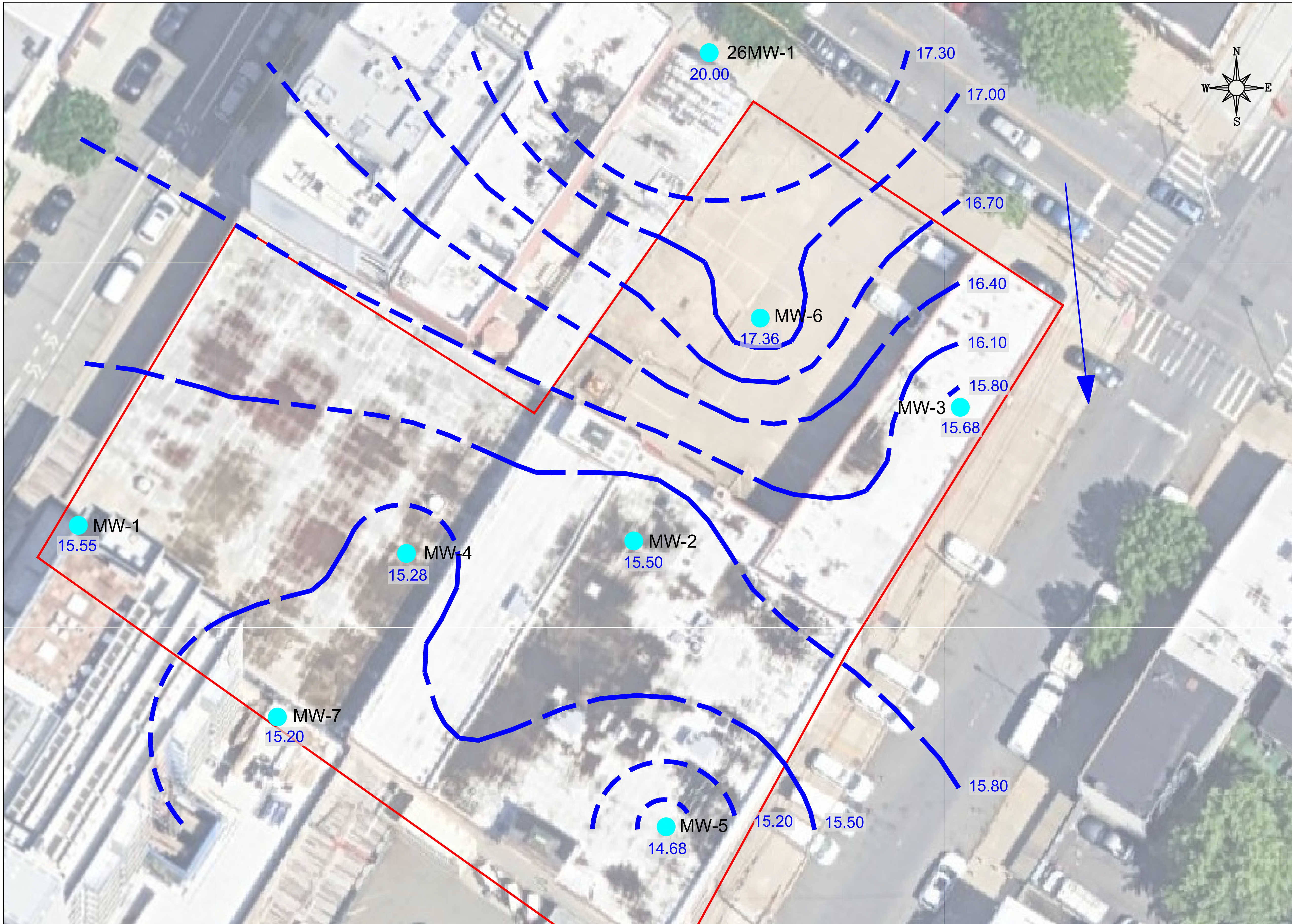
t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

Legend:

- BCP Site Boundary
- Former Building Footprint on Lot 16
- Former Building Footprint on Lot 5
- Paved Parking Footprint on Lot 5
- Building Footprint on Lot 12
- Electrical Manhole
- Sewer Manhole
- Floor Drain
- Metal Cover
- Utility Pole

Scale:
0 25' 50'

Figure No.	3
Figure Name:	SITE PLAN
Report:	RAWP
Date:	3/13/2026
Drawn By:	EK
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK



vEKtor consultants

t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

Legend:

- Property Boundary
- Monitoring Well
- 15.08 Groundwater Elevation (feet)
- Groundwater Elevation Contour Line (feet) Contour Interval = 0.5 feet
- 15.08 Groundwater Elevation (feet)
- Groundwater Flow Direction

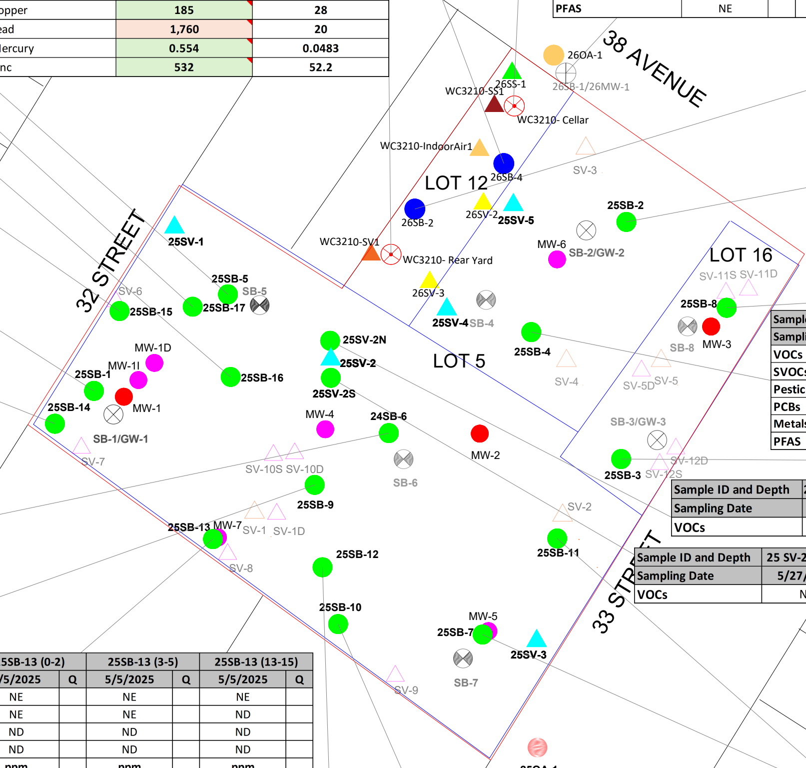
Scale:

0 25' 50'

Figure No.	4
Figure Name:	GROUNDWATER CONTOUR PLAN
Report:	RAWP
Date:	3/16/2026
Drawn By:	KB
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK

vEKtor consultants

t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com



Sample ID and Depth	25SB-5 (0-2)	25SB-5 (3-5)	25SB-5 (11-13)
Sampling Date	5/5/2025	5/5/2025	5/5/2025
VOCs	NE	NE	NE
SVOCs	NE	ND	ND
Pesticides	ND	ND	ND
PCBs	ND	ND	ND
Metals	NE	NE	NE
PFAS	NE	NE	NE

Sample ID and Depth	25SB-16 (0-2)	25SB-16 (2-4)	25SB-16 (11-13)
Sampling Date	5/27/2025	5/27/2025	5/27/2025
VOCs	ND	NE	NE

Sample ID and Depth	25SB-17 (0-2)	25SB-17 (2-4)	25SB-17 (12-14)
Sampling Date	5/27/2025	5/27/2025	5/27/2025
VOCs	NE	NE	NE

Sample ID and Depth	25SB-15 (0-2)	25SB-15 (4-6)	25SB-15 (10-12)
Sampling Date	5/6/2025	5/6/2025	5/6/2025
VOCs	NE	NE	NE
SVOCs	ND	ND	ND
Pesticides	ND	ND	ND
PCBs	ND	ND	ND
Metals	NE	NE	NE
PFAS	NE	NE	NE

Sample ID and Depth	25SB-1 (0-2)	25SB-1 (2-4)	25SB-1 (11-13)
Sampling Date	5/6/2025	5/6/2025	5/6/2025
VOCs	NE	NE	NE
SVOCs	NE	ND	NE
Pesticides	ND	ND	ND
PCBs	ND	ND	ND
Metals	NE	NE	NE
PFAS	NE	NE	NE

Sample ID and Depth	25SB-14 (0-2)	25SB-14 (4-6)	25SB-14 (10-12)
Sampling Date	5/6/2025	5/6/2025	5/6/2025
VOCs	NE	NE	NE
SVOCs	NE	ND	ND
Pesticides	ND	ND	ND
PCBs	ND	ND	ND
Metals	NE	NE	NE
PFAS	NE	NE	NE

Sample ID and Depth	25SB-6 (0-2)	Q	25SB-6 (3-5)	Q	25SB-6 (11.5-13.5)	Q
Sampling Date	5/5/2025	Q	5/5/2025	Q	5/5/2025	Q
VOCs	NE		NE		NE	
SVOCs	ND		ND		ND	
Pesticides	ND		ND		ND	
PCBs	ND		ND		ND	
Metals	ppm		ppm		ppm	
Lead	140	J	3.04	J	6.12	J
Zinc	186	J	101	J	42.5	J
PFAS	NE		NE		NE	

Sample ID and Depth	25SB-9 (0-2)	Q	25SB-9 (2-4)	Q	25SB-9 (12-14)	Q
Sampling Date	5/5/2025	Q	5/5/2025	Q	5/5/2025	Q
VOCs	NE		NE		NE	
SVOCs	NE		NE		NE	
Pesticides	ND		ND		ND	
PCBs	ND		ND		ND	
Metals	ppm		ppm		ppm	
Lead	85.8	J	3.28	J	2.94	J
PFAS	NE		NE		NE	

Sample ID and Depth	25SB-13 (0-2)	Q	25SB-13 (3-5)	Q	25SB-13 (13-15)	Q
Sampling Date	5/5/2025	Q	5/5/2025	Q	5/5/2025	Q
VOCs	NE		NE		NE	
SVOCs	NE		NE		ND	
Pesticides	ND		ND		ND	
PCBs	ND		ND		ND	
Metals	ppm		ppm		ppm	
Zinc	39.2	J	121	J	25.3	J
PFAS	NE		NE		NE	

Sample ID and Depth	25SB-12 (0-2)	Q	25SB-12 (3-5)	Q	25SB-12 (11-13)	Q
Sampling Date	5/5/2025	Q	5/5/2025	Q	5/5/2025	Q
VOCs	NE		NE		NE	
SVOCs	ppm		ppm		ppm	
Benzo(a)anthracene	31.4	D	0.0539	JD	ND	
Benzo(a)pyrene	29	D	0.0733	JD	ND	
Benzo(b)fluoranthene	27.6	D	0.0927	D	ND	
Benzo(g,h,i)perylene	22.1	D	0.0611	JD	ND	
Benzo(k)fluoranthene	26	D	ND		ND	
Chrysene	28.8	D	ND		ND	
Dibenzo(a,h)anthracene	4.18	JD	ND		ND	
Dibenzofuran	7.14	D	ND		ND	
Indeno(1,2,3-cd)pyrene	24.6	J	0.0856	JD	ND	
Naphthalene	15.3	D	ND		ND	
Phenanthrene	71.4	D	0.0525	JD	ND	
Pesticides	ND		ND		ND	
PCBs	ND		ND		ND	
Metals	ppm		ppm		ppm	
Copper	172	J	27.7	J	16.3	J
Lead	3,720	J	39.5	J	3	J
Zinc	524	J	46.9	J	37.7	J
Mercury	0.563		0.319		ND	
PFAS	NE		NE		NE	

Sample ID and Dedpth	26SB-4 (0-2)	26SB-4 (5-7)	26SB-4 (17-19)
Sampling Date	2/4/2026	2/4/2026	2/4/2026
VOCs	ND	ND	NE
SVOCs	NE	NE	ND
Pesticides	ND	ND	ND
PCBs	ND	ND	ND
Metals	NE	NE	NE
PFAS	NE	ND	NE

Sample ID and Dedpth	WC3210- Rear Yard (0-2)	WC3210- Rear Yard (3-4)
Sampling Date	11/13/2025	11/13/2025
VOCs	ND	ND
SVOCs	NE	ND
Metals	ppm	ppm
Barium	405	47.1
Copper	185	28
Lead	1,760	20
Mercury	0.554	0.0483
Zinc	532	52.2

Sample ID and Dedpth	WC3210- Cellar (0-2)	WC3210- Cellar (3-4)
Sampling Date	11/13/2025	11/13/2025
VOCs	ND	NE
SVOCs	NE	ND
Metals	NE	NE

Sample ID and Dedpth	26SB-1 (0-2)		26SB-1 (6-8)		26SB-1 (15-17)	
Sampling Date	2/4/2026		2/4/2026		2/4/2026	
VOCs	ND		ND		NE	
SVOCs	NE		ND		ND	
Pesticides	ppm		ppm		ppm	
4,4'-DDT	ND		0.00387	D	ND	
PCBs	ND		ND		ND	
Metals	NE		NE		NE	
PFAS	NE		ND		NE	

Sample ID and Dedpth	26SB-2 (0-2)		26SB-2 (7-9)		26SB-2 (17-19)
Sampling Date	2/4/2026		2/4/2026		2/4/2026
VOCs	NE		NE		ND
SVOCs	NE		ND		ND
Pesticides	ppm		ppm		ppm
4,4'-DDE	0.0392	JN	0.00206	D	ND
alpha-Chlordane	4.24	D	0.0889	D	ND
Heptachlor	1.37	D	0.0274	D	ND
PCBs	ND		ND		ND
Metals	ppm		ppm		ppm
Lead	395		3.77		2.53
Zinc	176		81.4		28.3
PFAS	ND		NE		NE

Sample ID and Depth	25SB-2 (0-2)	Q	25-SB-DUP-1(0-2)	Q	25SB-2 (5-7)	Q
Sampling Date	5/2/2025	Q	5/2/2025	Q	5/2/2025	Q
VOCs	NE		NE		NE	
SVOCs	ppm		ppm		ppm	
Indeno(1,2,3-cd)pyrene	0.628	J	0.37	J	NE	
Pesticides	ND		ND		ND	
PCBs	ND		ND		ND	
Metals	ppm		ppm		ppm	
Lead	66.3	J-	66.2	J-	2.69	J-
PFAS	NE		NE		NE	

Compounds	UUSCOs	RRSCOs	PGWSCOs
VOCs	ppm	ppm	ppm
Acetone	0.03	100	N/A
SVOCs	ppm	ppm	ppm
Benzo(a)anthracene	1	1.4	N/A
Benzo(a)pyrene	1	1	N/A
Benzo(b)fluoranthene	1	1.4	N/A
Benzo(k)fluoranthene	0.8	4.9	N/A
Chrysene	1	4.9	N/A
Dibenzo(a,h)anthracene	0.33	0.33	N/A
Dibenzofuran	2.1	18	N/A
Indeno(1,2,3-cd)pyrene	0.5	1.4	N/A
Naphthalene	12	100	N/A
Phenanthrene	1.1	4.9	N/A
Pesticides	ppm	ppm	ppm
4,4'-DDE	0.0033	3.4	N/A
4,4'-DDT	0.0033	3.8	N/A
alpha-Chlordane	0.014	0.65	N/A
Heptachlor	0.013	0.53	N/A
Metals	ppm	ppm	ppm
Arsenic	13	16	N/A
Acetone	0.03	100	N/A
Barium	410	410	N/A
Copper	50	280	N/A
Lead	63	400	N/A
Nickel	30	310	N/A
Zinc	109	6,600	N/A
Mercury	0.18	0.3	N/A

Sample ID and Depth	25SB-4 (0-2)	25SB-4 (3-5)	25SB-4 (11-13)
Sampling Date	5/2/2025	5/2/2025	5/2/2025
VOCs	NE	NE	NE
SVOCs	NE	NE	NE
Pesticides	ND	ND	ND
PCBs	ND	ND	ND
Metals	NE	NE	NE
PFAS	NE	NE	NE

Sample ID and Depth	25SB-8 (0-2)	Q	25-SB-DUP-3(0-2)	Q	25SB-8 (3-5)	Q	25SB-8 (12.5-14.5)	Q
Sampling Date	5/6/2025	Q	5/6/2025	Q	5/6/2025	Q	5/6/2025	Q
VOCs	NE		NE		NE		NE	
SVOCs	NE		NE		ND		ND	
Pesticides	ND		ND		ND		ND	
PCBs	ND		ND		ND		ND	
Metals	ppm		ppm		ppm		ppm	
Lead	59.4	J-	76.4	J-	2.28	J-	1.92	J-
Zinc	70.6	J-	146	J-	28.1	J-	22.5	J-
PFAS	NE		NE		NE		NE	

Sample ID and Depth	25 SV-2-N (10-12)	25 SV-2-N (12-14)	25 SV-2-N (14-15)
Sampling Date	5/27/2025	5/27/2025	5/27/2025
VOCs	NE	NE	NE

Sample ID and Depth	25 SV-2-S (0-2)	25 SV-2-S (2-4)	25 SV-2-S (10-12)	25 SV-2-S (12-14)	25 SV-2-S (14-15)
Sampling Date	5/27/2025	5/27/2025	5/27/2025	5/27/2025	5/27/2025
VOCs	NE	NE	NE	NE	NE

Sample ID and Depth	25SB-3 (0-2)	Q	25SB-3 (4-6)	Q	25SB-3 (11-13)	Q
Sampling Date	5/6/2025	Q	5/6/2025	Q	5/6/2025	Q
VOCs	NE		NE		NE	
SVOCs	ppm		ppm		ppm	
Benzo(a)anthracene	7.2	J-	0.268	J-	ND	
Benzo(a)pyrene	6.82	J-	0.239	J-	ND	
Benzo(b)fluoranthene	5.97	J-	0.324	J-	ND	
Benzo(g,h,i)perylene	4.77	J-	0.201	J-	ND	
Benzo(k)fluoranthene	5.29	J-	0.108	J-	ND	
Chrysene	7.45	J-	0.292	J-	ND	
Dibenzo(a,h)anthracene	1.23	J	0.051	J-	ND	
Indeno(1,2,3-cd)pyrene	4.12	J-	0.181	J-	ND	
Phenanthrene	3.2	J-	0.569	J-	ND	
Pesticides	ND		ND		ND	
PCBs	ND		ND		ND	
Metals	ppm		ppm		ppm	
Lead	165	J-	9.19	J-	6.92	J-
Zinc	220	J-	36.9	J-	52.1	J-
PFAS	NE		NE		NE	

Sample ID and Depth	25SB-11 (0-1.5)	
Sampling Date	5/6/2025	Q
VOCs	ppm	
Acetone	0.037	J+
SVOCs	ND	
Pesticides	ND	
PCBs	ND	
Metals	NE	
PFAS	NE	

Sample ID and Depth	25SB-10 (0-2)	Q	25SB-10 (2-4)	Q	25SB-10 (11-13)	Q
Sampling Date	5/2/2025	Q	5/2/2025	Q	5/2/2025	Q
VOCs	NE		NE		NE	
SVOCs	ppm		ppm		ppm	
Benzo(b)fluoranthene	1.29	J-	0.384	J-	0.972	J-
Benzo(g,h,i)perylene	0.839	J	0.194	J	0.446	J
Indeno(1,2,3-cd)pyrene	0.72	J	0.185	J	0.425	J
Pesticides	ppm		ppm		ppm	
4,4'-DDT	0.00487	D	ND		ND	
PCBs	NE		ND		ND	
Metals	ppm		ppm		ppm	
Copper	101	J	30.7	J	37.9	J
Lead	448	J-	79	J-	69.6	J-
Zinc	392	J	128	J	133	J
Mercury	0.388	J-	0.184	J-	0.138	J-
PFAS	NE		NE		NE	

Sample ID and Depth	25SB-7 (0-2)	Q	25SB-7 (3-5)	Q	25SB-7 (6-8)	Q
Sampling Date	5/6/2025	Q	5/5/2025	Q	5/5/2025	Q
VOCs	NE		NE		NE	
SVOCs	NE		ND		NE	
Pesticides	ND		ND		ND	
PCBs	ND		ND		ND	
Metals	ppm		ppm		ppm	
Lead	96.3	J	4.55	J-	4.35	J-
PFAS	NE		NE		NE	

Legend:
- BCP Site Boundary
- Building Boundary
- SB-X Prior Soil Boring Location and ID (July 2024)
- SB-X/GW-X Prior Soil Boring/Groundwater Sample Location and ID (July 2024)
- SV-X Prior Soil Vapor Point Location and ID (July 2024)
- SV-X Prior Soil Vapor Point Location and ID (August 2024)
- MW-X Monitoring Well Location and ID (August 2024)
- MW-X Monitoring Well Location and ID (May 2024)
- 25SB-X Soil Boring Location and ID (May 2025)
- 25SV-X Soil Vapor Point Location and ID (May 2025)
- 25OA-X Outdoor Ambient Air Location and ID (May 2025)
- 26SB-X Soil Boring Location and ID (February 2026)
- 26SV-X Soil Vapor Location and ID (February 2026)
- 26SB-1/26MW-1 Soil Boring/Monitoring Well Location and ID (February 2026)
- WCXX Soil Vapor Location and ID (November 2025)
- WCXX Soil Boring Location and ID (November 2025)
- 26OA-X Outdoor Ambient Air Location and ID (2026)
- WCXX-IndoorAirX Indoor Air Sample Location and ID (November 2025)
- 26SS-X Sub-Slab Soil Vapor Location and ID (February 2026)
- WCXX Sub-Slab Soil Vapor Location and ID (November 2025)

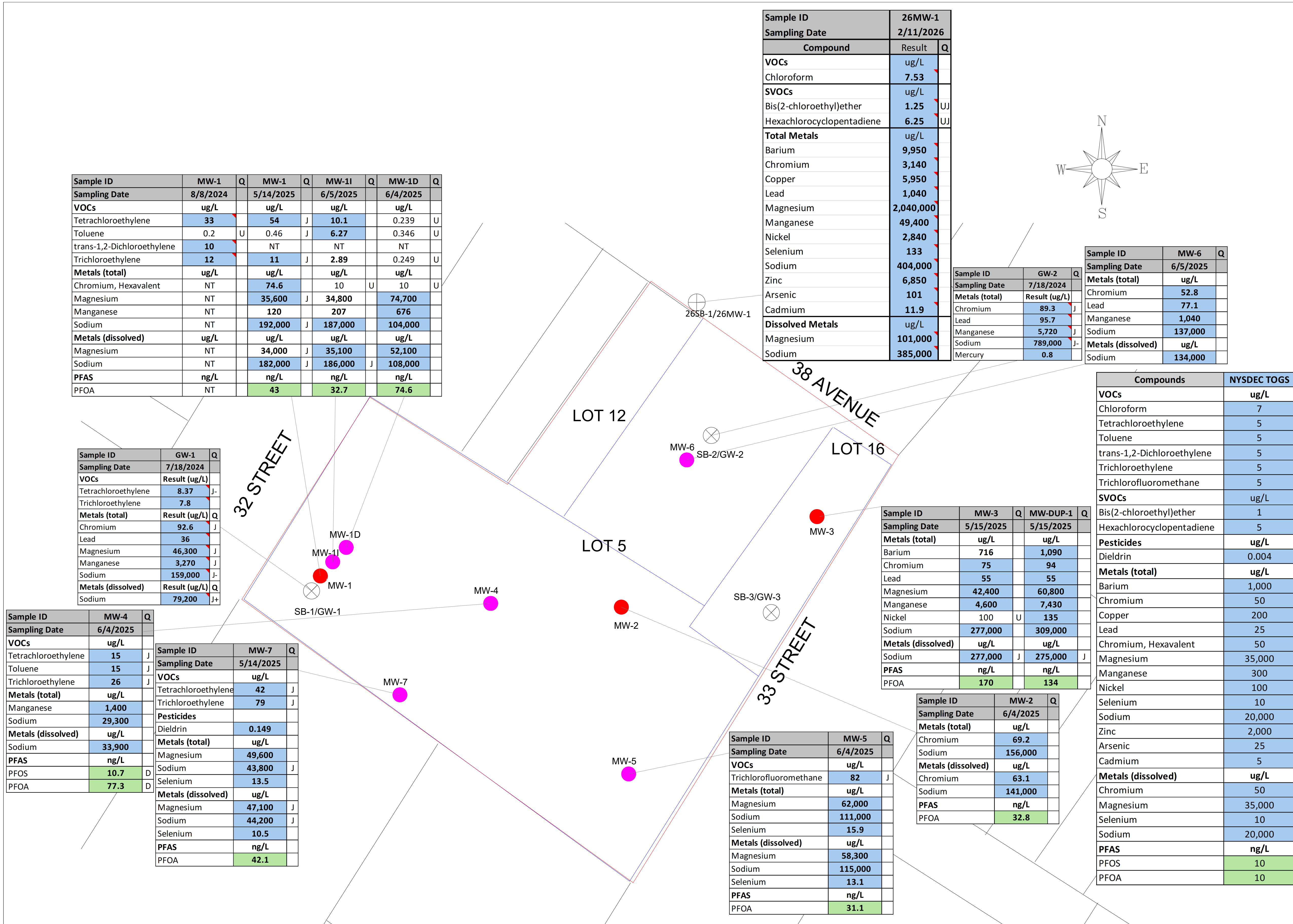
Notes:
1. Green highlighted values are detected at concentrations above NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives
2. Orange highlighted values are detected at concentrations above NYSDEC Part 375 Restricted Residential Use Soil Cleanup Objectives
3. Blue highlighted values are concentrations above Part 375 Protection of Groundwater Soil Cleanup Objectives
4. Q is the Qualifier Column with definitions as follows:
   J = analyte detected at or above the method detection limit but below the Reporting Limit - data is estimated
   J- = Analyte is present. Reported value may be biased low and associated with a higher level of uncertainty than is normally expected with the analytical method.
   J+ = Analyte is present. Reported value may be biased high and associated with a higher level of uncertainty than is normally expected with the analytical method.
   N/A: Not Applicable, NE: No Exceedance, ND: No Detections
   UUSCO: Part 375 Unrestricted Use Soil Cleanup Objectives
   RRSCO: Part 375 Restricted Residential Use Soil Cleanup Objectives
   PGWSCO: Part 375 Protection of Groundwater Soil Cleanup Objectives
   ppm: Parts per million

Scale: 0 60

Figure No.	5
Figure Name:	SOIL EXCEEDANCE MAP
Report:	RAWP
Date:	3/12/2026
Drawn By:	KB
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK

vEKtor consultants

t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com



Sample ID	26MW-1	
Sampling Date	2/11/2026	
Compound	Result	Q
VOCs	ug/L	
Chloroform	**7.53**	
SVOCs	ug/L	
Bis(2-chloroethyl)ether	**1.25**	UJ
Hexachlorocyclopentadiene	**6.25**	UJ
Total Metals	ug/L	
Barium	**9,950**	
Chromium	**3,140**	
Copper	**5,950**	
Lead	**1,040**	
Magnesium	**2,040,000**	
Manganese	**49,400**	
Nickel	**2,840**	
Selenium	**133**	
Sodium	**404,000**	
Zinc	**6,850**	
Arsenic	**101**	
Cadmium	**11.9**	
Dissolved Metals	ug/L	
Magnesium	**101,000**	
Sodium	**385,000**	

Sample ID	MW-1	Q	MW-1	Q	MW-1I	Q	MW-1D	Q
Sampling Date	8/8/2024		5/14/2025		6/5/2025		6/4/2025	
VOCs	ug/L		ug/L		ug/L		ug/L	
Tetrachloroethylene	**33**		**54**	J	**10.1**		0.239	U
Toluene	0.2	U	0.46	J	**6.27**		0.346	U
trans-1,2-Dichloroethylene	**10**		NT		NT		NT	
Trichloroethylene	**12**		**11**	J	**2.89**		0.249	U
Metals (total)	ug/L		ug/L		ug/L		ug/L	
Chromium, Hexavalent	NT		**74.6**		10	U	10	U
Magnesium	NT		**35,600**	J	**34,800**		**74,700**	
Manganese	NT		**120**		**207**		**676**	
Sodium	NT		**192,000**	J	**187,000**		**104,000**	
Metals (dissolved)	ug/L		ug/L		ug/L		ug/L	
Magnesium	NT		**34,000**	J	**35,100**		**52,100**	
Sodium	NT		**182,000**	J	**186,000**	J	**108,000**	
PFAS	ng/L		ng/L		ng/L		ng/L	
PFOA	NT		**43**		**32.7**		**74.6**	

Sample ID	GW-2	Q
Sampling Date	7/18/2024	
Metals (total)	**Result (ug/L)**	
Chromium	**89.3**	J
Lead	**95.7**	
Manganese	**5,720**	J
Sodium	**789,000**	J-
Mercury	**0.8**	

Sample ID	MW-6	Q
Sampling Date	6/5/2025	
Metals (total)	ug/L	
Chromium	**52.8**	
Lead	**77.1**	
Manganese	**1,040**	
Sodium	**137,000**	
Metals (dissolved)	ug/L	
Sodium	**134,000**	

Sample ID	GW-1	Q
Sampling Date	7/18/2024	
VOCs	**Result (ug/L)**	
Tetrachloroethylene	**8.37**	J-
Trichloroethylene	**7.8**	
Metals (total)	**Result (ug/L)**	**Q**
Chromium	**92.6**	J
Lead	**36**	
Magnesium	**46,300**	J
Manganese	**3,270**	J
Sodium	**159,000**	J-
Metals (dissolved)	**Result (ug/L)**	**Q**
Sodium	**79,200**	J+

Sample ID	MW-3	Q	MW-DUP-1	Q
Sampling Date	5/15/2025		5/15/2025	
Metals (total)	ug/L		ug/L	
Barium	**716**		**1,090**	
Chromium	**75**		**94**	
Lead	**55**		**55**	
Magnesium	**42,400**		**60,800**	
Manganese	**4,600**		**7,430**	
Nickel	100	U	**135**	
Sodium	**277,000**		**309,000**	
Metals (dissolved)	ug/L		ug/L	
Sodium	**277,000**	J	**275,000**	J
PFAS	ng/L		ng/L	
PFOA	**170**		**134**	

Sample ID	MW-4	Q
Sampling Date	6/4/2025	
VOCs	ug/L	
Tetrachloroethylene	**15**	J
Toluene	**15**	J
Trichloroethylene	**26**	J
Metals (total)	ug/L	
Manganese	**1,400**	
Sodium	**29,300**	
Metals (dissolved)	ug/L	
Sodium	**33,900**	
PFAS	ng/L	
PFOS	**10.7**	D
PFOA	**77.3**	D

Sample ID	MW-7	Q
Sampling Date	5/14/2025	
VOCs	ug/L	
Tetrachloroethylene	**42**	J
Trichloroethylene	**79**	J
Pesticides		
Dieldrin	**0.149**	
Metals (total)	ug/L	
Magnesium	**49,600**	
Sodium	**43,800**	J
Selenium	**13.5**	
Metals (dissolved)	ug/L	
Magnesium	**47,100**	J
Sodium	**44,200**	J
Selenium	**10.5**	
PFAS	ng/L	
PFOA	**42.1**	

Sample ID	MW-2	Q
Sampling Date	6/4/2025	
Metals (total)	ug/L	
Chromium	**69.2**	
Sodium	**156,000**	
Metals (dissolved)	ug/L	
Chromium	**63.1**	
Sodium	**141,000**	
PFAS	ng/L	
PFOA	**32.8**	

Sample ID	MW-5	Q
Sampling Date	6/4/2025	
VOCs	ug/L	
Trichlorofluoromethane	**82**	J
Metals (total)	ug/L	
Magnesium	**62,000**	
Sodium	**111,000**	
Selenium	**15.9**	
Metals (dissolved)	ug/L	
Magnesium	**58,300**	
Sodium	**115,000**	
Selenium	**13.1**	
PFAS	ng/L	
PFOA	**31.1**	

Compounds	NYSDEC TOGS
VOCs	ug/L
Chloroform	7
Tetrachloroethylene	5
Toluene	5
trans-1,2-Dichloroethylene	5
Trichloroethylene	5
Trichlorofluoromethane	5
SVOCs	ug/L
Bis(2-chloroethyl)ether	1
Hexachlorocyclopentadiene	5
Pesticides	ug/L
Dieldrin	0.004
Metals (total)	ug/L
Barium	1,000
Chromium	50
Copper	200
Lead	25
Chromium, Hexavalent	50
Magnesium	35,000
Manganese	300
Nickel	100
Selenium	10
Sodium	20,000
Zinc	2,000
Arsenic	25
Cadmium	5
Metals (dissolved)	ug/L
Chromium	50
Magnesium	35,000
Selenium	10
Sodium	20,000
PFAS	ng/L
PFOS	10
PFOA	10

Legend:

- BCP Site Boundary
- Building Boundary
- SB-X/GW-X — Prior Soil Boring/Groundwater Sample Location and Designated ID (July 2024)
- MW-X — Monitoring Well Location and ID (August 2024)
- MW-X — Monitoring Welll Location and Designated ID (May 2025)
- 26SB-1/26MW-1 — Soil Boring/Monitoring Well Location and ID (February 2026)

Notes:

1. NYSDEC TOGS: Technical and Operation Guidance Series
2. NT: Not Taken
3. All results, except for PFAS, are reported in , micrograms per liter (ug/L)
4. PFAS is reported in nanograms per liter (ng/L)
5. PFOS: Perfluorooctanesulfonic acid
6. PFOA: Perfluorooctanoic acid

Scale:

0 25' 50'

Figure No. 7

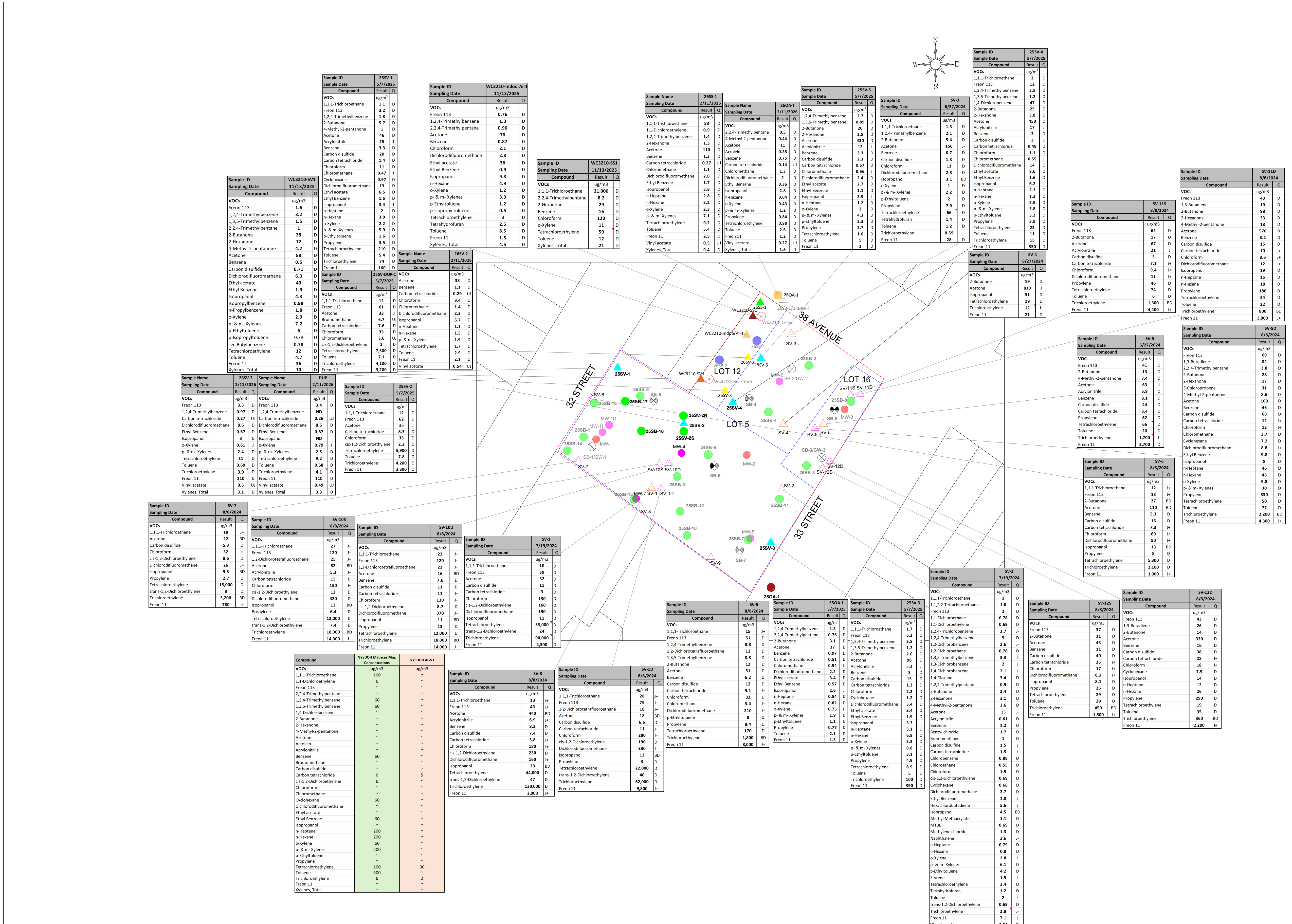
Figure Name: GROUNDWATER EXCEEDANCE

Report: RAWP

Date: 3/12/2026

Drawn By: KB

Site Address: 32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK



vEKtor consultants

t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

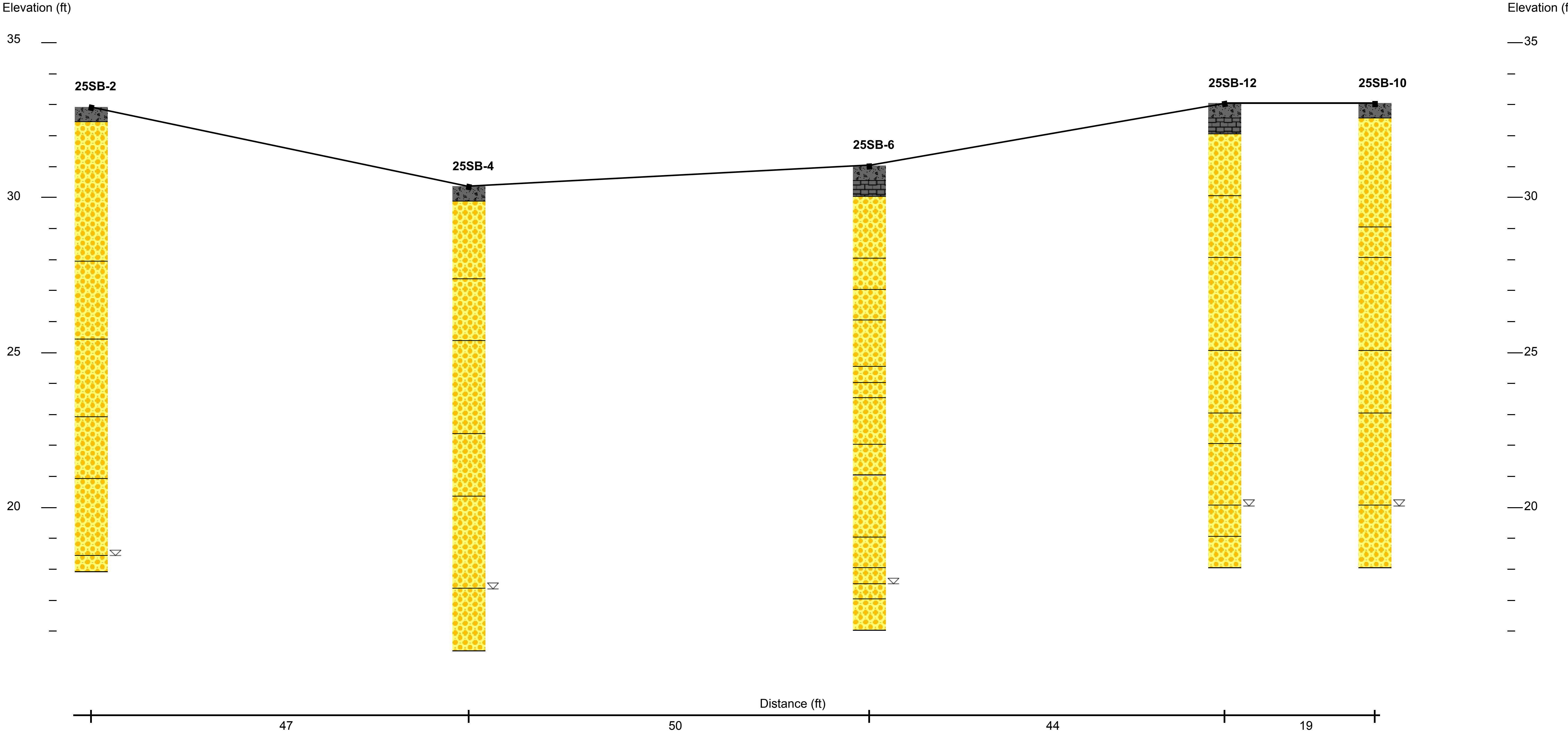
Legend:

- BCP Site Boundary
- Building Boundary
- SB-X Prior Soil Boring Location and ID (July 2024)
- SB-X/GW-X Prior Soil Boring/Groundwater Sample Location and ID (July 2024)
- SV-X Prior Soil Vapor Point Location and ID (July 2024)
- SV-X Prior Soil Vapor Point Location and ID (August 2024)
- MW-X Monitoring Well Location and ID (August 2024)
- MW-X Monitoring Well Location and ID (May 2024)
- 25SB-X Soil Boring Location and ID (May 2025)
- 25SV-X Soil Vapor Point Location and ID (May 2025)
- 25OA-X Outdoor Ambient Air Location and ID (May 2025)
- 26SB-X Soil Boring Location and ID (February 2026)
- 26SV-X Soil Vapor Location and ID (February 2026)
- 26SB-1/26MW-1 Soil Boring/Monitoring Well Location and ID (February 2026)
- WCXX Soil Vapor Location and ID (November 2025)
- WCXX Soil Boring Location and ID (November 2025)
- 26OA-X Outdoor Ambient Air Location and ID (2026)
- WCXX-IndoorAirX Indoor Air Sample Location and ID (November 2025)
- 26SS-X Sub-Slab Soil Vapor Location and ID (February 2026)
- WCXX Sub-Slab Soil Vapor Location and ID (November 2025)

Notes:

1. All results are reported in micrograms per cubic meter (ug/m3)
2. Freon 113: 1,1,2-Trichloro-1,2,2-trifluoroethane
3. Freon 11: Trichlorofluoromethane
4. Qualifiers
   D=result is from an analysis that required a dilution
   U=analyte not detected at or above the level indicated
   J = Analyte is present. Reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method.
   J- = Analyte is present. Reported value may be biased low and associated with a higher level of uncertainty than is normally expected with the analytical method.
   J+ = Analyte is present. Reported value may be biased high and associated with a higher level of uncertainty than is normally expected with the analytical method.
   UJ = Not detected, quantitation limit may be inaccurate or imprecise.
   ~=this indicates that no regulatory limit has been established for this analyte
   D=result is from an analysis that required a dilution
   B=analyte found in the analysis batch blank

Scale:	0 60
Figure No.	7
Figure Name:	SOIL VAPOR DETECTIONS
Report:	RAWP
Date:	4/13/2026
Drawn By:	KB
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK



Horizontal scale: 5 feet
Vertical scale: 5 feet

Legend

CONCRETE
Poorly graded SAND (SP)
ASPHALT

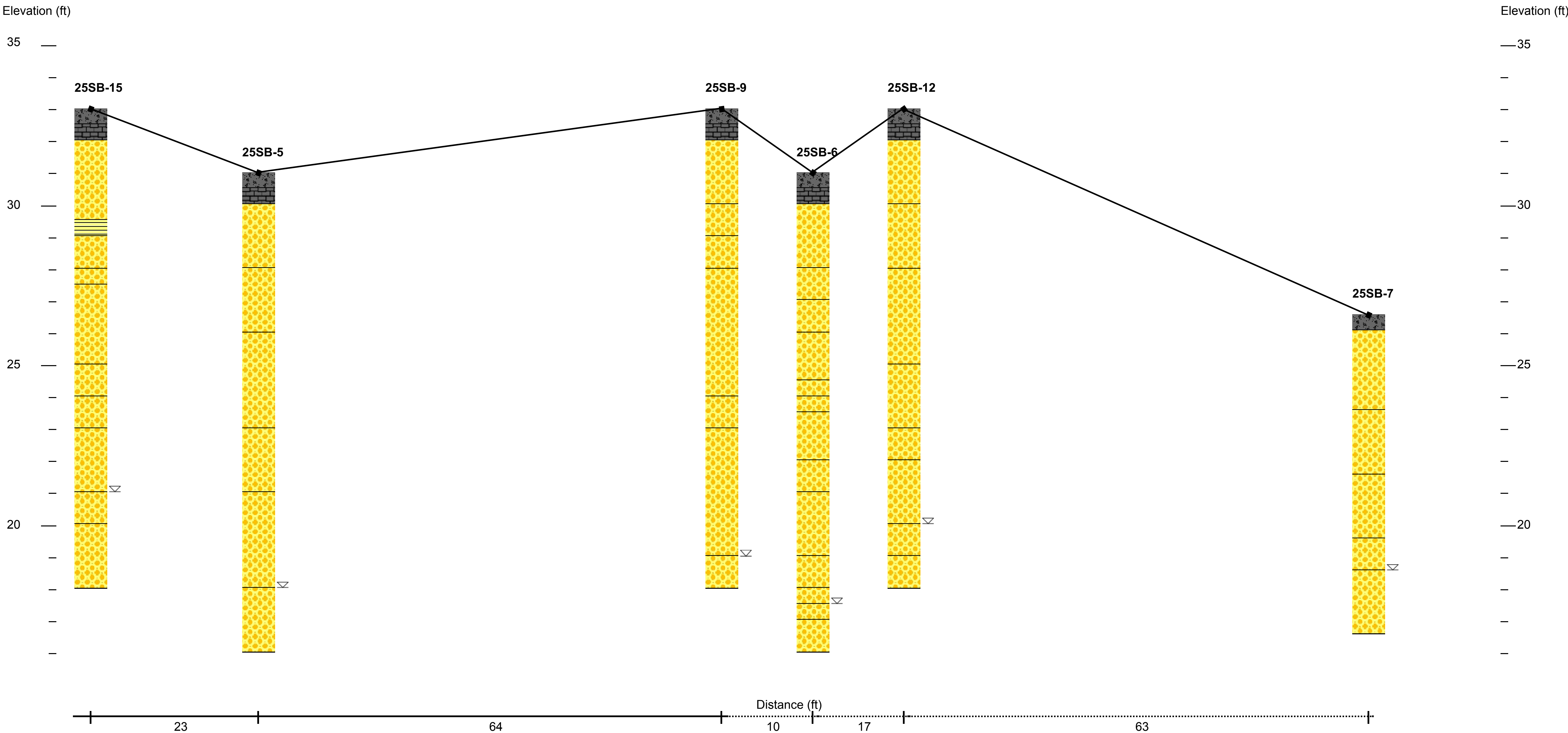
Water Level During Drilling
Water Level at End of Drilling
Cap
Screen
Annular Seal
Sanitary Seal
Filter Pack
Backfill

Built with Google Maps

vEKtor consultants

Figure 8 / RAWP
SUBSURFACE CROSS SECTION N-S

32-20 38TH AVENUE &
38-18 33RD STREET
QUEENS, NY



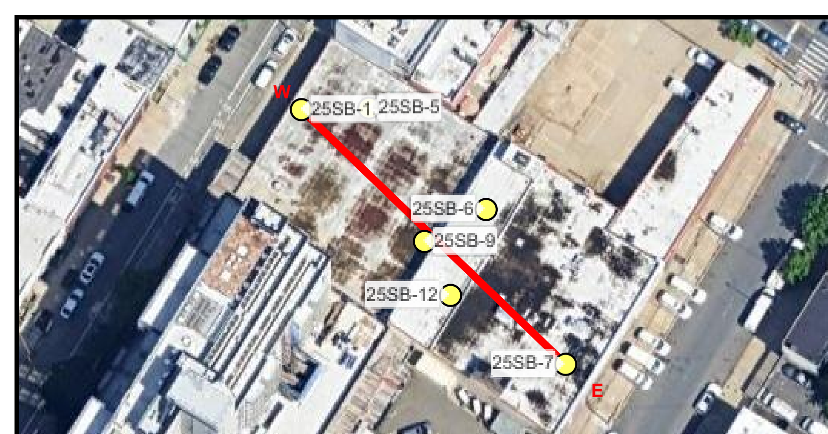
Horizontal scale: 5 feet
Vertical scale: 5 feet

Legend

CONCRETE
ASPHALT
Poorly graded SAND (SP)
SEDIMENTARY Rock

Water Level During Drilling
Water Level at End of Drilling
Cap
Screen
Annular Seal
Sanitary Seal
Filter Pack
Backfill

Built with Google Maps



vEKtor consultants

Figure 9 / RAWP
SUBSURFACE CROSS SECTION E-W

32-20 38TH AVENUE &
38-18 33RD STREET
QUEENS, NY

vEKtor consultants
t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

Legend:

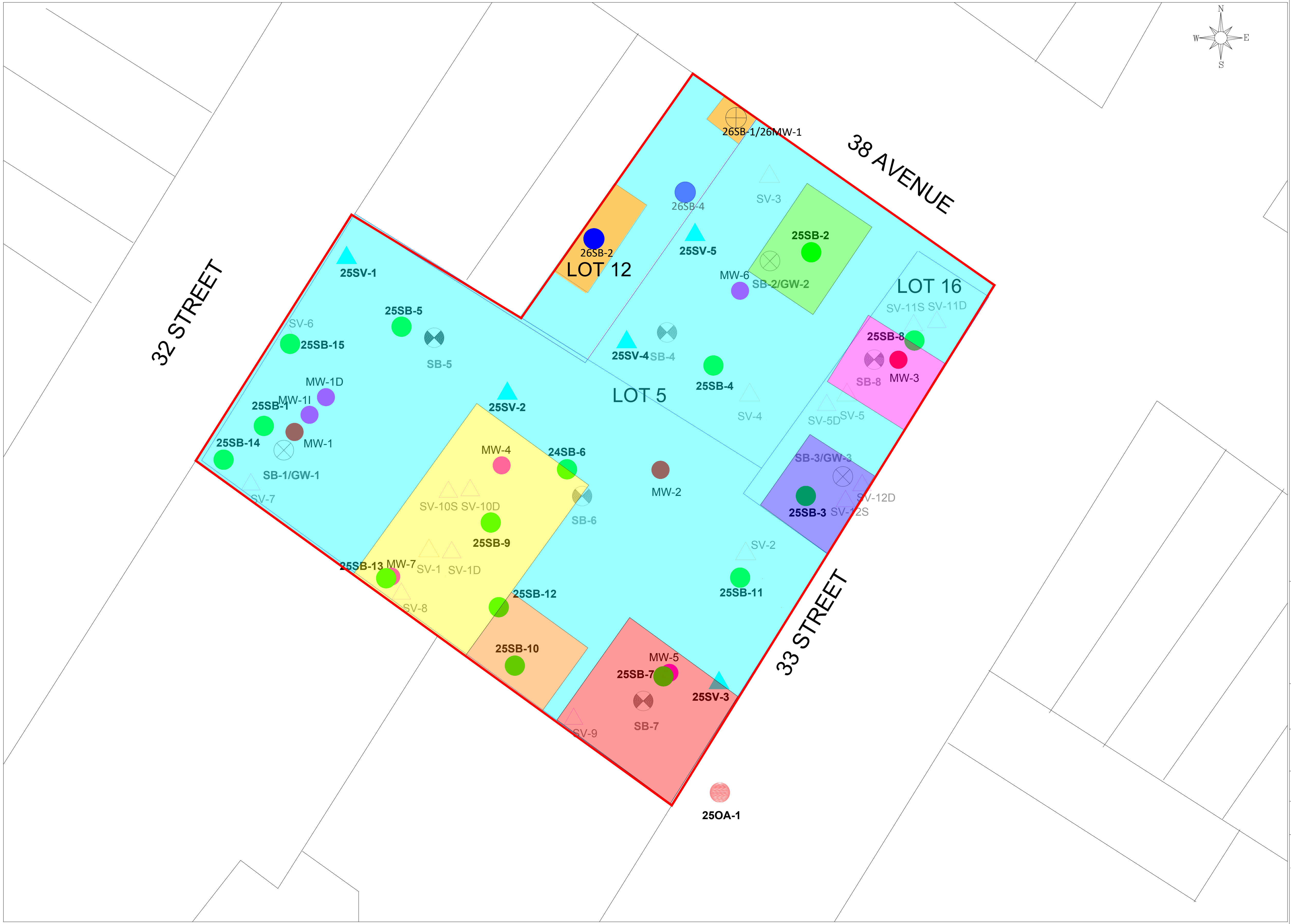
Site Boundary

EP-X End Point Sample ID and Location

Scale:

0 25' 50'

Figure No.	10
Figure Name:	PROPOSED END POINT SAMPLING PLAN
Report:	RAWP
Date:	4/6/2026
Drawn By:	KB
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK



vEKtor consultants

t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

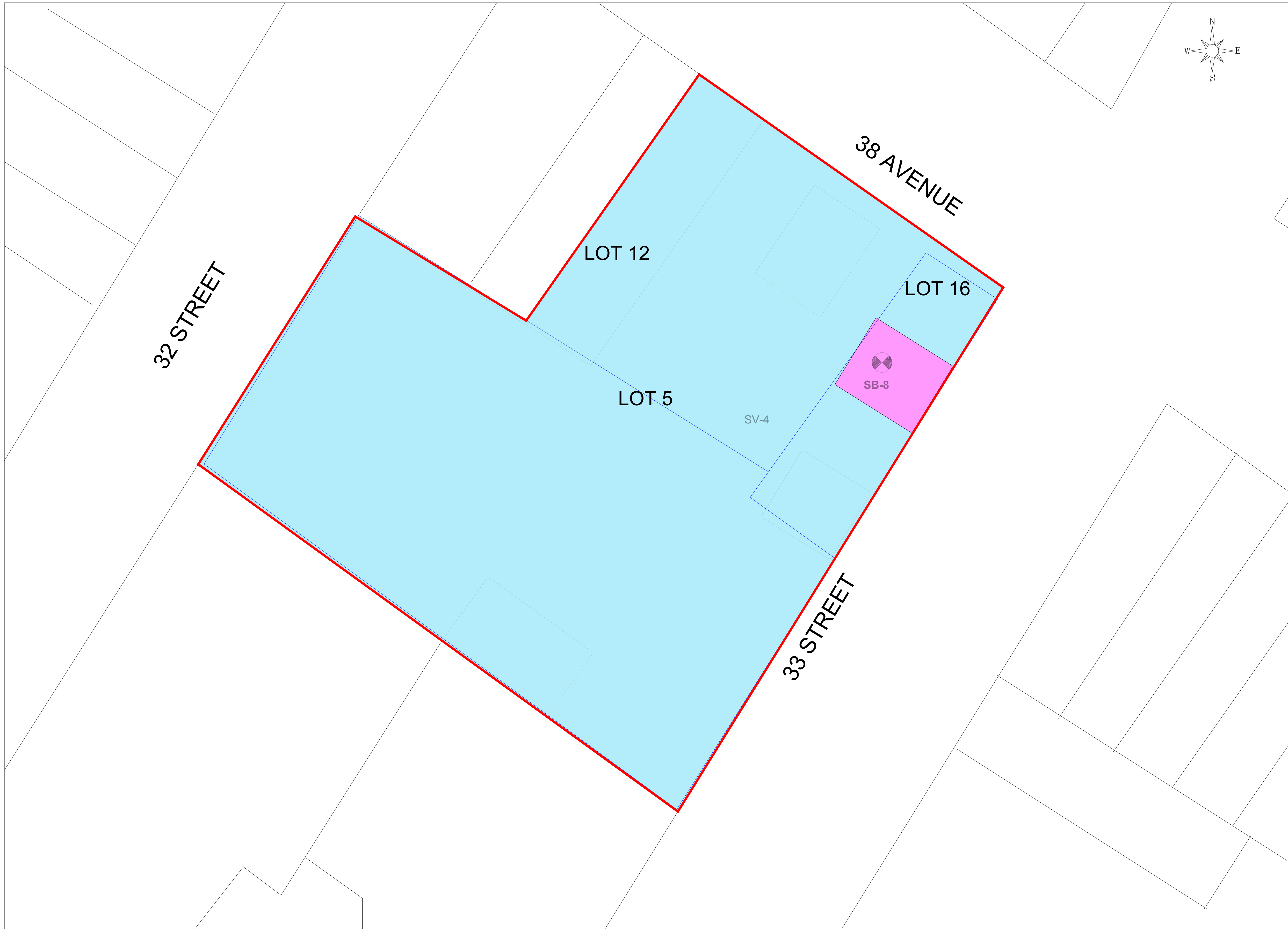
Legend:

- Site Boundary
- Building Boundary
- Sitewide Excavation to ~2 feet min
- Excavation to ~2 feet min
- Excavation to ~4-5 feet min
- Excavation to ~5 feet min
- Excavation to ~10 feet min
- Excavation to ~12 feet min
- Excavation to ~13 feet min
- Excavation to ~18 feet min

Scale:

0 25' 50'

Figure No.	11
Figure Name:	TRACK 1 EXCAVATION MAP
Report:	RAWP
Date:	4/3/2026
Drawn By:	KB
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK



vEKtor consultants
t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

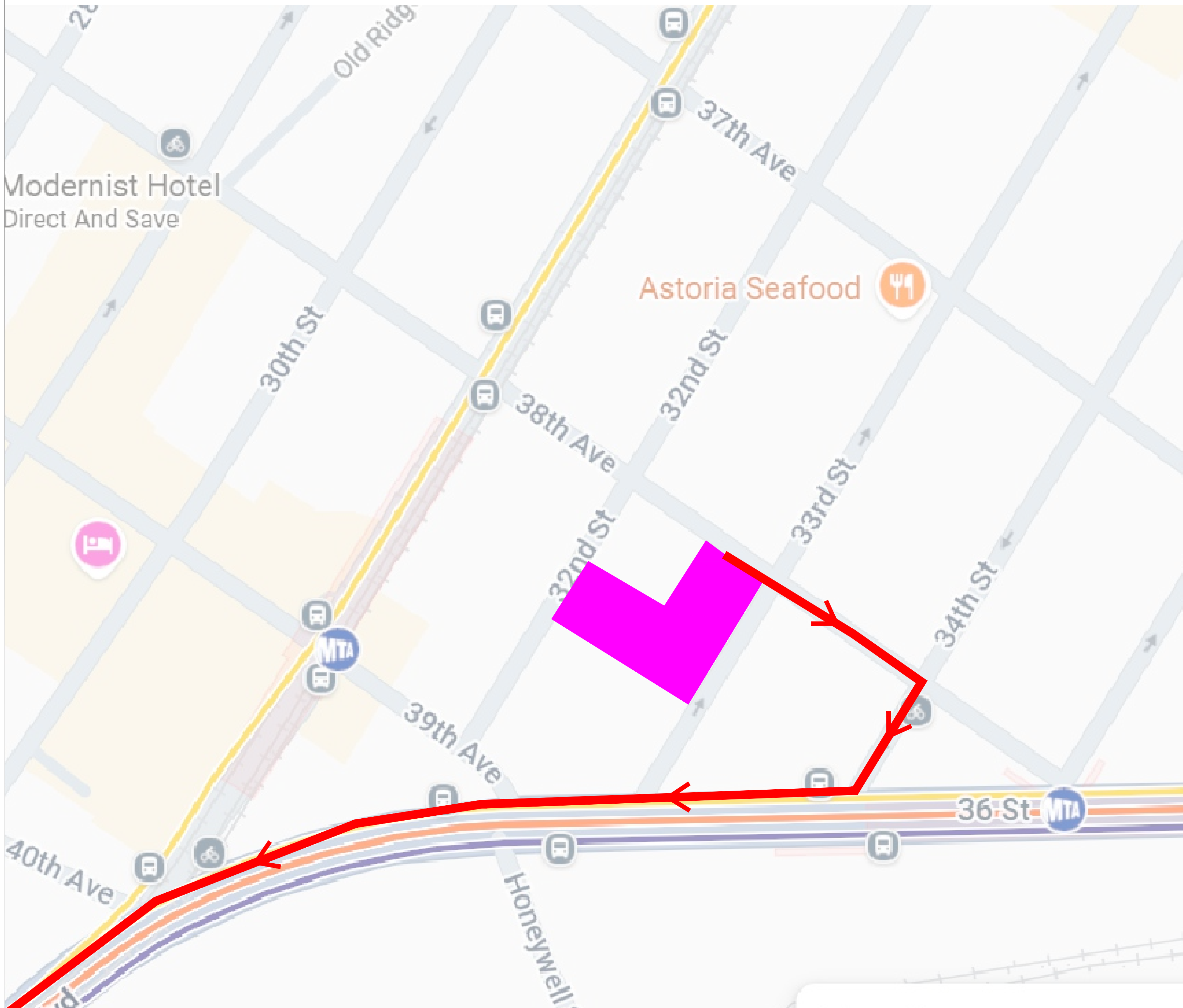
Legend:

- Site Boundary
- Building Boundary
- Sitewide Excavation to ~2 feet min
- Excavation to ~12 feet min

Scale:

0 25' 50'

Figure No.	12
Figure Name:	TRACK 2 EXCAVATION MAP
Report:	RAWP
Date:	4/3/2026
Drawn By:	KB
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK



vEKtor consultants
t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

Legend:

Site Location

Truck Route (towards NJ)

Notes:

1. All feature locations are approximate
2. Base Maps provided by NYCDOT and Google Maps

Scale:

NOT TO SCALE

Figure No.	13
Figure Name:	TRUCK ROUTE
Report:	RAWP
Date:	6/15/2025
Drawn By:	KB
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK

LEGEND

	6" CLEAN GRAVEL FILL
	BCP SITE BOUNDARY

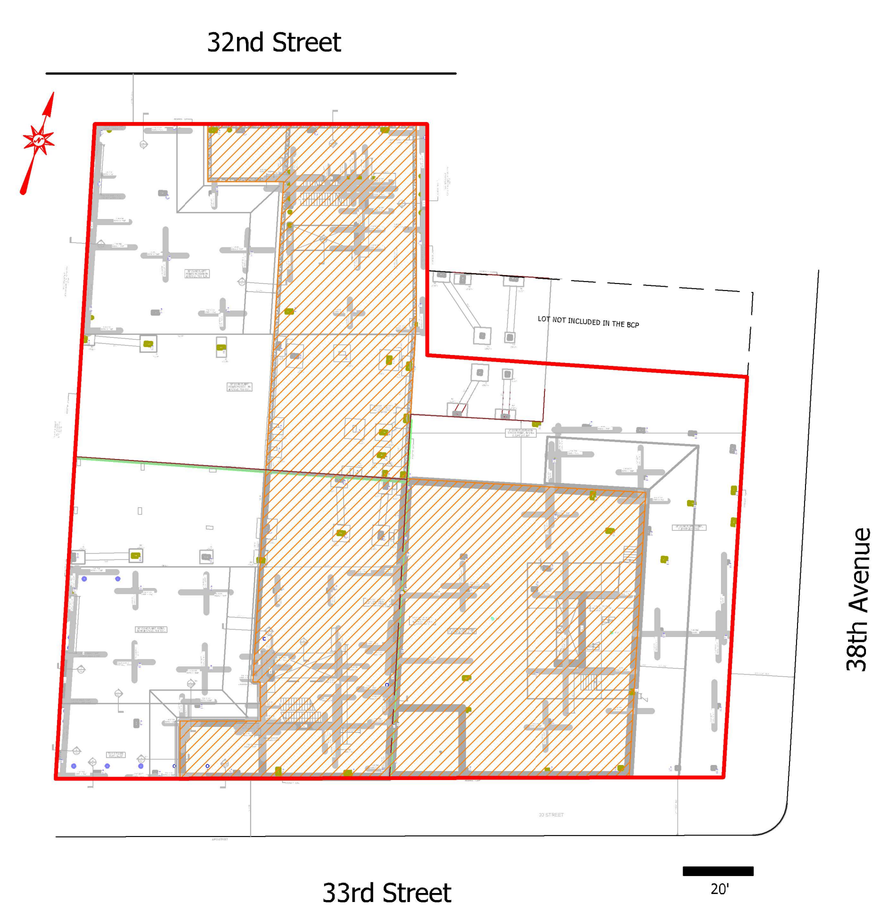
AMC ENGINEERING PLLC
18-36 42nd Street
Astoria, NY 11105
(718) 545-0474

PROJECT
38-18 33RD STREET
LONG ISLAND CITY, NY 11101

TITLE: FIGURE 14
BACKFILL IMPORT LOCATIONS

SEAL & SIGNATURE:

DATE: APR 21, 2026
PROJECT No:
DRAWING BY: AK
CHK BY: AC
DWG No:
CADD FILE No:



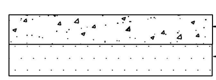
CELLAR PLAN

FIRST FLOOR PLAN

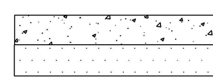
LEGEND

- COMPOSITE COVER FOR CELLAR (SEE DETAIL A)
- COMPOSITE COVER FOR FIRST FLOOR (SEE DETAIL B)
- CELLAR FOOTPRINT
- BCP SITE BOUNDARY

DETAIL A: TYPICAL CELLAR (NTS)



DETAIL B: TYPICAL SLAB ON-GRADE (NTS)



AMC ENGINEERING PLLC
18-36 42nd Street
Astoria, NY 11105
(718) 545-0474

PROJECT

38-18 33RD STREET
LONG ISLAND CITY, NY 11101

TITLE: FIGURE 15

PROPOSED COMPOSITE COVER FOR TRACK 4 CONTINGENCY

SEAL & SIGNATURE:

DATE: APR 21, 2026
PROJECT No:
DRAWING BY: AK
CHK BY: AC
DWG No:
CADD FILE No:

CELLAR PLAN

FIRST FLOOR PLAN

LEGEND

- Proposed Sleeve
- Monitoring Point
- SSDS Riser Location
- BCP Site Boundary
- 4" Perforated PVC SSDS Pipe (Wrapped with Filter Fabric)
- Cellar Footprint
- 4" Solid PVC Pipe

NOTES:

1. If there is sufficient headspace between the groundwater table and the bottom of the cellar slab, then SSDS piping will be installed as proposed below the cellar slab.
2. The proposed active SSDS for the cellar consists of three (3) loops, one in each building cellar, and six (6) monitoring points.
3. The proposed active SSDS piping for the first floor consists of four (4) loops and eight (8) monitoring points.
4. Cast-iron sleeves may need to be used through grade beams or footings depending on foundation layout.
5. Riser locations to be finalized after MEP and RA coordination.

AMC ENGINEERING PLLC
18-36 42nd Street
Astoria, NY 11105
(718) 545-0474

PROJECT
38-18 33RD STREET
LONG ISLAND CITY, NY 11101

TITLE: FIGURE 16
PROPOSED ACTIVE SSDS LAYOUT

SEAL & SIGNATURE:

DATE: APR 21, 2026
PROJECT No:
DRAWING BY: AK
CHK BY:
DWG No:
CADD FILE No:

TABLES

Table 1
Remedial Cost Estimate for Alternative 1
Track 1 UUSCO
FORMER REFRON INC. GAS RECLAMATION SITE
32-10 38TH AVENUE, 38-18 33RD STREET AND 32-20 38TH AVENUE
QUEENS, NEW YORK

Task No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Site Preparation/Remedial/Contractor Fees					
1	Mobilization/Demobilization, Security, Site Maintenance		LS		$2,000,000
2	Demolition and Abatement		LS		$1,000,000
3	Fence, Shed		LS		$200,000
4	Decontamination Area		LS		$10,000
5	Permitting		LS		$150,000
6	In-situ Waste Characterization		LS		$30,000
7	Remedial Off-site Soil Disposal (Top 2 Feet - Historic Fill + Hot Spots)	3,615	Ton	$56	$202,440
8	Remedial Off-site Soil Disposal (Remaining Excavation)	3,355	Ton	$36	$120,780
9	Well Abandonment		LS		$10,000
10	Support of Excavation (SOE)		LS		$1,000,000
11	Dewatering		LS		$580,000
12	Dust, Odor, Vapor Control	8	Month	$10,000	$80,000
13	Endpoint Sampling (Endpoint Samples and QA/QC Samples)	88	Sample	$1,500	$132,000
14	Excavation Oversight and CAMP	8	Month	$30,000	$240,000
15	Import of 3/4" Stone	300	CY	$75	$22,500
16	Sub-Slab Depressurization System (SSDS)		LS		$75,000
17	Surveying		LS		$25,000
18	SSDS Operations & Maintenance	5	Year	$7,500	$37,500
Engineering and Consulting Fees					
19	Project Management, Reporting (Daily Reports, Monthly Reports)	8	Month	$10,000	$80,000
20	Special Inspections for SOE	1	Month	$25,000	$25,000
21	SSDS Startup Inspection		LS		$5,000
22	**Final Engineering Report, SMP, EE (Conditional Track 1), Annual Inspections, PRR**		LS		$60,000
				Subtotal	$6,085,220
				20% Contingency	$1,217,044
				Estimated Total	**$7,302,264**

Table 2
Remedial Cost Estimate for Alternative 2
Track 2/4 RRSCO
FORMER REFRON INC. GAS RECLAMATION SITE
32-10 38TH AVENUE, 38-18 33RD STREET AND 32-20 38TH AVENUE
QUEENS, NEW YORK

Task No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Cost
Site Preparation/Remedial/Contractor Fees					
1	Mobilization/Demobilization, Security, Site Maintenance		LS		$2,000,000
2	Demolition and Abatement		LS		$1,000,000
3	Fence, Shed		LS		$200,000
4	Decontamination Area		LS		$10,000
5	Permitting		LS		$150,000
6	In-situ Waste Characterization		LS		$30,000
7	Remedial Off-site Soil Disposal (Top 2 Feet - Historic Fill, 0-2 Feet BGS)	3,560	Ton	$56	$199,360
8	Remedial Off-site Soil Disposal (Remaining Excavation)	435	Ton	$36	$15,660
9	Well Abandonment		LS		$10,000
10	Support of Excavation (SOE)		LS		$1,000,000
11	Dust, Odor, Vapor Control	6	Month	$10,000	$60,000
12	Endpoint Sampling (Endpoint Samples and QA/QC Samples)	88	Sample	$1,500	$132,000
13	Excavation Oversight and CAMP	6	Month	$30,000	$180,000
14	Import of 3/4" Stone	300	CY	$75	$22,500
15	Sub-Slab Depressurization System (SSDS)		LS		$75,000
16	Surveying		LS		$25,000
17	SSDS Operations & Maintenance	5	Year	$7,500	$37,500
Engineering and Consulting Fees					
18	Project Management, Reporting (Daily Reports, Monthly Reports)	6	Month	$10,000	$60,000
19	Special Inspections for SOE	1	Month	$25,000	$25,000
20	SSDS Startup Inspection		LS		$5,000
21	**Final Engineering Report, Environmental Easement, Site Management Plan, PRR**		LS		$60,000
				Subtotal	$5,297,020
				20% Contingency	$1,059,404
				Estimated Total	**$6,356,424**

Table 3
Soil Cleanup Objectives
Former Refron Inc. Gas Reclamation Site (C241285)

COMPOUNDS	UUSCOs	RRSCOs	PGWSCOs
VOCs	ppm	ppm	ppm
1,1,1,2-Tetrachloroethane	~	~	~
1,1,1-Trichloroethane	0.68	100	N/A
1,1,2,2-Tetrachloroethane	~	~	~
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	~	~	~
1,1,2-Trichloroethane	~	~	~
1,1-Dichloroethane	0.27	47	N/A
1,1-Dichloroethylene	0.24	0.98	N/A
1,2,3-Trichlorobenzene	~	~	~
1,2,3-Trichloropropane	~	~	~
1,2,4-Trichlorobenzene	~	~	~
1,2,4-Trimethylbenzene	5.9	100	N/A
1,2-Dibromo-3-chloropropane	~	~	~
1,2-Dibromoethane	~	~	~
1,2-Dichlorobenzene	1.1	100	N/A
1,2-Dichloroethane	0.02	5.8	N/A
1,2-Dichloropropane	~	~	~
1,3,5-Trimethylbenzene	3.1	100	N/A
1,3-Dichlorobenzene	2.6	38	N/A
1,4-Dichlorobenzene	1.8	24	N/A
1,4-Dioxane	0.1	5.7	N/A
2-Butanone	0.10	100	N/A
2-Hexanone	~	~	~
4-Methyl-2-pentanone	~	~	~
Acetone	0.03	100	N/A
Acrolein	~	~	~
Acrylonitrile	~	~	~
Benzene	0.06	3.7	N/A
Bromochloromethane	~	~	~
Bromodichloromethane	~	~	~
Bromoform	~	~	~
Bromomethane	~	~	~
Carbon disulfide	~	~	~
Carbon tetrachloride	0.76	7.1	N/A
Chlorobenzene	4.5	100	N/A
Chloroethane	~	~	~
Chloroform	0.37	24	0.37
Chloromethane	~	~	~
cis-1,2-Dichloroethylene	0.19	41	N/A
cis-1,3-Dichloropropylene	~	~	~
Cyclohexane	~	~	~
Dibromochloromethane	~	~	~
Dibromomethane	~	~	~
Dichlorodifluoromethane	~	~	~
Ethyl Benzene	1	76	N/A
Hexachlorobutadiene	~	~	~
Isopropylbenzene	~	~	~
Methyl acetate	~	~	~
Methyl tert-butyl ether (MTBE)	0.10	100	N/A
Methylcyclohexane	~	~	~
Methylene chloride	0.05	81	N/A
n-Butylbenzene	18	100	N/A
n-Propylbenzene	5	100	N/A
o-Xylene	~	~	~
p- & m- Xylenes	~	~	~
p-Isopropyltoluene	~	~	~
sec-Butylbenzene	25	100	N/A
Styrene	~	~	~
tert-Butyl alcohol (TBA)	~	~	~
tert-Butylbenzene	11	100	N/A
Tetrachloroethylene	1.3	18	1.3
Toluene	0.7	100	0.7
trans-1,2-Dichloroethylene	0.19	100	0.19
trans-1,3-Dichloropropylene	~	~	~
Trichloroethylene	0.47	6.4	0.47
Trichlorofluoromethane	~	~	~
Vinyl Chloride	0.03	0.48	N/A
Xylenes, Total	0.26	100	N/A

COMPOUNDS	UUSCOs	RRSCOs	PGWSCOs
SVOCs	ppm	ppm	ppm
1,2,4,5-Tetrachlorobenzene	~	~	N/A
1,4-Dioxane	0.1	5.7	0.1
1,1-Biphenyl	~	~	~
1,2,4,5-Tetrachlorobenzene	~	~	~
1,2,4-Trichlorobenzene	~	~	~
1,2-Dichlorobenzene	1.1	100	N/A
1,2-Diphenylhydrazine (as Azobenzene	~	~	~
1,3-Dichlorobenzene	2.6	38	N/A
1,4-Dichlorobenzene	1.8	24	N/A
2,3,4,6-Tetrachlorophenol	~	~	~
2,4,5-Trichlorophenol	~	~	~
2,4,6-Trichlorophenol	~	~	~
2,4-Dichlorophenol	~	~	~
2,4-Dimethylphenol	~	~	~
2,4-Dinitrophenol	~	~	~
2,4-Dinitrotoluene	~	~	~
2,6-Dinitrotoluene	~	~	~
2-Chloronaphthalene	~	~	~
2-Chlorophenol	~	~	~
2-Methylnaphthalene	~	~	~
2-Methylphenol	0.33	100	N/A
2-Nitroaniline	~	~	~
2-Nitrophenol	~	~	~
3- & 4-Methylphenols	0.33	100	N/A
3,3-Dichlorobenzidine	~	~	~
3-Nitroaniline	~	~	~
4,6-Dinitro-2-methylphenol	~	~	~
4-Bromophenyl phenyl ether	~	~	~
4-Chloro-3-methylphenol	~	~	~
4-Chloroaniline	~	~	~
4-Chlorophenyl phenyl ether	~	~	~
4-Nitroaniline	~	~	~
4-Nitrophenol	~	~	~
Acenaphthene	20	100	N/A
Acenaphthylene	100	100	N/A
Acetophenone	~	~	~
Aniline	0.04	8.1	N/A
Anthracene	100	100	N/A
Atrazine	~	~	~
Benzaldehyde	~	~	~
Benzidine	~	~	~
Benzo(a)anthracene	1	1.4	N/A
Benzo(a)pyrene	1	1	N/A
Benzo(b)fluoranthene	1	1.4	N/A
Benzo(g,h,i)perylene	0.64	4.9	N/A
Benzo(k)fluoranthene	0.8	4.9	N/A
Benzoic acid	~	~	~
Benzyl alcohol	~	~	~
Benzyl butyl phthalate	~	~	~
Bis(2-chloroethoxy)methane	~	~	~
Bis(2-chloroethyl)ether	~	~	~
Bis(2-chloroisopropyl)ether	~	~	~
Bis(2-ethylhexyl)phthalate	~	~	~
Caprolactam	~	~	~
Carbazole	~	~	~
Chrysene	1	4.9	N/A
Dibenzo(a,h)anthracene	0.33	0.33	N/A
Dibenzofuran	2.1	18	N/A
Diethyl phthalate	~	~	~
Dimethyl phthalate	~	~	~
Di-n-butyl phthalate	~	~	~
Di-n-octyl phthalate	~	~	~
Fluoranthene	85	100	N/A
Fluorene	30	100	N/A
Hexachlorobenzene	0.33	0.33	N/A
Hexachlorobutadiene	~	~	~
Hexachlorocyclopentadiene	~	~	~
Hexachloroethane	~	~	~
Indeno(1,2,3-cd)pyrene	0.5	1.4	N/A
Isophorone	~	~	~
Naphthalene	12	100	N/A
Nitrobenzene	0.08	1.8	N/A

COMPOUNDS	UUSCOs	RRSCOs
Herbicides	ppm	ppm
2,4,5-T	~	~
2,4,5-TP (Silvex)	3.8	100
2,4-D	~	~
Pesticides	ppm	ppm
4,4'-DDD	0.0033	13
4,4'-DDE	0.0033	8.9
4,4'-DDT	0.0033	7.9
Aldrin	0.005	0.097
Alpha-BHC	0.02	0.48
Beta-BHC	0.036	0.36
Chlordane	~	~
cis-Chlordane	0.094	4.2
Delta-BHC	0.04	100
Dieldrin	0.005	0.2
Endosulfan I	2.4	24
Endosulfan II	2.4	24
Endosulfan sulfate	2.4	24
Endrin	0.014	11
Endrin aldehyde	~	~
Endrin ketone	~	~
Heptachlor	0.042	2.1
Heptachlor epoxide	~	~
Lindane	0.1	1.3
Methoxychlor	~	~
Toxaphene	~	~
trans-Chlordane	~	~
TAL Metals	ppm	ppm
Aluminum	~	~
Antimony	~	~
Arsenic	13	16
Barium	350	400
Beryllium	7.2	72
Cadmium	2.5	4.3
Calcium	~	~
Chromium	~	~
Cobalt	~	~
Copper	50	270
Iron	~	~
Lead	63	400
Magnesium	~	~
Manganese	1600	2000
Mercury	0.18	0.81
Nickel	30	310
Potassium	~	~
Selenium	3.9	180
Silver	2	180
Sodium	~	~
Thallium	~	~
Vanadium	~	~
Zinc	109	10000
PFAS	ppm	ppm
PFOS	0.00088	0.044
PFOA	0.00066	0.033

APPENDICES

APPENDIX A

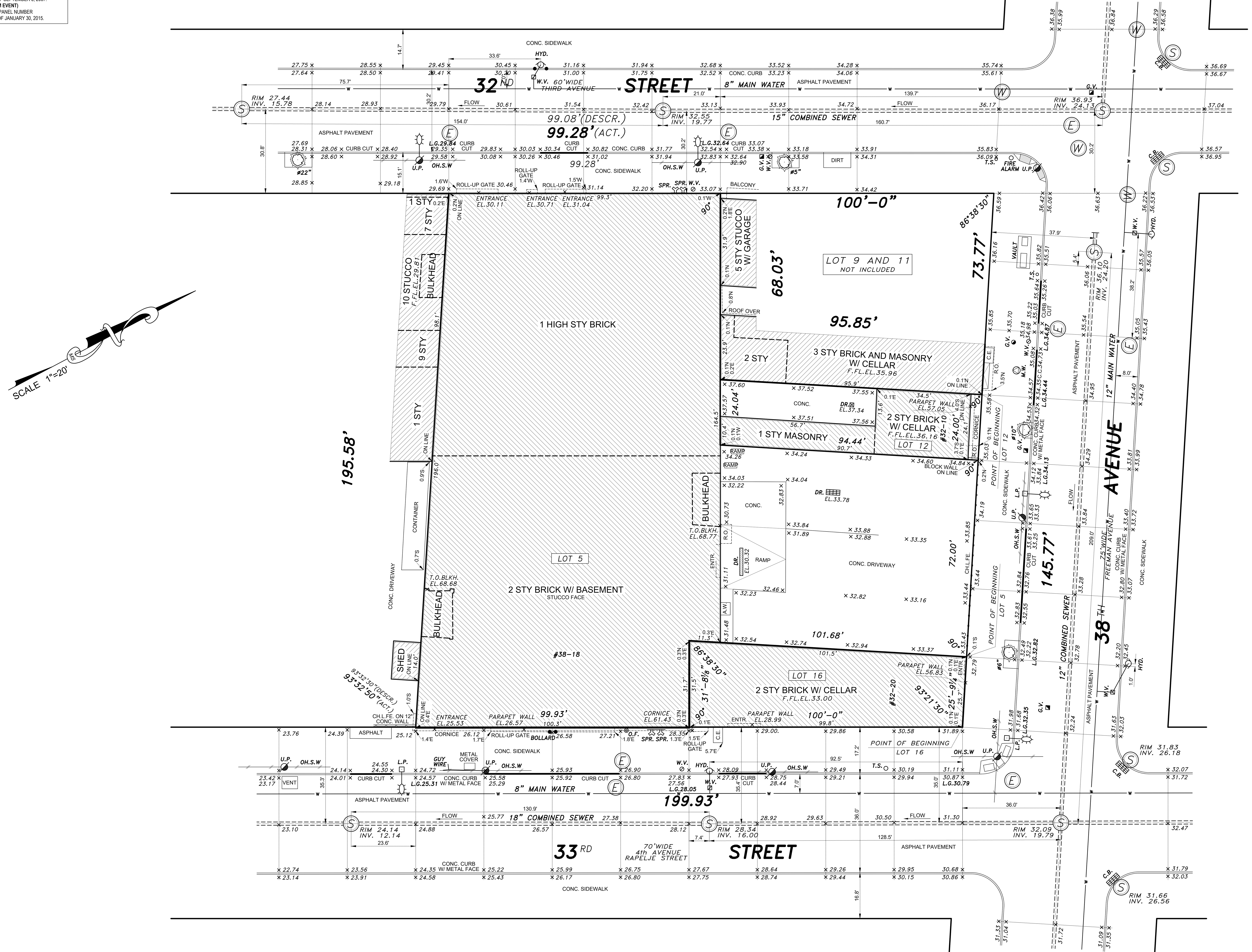
SURVEY & METES AND BOUNDS

JOB NO. Q 381-5-16-TO

SURVEYED ON: MAY 8, 2025

FLOOD NOTE

BY GRAPHIC PLOTTING ONLY, SUBJECT PROPERTY IS LOCATED IN
ZONE X (0.2% ANNUAL CHANCE STORM EVENT)
AS SHOWN ON THE FLOOD INSURANCE RATE MAP FOR COMMUNITY PANEL NUMBER
360 497 0093 F WHICH BEARS AN EFFECTIVE DATE OF SEPTEMBER 5, 2007.
ZONE X (0.2% ANNUAL CHANCE STORM EVENT)
AS SHOWN ON THE PRELIMINARY FEMA MAP PANEL NUMBER
360 497 0093 G WHICH BEARS AN REVISED DATE OF JANUARY 30, 2015.



SYMBOLS AND ABBREVIATIONS

- FENCE — CH.L.FE. / WOOD FE.
- UTILITY POLE — U.P.
- PARKING METER — P.M.
- OIL FILL — O.F.
- MONITORING WELL — M.W.
- TRAFFIC LIGHT — T.L.
- LIGHT
- STREET LIGHT — L.P.
- FIRE HYDRANT — HYD.
- SIAMESE CONNECTION — SPR.
- SHUT OFF VALVE — G.V. / W.V.
- HANDICAPPED PARKING
- EXISTING TREE — #12"
- DRAINS — DR.
- ROOF OVER — R.O.
- EXISTING ELEVATIONS — × 43.15 TOP OF CURB / × 42.93 BOTTOM OF CURB
- CITY ESTABLISHED GRADES — L.G.7.52
- CURB AND CURB CUT — C.C.
- OVERHEAD SERVICE — OH.S.W.
- CABLE TV MANHOLE — CTV
- MANHOLES — MH / E / T / W / S — RIM EL. / INV.EL.
- CATCH BASIN — C.B.
- FIRE ESCAPE — F.E.
- PLATFORM — PL. or PLTF.
- BASEMENT ENTRANCE — B.E.
- CELLAR ENTRANCE — C.E.
- AIR WAY — A.W.
- BAY WINDOW — B.W.
- CONCRETE — CONC.
- OVERHANG — O.H.
- AIR CONDITION — AC
- METAL — MET.
- NORTH OF PROPERTY LINE — N
- SOUTH OF PROPERTY LINE — S
- EAST OF PROPERTY LINE — E
- WEST OF PROPERTY LINE — W

GENERAL NOTES

SUBSURFACE UTILITIES ARE NOT GUARANTEED BY SURVEYOR. HIGH CAUTION RECOMMENDED AND VERIFICATION WITH PROPER CITY AGENCIES, IS MANDATORY BEFORE COMMENCING ALL NEW WORK.

ALL SUBSURFACE AND OVERHEAD UTILITIES (AS TO SIZE , TYPE AND DEPTH) SHOWN ON THIS SURVEY ARE TAKEN FROM RECORDS OF GOVERNMENTAL AGENCIES AND UTILITY COMPANIES, UNLESS OTHERWISE NOTED AND SHOWN.

COVER OR DEPTH OF UTILITIES WHICH DERIVED FROM FIELD MEASUREMENTS SHOWN ON THIS SURVEY SHOULD BE VERIFIED WITH PROPER AGENCY PRIOR TO CONSTRUCTION OF PROJECT. INVERT ELEVATIONS ARE DERIVED FROM CITY AGENCY RECORDS WHEN NOT AVAILABLE BY FIELD SURVEY AND NOTED AS "PER RECORD" ON THE SURVEY.

ALL SUBSURFACE UTILITY AS TO LOCATION AND DEPTH, SHOULD BE RECHECKED AND LEGAL GRADES SHOULD BE VERIFIED WITH THE TOPOGRAPHICAL BUREAU, PREFERABLY IN WRITING BEFORE COMMENCING CONSTRUCTION.

THIS IS TO CERTIFY THAT THERE ARE NO STREAMS OR NATURAL WATER COURSES ON THE SURVEYED PROPERTY EXCEPT AS SHOWN AND/OR DESCRIBED ON THIS SURVEY.

ALL OPERATIONS OF UNDERGROUND FACILITIES AND ALL EXCAVATORS ARE OBLIGATED TO COMPLY WITH ARTICLE 36 OF THE GENERAL BUSINESS LAW AND WITH PROVISIONS OF INDUSTRIAL CODE PART (RULE NO.35) BEFORE ANY EXCAVATION OR DEMOLITION IS COMMENCED. EVERY EXCAVATOR IS REQUIRED BY THESE LAWS TO GIVE ADVANCE NOTICE TO EVERY OPERATOR OF UNDERGROUND FACILITIES OF HIS INTENT TO PERFORM EXCAVATION OR DEMOLITION WORK IN THE SPECIFIED AREA

ALL ELEVATIONS SHOWN REFER TO THE NAVD 1988 DATUM. TO OBTAIN:
- NGVD 1929 DATUM - ADD 1.098 FEET
- QUEENS BOROUGH DATUM - SUBTRACT 1.625 FEET

EASEMENTS IF ANY ARE NOT SHOWN ON THIS SURVEY. NO INFORMATION PROVIDED TO SURVEYOR AT THIS TIME.

UNDERGROUND UTILITIES NOTES

UNDERGROUND, OVERHEAD AND GROUND LEVEL UTILITIES ARE NOT GUARANTEED AS TO ACCURACY, EXACT LOCATION, TYPE OR USE, ACTIVE OR INACTIVE. VERIFICATION IS MANDATORY WITH MUNICIPAL AGENCIES, PUBLIC AND PRIVATE UTILITY COMPANIES PRIOR TO TAKING TITLE AND OR DESIGN WORK. BOUNDARIES ARE NOT GUARANTEED UNLESS SO NOTED.

ALL OPERATIONS OF UNDERGROUND FACILITIES AND ALL EXCAVATORS ARE OBLIGATED TO COMPLY WITH ARTICLE 36 OF THE GENERAL BUSINESS LAW AND WITH PROVISIONS OF INDUSTRIAL CODE PART (RULE NO. 35) BEFORE ANY EXCAVATION OR DEMOLITION IS COMMENCED. EVERY EXCAVATOR IS REQUIRED BY THESE LAWS TO GIVE ADVANCE NOTICE TO EVERY OPERATOR OF UNDERGROUND FACILITIES OF HIS INTENT TO PERFORM EXCAVATION OR DEMOLITION WORK IN THE SPECIFIED AREA

GUARANTEED TO:			
COUNTY: QUEENS		CITY: LONG ISLAND CITY	
SECTION:	BLOCK: 381	LOT(S): 5, 12, 16	
PROPERTY ADDRESS:	38-18 33rd STREET 32-10, 32-20 38th AVENUE		

ARCHITECTURAL SURVEY

PREPARED BY

PERFECT POINT
LAND SURVEYING
brooklyn - queens - manhattan - bronx
staten island - nassau
phone: (718) 474-7700
fax: (718) 872-9699
info@ppsurveying.com
www.ppsurveying.com

DATE: MAY 8, 2025

GRAPHIC SCALE

ALL WRITTEN MEASUREMENTS AND OFFSETS NOTED ON THIS SURVEY SUPERSEDE MEASUREMENTS SCALED OF THIS PLOT.

SCALE 1:20

0 5 10 15 20 25 30 35 40 45 50 100

LOT 5 AREA = 26853.29 sq.ft. = 0.6165 acre
LOT 12 AREA = 2283.50 sq.ft. = 0.0524 acre
LOT 16 AREA = 2894.18 sq.ft. = 0.0664 acre
TOTAL AREA = 32030.97 sq.ft. = 0.7353 acre

BUILDINGS

BROWNFIELD CLEANUP PROGRAM SITE BOUNDARY

N.Y.S. L.L.S. 050569

APPENDIX B

HEALTH AND SAFETY PLAN

vEKtor consultants

t: +1.347.871.0750
f: +1.347.402.7735

info@vektorconsultants.com
www.vektorconsultants.com

HEALTH AND SAFETY PLAN

Prepared For: 38-18 33rd Street LLC and 32-20 38th Avenue LLC c/o Cavu Property Group

Project Name: Former Refron Inc. Gas Reclamation Site

Project Location: 32-10 38th Avenue, 38-18 33rd Street, and 32-20 38th Avenue, Queens, New York

Date: April 2026

555 8th Avenue, Suite 2302, New York, NY 10018

Table of Contents

Emergency Contacts			
Position	**Name**	**Organization**	**Phone**
Remedial Engineer	Ariel Czemerinski	AMC Engineering	(718) 545-0474
Project Director	Ezgi Karayel	Vektor Consultants	(347) 871-0750
Project Manager	David Klein	Vektor Consultants	(347) 871-0750
Field Leader/Representative	Izzy Hettleman	Vektor Consultants	(347) 871-0750
Site Health and Safety Supervisor	Izzy Hettleman	Vektor Consultants	(347) 871-0750
Client Contact	Alex Bancu	38-18 33rd Street LLC & 32-20 38th Avenue LLC	(212) 837-4509
Project Manager	Haala Al-Hadithy	NYSDEC	(718) 482-4995
Project Manager	Josephine McCarthy	NYSDOH	(518) 402-7860
Emergency Response	-	FDNY	911
Spill Hotline	-	NYSDEC	(800) 457-7362

Emergency Medical Facility	
Primary	***Alternate***
NYC Health + Hospitals – Elmhurst 79-01 Broadway, Queens, NY 11373 Tel: (718) 334-4000 Open 24 Hours	CityMD Long Island City Urgent Care – Queens 25-18 Queens Plaza S, Long Island City, NY 11101 Tel: (646) 647-1261 Open 7 Days a Week 8AM–8PM
Route to emergency medical facility map attached to back of this health & safety plan	

Sign-in Sheet

Name	Signature	Company	Date

1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared on behalf of 38-18 33rd Street LLC and 32-20 38th Avenue LLC for the implementation of a Remedial Action Work Plan (RAWP) by Vektor Consultants, LLC (Vektor), AMC Engineering, PLLC (AMC) and their subcontractors for the Former Refron Inc. Gas Reclamation Site located at 32-10 38th Avenue, 38-18 33rd Street, and 32-20 38th Avenue in the Long Island City section of Queens County, New York (the Site). The Site is identified by the City of New York as Borough of Brooklyn, Tax Block 381, Lots 5, 12 and 16.

This HASP describes lines of authority, responsibility, and communication as they pertain to health and safety functions at this site in compliance with *29 CFR 1910.120(b)(2) and 29 CFR 1926.65(b)(2)*. This plan also details key personnel who are responsible for the development and implementation of the HASP. Vektor and AMC field personnel will implement this HASP during Remedial Action.

1.1 Site Location and Description

The Site, addressed as 32-10 38th Avenue, 38-18 33rd Street and 32-20 38th Avenue, is located on the southwest corner of the 38th Avenue and 33rd Street intersection in Queens County, New York. The Site consists of three tax lots totaling approximately 32,031 square feet. The legal description of the Site is New York City Department of Finance Tax Block 381, Lots 5, 12 and 16. A site location map is provided in Figure 1.

The Site is currently vacant, and consists of two former two-story industrial and manufacturing buildings with partial cellars on each of the two lots with the ground surface capped by the former concrete building slabs and a concrete paved parking lot

1.2 Summary of Previous Investigations

The following reports were reviewed during the preparation of this HASP in order to determine potential hazards:

Phase I Environmental Site Assessment at 32-20 38th Avenue, Queens, New York, by H2M Architects + Engineers, January 2023

- H2M architects + engineers (H2M) prepared this report for Lot 16 on behalf of Venta Industries, LLC, in accordance with ASTM Standard E1527-13 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment (ESA) Process.
- The following Recognized Environmental Conditions (RECs) were identified during the Phase I:

    - Presence of possibly impacted soil vapor beneath the Site and the potential soil vapor intrusion due to the reported petroleum-related releases, dry cleaning, and auto repair operations in the vicinity of the property.
    - Listing of the property on the NYC E-Designation database. Future development activities at the subject property will require formal environmental investigations, including soil vapor and soil and groundwater sampling, and approvals obtained through the New York City Mayor's Office of Environmental Remediation.
- The following Business Environmental Risks (BERs) were identified during the Phase I ESA:
    - The building's historical uses as a chemical laboratory, a jewelry manufacturing company, and a storage and reclamation of refrigerant gases.
    - The building's floor drains are also reportedly capped due to stormwater runoff causing floods. H2M considered this a BER due to the unknown conditions of the bottom sediments within the floor drains.

Phase I Environmental Site Assessment at 38-18 33rd Street, Queens, New York by H2M Architects + Engineers, January 2023

- H2M prepared this report for Lot 5 on behalf of Vecta Industries, LLC, in accordance with ASTM Standard E1527-13 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process.
- The following RECs were identified during the Phase I:
    - Presence of possibly impacted soil vapor beneath the Site and the potential soil vapor intrusion due to the reported petroleum-related releases, dry cleaning, and auto repair operations in the vicinity of the property.
    - Listing of the property on the NYC E-Designation database. Future development activities at the subject property will require formal environmental investigations, including soil vapor and soil and groundwater sampling, and approvals obtained through the New York City Mayor's Office of Environmental Remediation.
- The following Historical Recognized Environmental Condition (HREC) was identified during the Phase I ESA:
    - Former spill on the property that occurred on March 20, 2019. According to the report, 25 gallons of diesel fuel were released due to a ruptured tank, and a large amount of absorbent was spread out to cover the fuel staining on the street. DEP's Division of Emergency Response and Technical Assessment (DERTA) verified that no underground structures were impacted by the fuel spill, and any remaining fuel was returned to the vehicle's gas tank. All materials regarding the fuel spill were removed from the location, and the New

York City Department of Sanitation (DOS) was contacted for additional clean-up.

- The following BERs were identified during the Phase I ESA:
  - The building's historical uses as storage and reclamation of refrigerant gases.
  - The subject building currently operates with a fuel oil aboveground storage tank in the basement to supply fuel for a backup generator. During the visual inspection of this system, no evidence of leaking or damage was noted. Therefore, the presence of an active fuel oil AST is considered a BER.
  - The building's floor drains are also reportedly capped due to stormwater runoff causing floods. H2M considers this a BER due to the unknown conditions of the bottom sediments within the floor drains.
- The following De Minimis Condition was identified during the Phase I ESA:
  - During the visual site inspection, pools of water were observed on the floor in both boiler rooms. Water was leaking overhead from the pipes in the boiler room located in the basement. No sheens or unusual odors indicative of a fuel oil release were observed.

Phase II Investigation Report at 38-18 33rd Street and 32-20 38th Avenue, Queens, New York by Vektor Consultants, September 2024

- Based on the review of available Phase I ESA Reports summarized above, Vektor recommended a limited Phase II Environmental Site Assessment (Phase II) to evaluate if the former industrial operations have adversely impacted the subsurface conditions beneath the Site prior to the acquisition of the Subject Property.
- A limited Phase II investigation consisting of performance of a geophysical survey, installation and sampling of eight soil borings, installation and sampling of two temporary groundwater monitoring wells, and the installation and sampling of five soil vapor points was conducted at the Site from July 18, 2024 to July 19, 2024. A supplemental investigation consisting of the installation and sampling of three monitoring wells and the installation and sampling of twelve soil vapor points was conducted at the Site from August 7, 2024 to August 8, 2024.
- The subsurface materials were generally described from surface grade to 17 feet below grade as light brown fine-grained sand with varying amounts of fine gravel, concrete, asphalt, glass, fine to medium-grained sand, weathered rock, and silt. From 17 to 25 feet below grade, brown fine sand with varying amounts of fine gravel, silt, and clay is described.
- The geophysical survey did not identify any anomalies or areas of concern indicative of underground storage tanks.
- Eight soil borings were installed, and eight soil samples were collected to be analyzed at the New York State Department of Health (NYSDOH) Environmental Laboratory

Approval Program (ELAP)-certified laboratory for the presence of Part 375 Target Compound List (TCL) volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) Method 8260, TCL semi-volatile organic compounds (SVOCs) by EPA Method 8270, and Target Analyte List (TAL) Metals by EPA Method 6000/7000.

  - No photoionization detector (PID) readings were detected in the soil samples, except for one soil boring, SB-2, at the 2-4 feet interval and 22-23 feet interval, which were detected at 19.1 and 0.5 parts per million (ppm), respectively.
  - Although VOCs, tetrachloroethylene and trichlorofluoromethane were detected above their method detection limits (MDLs), they were below) their respective UUSCOs. No VOCs were detected in the soil samples above their respective NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives (SCOs).
  - Although SVOCs, mainly consisting of PAHs, were detected in soil samples, no SVOCs were detected above their respective NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives (SCOs).
  - One heavy metal, arsenic, was detected in one soil sample at a concentration above its respective Part 375 Restricted Residential Use SCOs.

- Groundwater was encountered at a range of approximately 13.8 to 15.2 feet below grade.
- During the initial investigation in July 2024, two temporary monitoring wells were installed, and two groundwater samples were collected to be analyzed for the presence of TCL VOCs via USEPA Method 8260, TCL SVOCs via USEPA Method 8270, and Target Analyte Metals by EPA Methods 6000/7000. During the supplemental investigation in August 2024, three permanent groundwater monitoring wells were installed, and three groundwater samples were collected to be analyzed for TCL VOCs via USEPA Method 8260.
  - No SVOCs above their respective NYSDEC Class GA Ambient Water Quality Standards (AWQS) were identified in groundwater samples.
  - Chlorinated VOC impacts (PCE, TCE, and trans-1,2-dichloroethylene) were identified in the groundwater, specifically in the western portion of the Site.
- During the initial investigation in July 2024, five soil vapor points were installed to depths between 2.5 feet and 10 feet, and five soil vapor samples were collected. During the supplemental investigation in August 2024, twelve soil vapor points were installed to depths between 10 and 13 feet, and twelve soil vapor samples were collected.
  - Results showed low concentrations of petroleum-related VOCs and elevated concentrations of CVOCs in all soil vapor samples. Furthermore, Freon was detected at elevated concentrations in almost all soil vapor samples. Although Freon does not have a regulatory standard, it was utilized during the historical

operations at the Subject Property, and therefore, the results suggest a release from former uses of the properties.

Phase I Environmental Site Assessment at 38-18 33rd Street and 32-20 38th Avenue, Queens, New York by Vektor Consultants, September 2024

- Vektor prepared this report for 38-18 33rd Street LLC and 38-18 33rd Street LLC in accordance with ASTM Standard E1527-21 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process.
- The following RECs were identified during the Phase I:
    - Based on the available records, historical uses of the Lots 5 and 16 include a chain manufacturing business, a refrigerant supply business, and a chemical laboratory. These facilities typically utilize hazardous substances or petroleum products as part of their operations, and potential historic releases from these facilities could have affected the subsurface conditions. The EDR database also indicates that the Subject Property has a history of generating sodium cyanide, ignitable, corrosive material, and halogenated solvents as waste. Therefore, the historical uses of the Site were considered REC.
    - Based on the available records, the properties in the vicinity of the Subject Property were utilized as dry cleaners and auto repair operations. Therefore, the presence of possibly impacted soil vapor beneath the Site and the potential soil vapor intrusion) cannot be ruled out and is considered a REC.
    - A Phase II Environmental Site Assessment conducted at the Subject Property in July and August 2024 identified the presence of CVOCs in groundwater beneath the Site at concentrations exceeding regulatory standards as well as the presence of elevated concentrations of CVOCs and Freon, likely associated with historical operations, in soil vapor across the Subject Property. The presence of contaminants exceeding regulatory standards and guidance limits was considered a REC.
- This Phase I ESA revealed the following HRECs in connection with Lots 5 and 16 of the Site:
    - Landstar Inway on Lot 5 is listed on the Spills database under Spill #1812448 due to an equipment failure that occurred on March 20, 2019. According to the regulatory database report, the spill incident was reported to the NYSDEC on March 20, 2019, when a saddle tank was punctured, and approximately 20 gallons of diesel fuel spilled onto the asphalt. First Environmental was reported to clean up the spill on March 28, 2019. No drains or soils were impacted. The NYSDEC closed the case on March 28, 2019, as no further action was required. Based on the regulatory status and the de minimis amount of oil spilled, this listing was considered an HREC.

- The Phase I ESA revealed the following environmental issues in connection with the Site:

    - Tax Block 381, Lots 5 and 16, is listed on the E-designation database under E-number E-218 for hazardous materials regarding Phase I and Phase II testing protocol as a result of rezoning of the general surrounding area [Dutch Kills Rezoning and Related Actions (CEQR # 08DCP021Q)]. An E-Designation is a New York City zoning map designation that indicates the presence of an environmental requirement pertaining to potential hazardous materials contamination. Any future redevelopment and/or alteration work must also be coordinated with the NYCOER in order to obtain construction permits from the NYCDOB.
    Based on the age of the building, building materials may contain asbestos-containing materials (ACM) and lead-based paint (LBP). Readily visible suspect ACMs and painted surfaces were observed to be in good condition. Should these materials be replaced, a pre-demolition survey would need to be conducted prior to any renovation or demolition activities.

- Vektor recommended the following:

    - Based on the results of the Phase II Environmental Site Assessment, impacts to groundwater and soil vapor beneath the Site were identified. The results must be reported to the NYSDEC, and the Subject Property must be remediated in order to protect the public health and the environment.
    - Any future redevelopment and/or alteration work must be coordinated with the NYCOER in order to obtain construction permits from the NYCDOB due to the presence of E-Designation for hazardous materials on the Subject Property.
    - An Operations and Maintenance (O&M) Plan should be prepared and implemented in order to safely manage the suspect ACMs and LBP at the Subject Property. If redevelopment or renovation of the Subject Property is planned, suspect ACMs and LBP should be surveyed and abated in accordance with federal and NYC regulations.

Although January 2023 Phase I ESAs conducted at the Site stated all floor drains were capped, two floor drains were observed in the utility room of the building on Lot 5, and a floor drain was observed in the boiler room of Lot 16. The locations of the floor drains are provided in Figure 2 in the Phase I ESA. No other differences were identified from the Phase I ESA findings.

Phase II Investigation Report at 32-10 38th Avenue, Queens, New York by Vektor Consultants, November 2025

- A Phase II investigation consisting of performance of a geophysical survey, installation and sampling of two soil borings, and the installation and sampling of five soil vapor points was conducted at Lot 12 of the Site on November 13, 2025.
- The stratigraphy of Lot 12, from the surface down, consists of approximately 5 feet of urban fill underlain by 5 feet of poorly graded brown to light brown sand with varying degrees of silt.
- The geophysical survey did not identify any anomalies or areas of concern indicative of underground storage tanks.
- Two soil borings were installed, and four soil samples were collected. Soil samples were analyzed at a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory for the presence of Part 375 Target Compound List (TCL) volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) Method 8260, TCL semi-volatile organic compounds (SVOCs) by EPA Method 8270, Target Analyte List (TAL) Metals by EPA Method 6000/7000, and TCLP lead by EPA 6010.
    - No photoionization detector (PID) readings were detected in the soil samples.
    - No volatile organic compounds (VOCs) or semi-VOCs (SVOCs) were detected above their respective SCOs in any of the collected soil samples.
    - Five target analyte metals, barium, copper, lead, mercury, and zinc, were detected at concentrations exceeding their respective Unrestricted Use SCOs in the one shallow soil sample WC3210- Rear Yard (0-2'). Of these, two metals; barium (405 ppm) and lead (1,760 ppm) also exceeded their respective Restricted Residential Use SCOs.
    - TCLP lead was not detected above its EPA Hazardous Waste Limit in any of the soil samples.
- Groundwater was not encountered during the investigation. Depth to groundwater is approximately 15 feet bgs at the Site.
- One soil vapor point was installed to 3 feet, and one sub-slab soil vapor point was installed 2" below the existing lowest level slab, and one soil vapor sample, one sub-slab soil vapor sample, and one co-located indoor air sample were collected.
    - The total VOC concentration in the one soil vapor sample, WC3210-SV1, is 285.4 μg/m$^{3.}$
    - The total concentration of petroleum-related VOCs (BTEX) in the one soil vapor sample WC3210-SV1 is 17.2 μg/m^3.
    - One chlorinated VOC (CVOC), tetrachloroethene (12 μg/m^3), was detected in one soil vapor sample. The CVOCs 1,1,1-trichloroethane, 1,1-dichloroethane, carbon

tetrachloride, cis-1,2-dichloroethene, methylene chloride, trichloroethene and vinyl chloride were not detected in the soil vapor sample.

- Other VOCs detected include: 1,1,2-trichloro-1,2,2-trifluoroethane (freon 113) (1.6 µg/m^3), 1,2,4-trimethylbenzene (3.2 µg/m^3), 1,3,5-trimethylbenzene (1.5 µg/m^3), 2,2,4-trimethylpentane (1 µg/m^3), 2-butanone (28 µg/m3), 2-hexanone (12 µg/m^3), 4-methyl-2-pentanone (4.2 µg/m^3), acetone (88 µg/m^3), benzene (0.5 µg/m^3), carbon disulfide (0.71 µg/m^3), dichlorodifluoromethane (6.3 µg/m^3), ethyl acetate (49 µg/m^3), ethyl benzene (1.9 µg/m^3), isopropanol (4.3 µg/m^3), isopropylbenzene (0.98 µg/m^3), n-propylbenzene (1.8 µg/m^3), o-xylene (2.9 µg/m^3), p- & m- xylenes (7.2 µg/m^3), p-ethyltoluene (6 µg/m^3), p-isopropyltoluene (0.78 µg/m^3), sec-butylbenzene (0.78 µg/m^3), toluene (4.7 µg/m^3), trichlorofluoromethane (freon 11) (36 µg/m^3), and xylenes, total (10 µg/m^3).
- The total concentration of VOCs in the one sub-slab soil vapor sample WC3210-SS1 is 21,276 µg/m^3.
- The total concentration of petroleum-related VOCs (BTEX) in the one sub-slab soil vapor sample WC3210-SS1 is 39 µg/$m^{3.}$
- Two Chlorinated VOCs (CVOCs); 1,1,1-trichloroethane (21,000 µg/m^3), tetrachloroethene (59 µg/m^3) were detected in the one soil vapor sample. The CVOCs 1,1-dichloroethane, carbon tetrachloride, cis-1,2-dichloroethene, methylene chloride, trichloroethene and vinyl chloride were not detected in the sub-slab soil vapor sample.
- Other VOCs detected include: 2,2,4-trimethylpentane (8.2 µg/m^3), 2-hexanone (29 µg/m^3), benzene (16 µg/m^3), chloroform (120 µg/m^3), o-Xylene (11 µg/m^3), Toluene (12 µg/m^3), and Xylenes, Total (21 µg/m^3).
- Total concentrations of VOCs detected in the WC3210-IndoorAir1 indoor air sample are 162.59 µg/m^3.
- Total concentrations of petroleum-related VOCs (BTEX) detected in the indoor air sample are 14.8 µg/m^3.
- One CVOCs tetrachloroethene (3 µg/m^3) was detected in the IA-1 indoor air sample. The CVOCs 1,1,1-trichloroethane, 1,1-dichloroethane, carbon tetrachloride, cis-1,2-dichloroethene, methylene chloride, trichloroethene and vinyl chloride were not detected in the indoor air sample.
- Other VOC detections in the indoor air sample include: 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113) 0.76 µg/m^3), 1,2,4-trimethylbenzene (1.3 µg/m^3), 2,2,4-trimethylpentane (0.96 µg/m^3), acetone (76 µg/m^3), benzene (0.87 µg/m^3), chloroform (2.1 µg/m^3), dichlorodifluoromethane (2.8 µg/m^3), ethyl acetate (36 µg/m^3), ethyl benzene (0.9 µg/m^3), isopropanol (9.8 µg/m^3), n-hexane (4.9 µg/m^3), o-xylene (1.2 µg/m^3), p- & m- xylenes (3.3 µg/m^3), p-ethyltoluene (1.2 µg/m^3), p-isopropyltoluene (0.5 µg/m^3), tetrahydrofuran (2.5 µg/m^3), toluene (8.5 µg/m^3), trichlorofluoromethane (freon 11) (1.5 µg/m^3), and xylenes, total (4.5 µg/m^3).

Remedial Investigation Report by Vektor Consultants, LLC, dated June 2025, updated April 2026

Vektor prepared this report on behalf of 38-18 33rd Street LLC and 32-20 38th Avenue LLC in April 2026.

The following contaminants of concern were identified at the Site:

- PAHs and Metal Impacts in Soil
- CVOCs in Soil, Groundwater, and Soil Vapor
- Metals in Groundwater
- PFAS compounds in Groundwater

SVOCs (PAHs) and Metal Impacts in Soil

Contaminants associated with urban fill from unknown sources were identified across the Site. A historic urban fill layer extending down to approximately 5 feet below the majority of the Site. The fill material predominantly consists of primarily brown and dark brown fine to medium sand with varying amounts of gravel, concrete, asphalt, glass, and silt. Based on the investigation results, these fill layers have detections of SVOCs, specifically polycyclic aromatic hydrocarbons (PAHs), and metals. Eleven SVOCs, including polycyclic aromatic hydrocarbons (PAHs), benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, indeno(1,2,3-cd)pyrene, naphthalene, and phenanthrene were detected at concentrations exceeding their respective UUSCOs. The RRSCO for two of these SVOCs [benzo(a)pyrene and dibenzo(a,h)anthracene] are the same as the UUSCOs and therefore, also exceeded their respective RRSCOs. Benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and phenanthrene have differing UUSCOs and RRSCOs but were detected at concentrations above both UUSCOs and RRSCOs. Only dibenzofuran and naphthalene were detected at concentrations exceeding its respective UUSCO but below its RRSCO.

Four metals (copper, lead, zinc, and mercury) were detected at concentrations exceeding their respective UUSCOs in twelve soil samples and one soil duplicate sample. Of these, two metals, lead and mercury also exceeded their respective RRSCOs in two shallow soil samples. Mercury also exceeded its respective RRSCO in one intermediate soil sample.

The SVOC and metal exceedances in soil were identified in generally shallow depths, specifically the 0-to-2-foot interval and 3-to-5-foot interval and can be attributed to the presence of historic fill at the Site.

CVOCs in Soil, Groundwater and Soil Vapor

Four VOCs, including tetrachloroethylene (PCE), toluene, trichloroethylene (TCE), and trichlorofluoromethane, were detected above their respective AWQS in five groundwater samples. The petroleum-related VOC toluene was detected in two groundwater samples in the western and central portions of the Site, slightly above its AWQS of 5 ug/L (6.27 ug/L in MW-1I and 15 ug/L in MW-4). The three CVOCs, PCE, TCE, and trichlorofluoromethane (Freon 11) were detected at concentrations ranging from 10.1 µg/L to 82 µg/L above the AWQS of 5 ug/L for all three CVOCs. PCE exceedances were detected in four monitoring wells, MW-1, MW-1I, MW-4, and MW-7, located in the southwestern and south-central portion of the Site, with concentrations 10.1 µg/L to 42 µg/L. TCE exceedances were detected in three monitoring wells, MW-1, MW-4, and MW-7, with concentrations 11 µg/L to 79 µg/L. Both PCE and TCE exceedances were identified in monitoring wells located in the southwestern and south-central portions of the Site. Trichlorofluoromethane only exceeded AWQS in one monitoring well, MW-5, at a concentration of 82 µg/L in the southeastern portion of the Site.

Soil vapor results showed concentrations of CVOCs in all soil vapor samples. The highest concentrations of CVOCs detected were of PCE at 25SV-2 (5,900 µg/m^3) and TCE at 25SV-2 (4,200 µg/m^3), located in the central portion of the Site. PCE was detected in eight soil vapor samples and the two duplicate soil vapor samples, ranging from 1.6 µg/m^3 in 25SV-5 to 7,300 µg/m^3 in 25SV-DUP-1 (collected from the 25SV-2 location). PCE was not detected in the outdoor ambient 25OA-1 sample; however, PCE was detected at 0.88 µg/m^3 in the outdoor ambient 26OA-1 sample. TCE was detected in six soil vapor samples and the two duplicate soil vapor samples, ranging from 3.9 µg/m^3 in 26SV-3 to 4,200 µg/m^3 in 25SV-2. TCE was not detected in the outdoor ambient air samples. Trichlorofluoromethane (Freon 11) was detected in four soil vapor samples and the duplicate soil vapor sample, ranging from 2.1 µg/m^3 in 26SV-2 to 3,300 µg/m^3 in 25SV-2. Trichlorofluoromethane (Freon 11) was detected at 1.2 µg/m^3 in the outdoor ambient 26OA-1 sample.

The highest CVOC concentrations in both groundwater and soil vapor are in proximity to one another in the south and central portions of the Site. Since concentrations of CVOCs were also detected in the soil, the presence of CVOCs in groundwater and soil vapor is indicative of an on-site source.

<u>Metals in Groundwater</u>

A total of thirteen metals, including arsenic, barium, cadmium, chromium (total and hexavalent), copper, lead, magnesium, manganese, nickel, selenium, sodium, and zinc, were detected at concentrations exceeding their respective AWQS in both the total and dissolved metals analysis. Of these metals, arsenic, barium, cadmium, copper, magnesium, manganese, nickel, selenium, sodium, and zinc. Only two non-naturally occurring metals, chromium (total and hexavalent) and lead, were detected in total and dissolved groundwater samples in monitoring well MW-2 in the central portion of the Site and 26MW-1 in the northern portion of the Site. During the RI, MW-2 and 26MW-1 were observed to have low groundwater recharge, and the well could not be properly sampled using low flow techniques to have the groundwater quality parameters stabilize prior to collecting a sample due to low volume. This slight exceedance can be attributed to excessive entrained sediment due to the need to collect a groundwater sample from this monitoring well location without having the turbidity drop to stabilized levels and is not likely attributable to an on-site source.

PFAS Compounds in Groundwater

A total of two PFAS compounds, including Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA), were detected at concentrations exceeding their respective NYSDEC Part 375 PFAS Remedial Program guidance values. PFOS was detected at a concentration of 10.7 ng/L, slightly exceeding its NYSDEC Part 375 Remedial Program guidance value of 10 ng/L in one groundwater sample collected at monitoring well MW-4 located in the south-central portion of the Site. PFOA was detected in all groundwater samples except for the groundwater sample collected from monitoring well MW-6. The highest concentration of PFOA was detected at 170 ng/L in MW-3, located in the northeastern portion of the Site. However, no PFAS compounds were detected in soil. Based on this, the presence of PFAS Compounds in groundwater is likely attributed to an off-site source.

1.3 Scope of HASP

This HASP includes safety procedures to be used by Vektor and AMC personnel during the following activities:

- Implementation of remedial oversight and air monitoring activities; and
- Collection of post-remediation endpoint soil samples.

Contractors performing remedial construction work will ensure that the performance of the work is in compliance with this HASP and applicable laws and regulations. The HASP pertains to remedial and invasive work performed at the Site.

2.0 ORGANIZATIONAL STRUCTURE

Vektor will provide a copy of this HASP to each contractor and subcontractor in accordance with 29 CFR 1910.120(b)(1)(iv) and 29 CFR 1926.65(b)(1)(iv) to inform them of site hazards and emergency procedures. All contractors and subcontractors are solely responsible for the safe and healthful performance of all work by each of its employees and/or support personnel who may enter the Site. Each contractor and subcontractor shall provide its own HASP as required by 29 CFR 1910.120 and 29 CFR 1926.65. However, they need to submit a copy of their HASP to Vektor/AMC or they can adopt this HASP during the Remedial activities.

2.1 Site Supervisor

As required by *29 CFR 1910.120(b)(2)(i)(A) and 29 CFR 1926.65(b)(2)(i)(A)*, a Site Supervisor will be assigned to the project prior to the implementation of the Remedial Action Work Plan. The Site Supervisor is responsible for directing all hazardous waste operations. All other site personnel report directly to the Site Supervisor unless otherwise noted. The Site Supervisor is directly responsible for:

- Ensuring the pre-entry briefing and/or tailgate-safety meetings are held prior to initiating any site activity, and at such other times as necessary to ensure that employees are apprised of site hazards
- Ensuring that all work activities conducted are consistent with this HASP and making any modifications as necessary
- Verifying all Job Hazard Analyses and ensuring that ongoing Hazard Analysis is conducted at this Site
- Overseeing the training program and ensuring that employees are trained for all tasks or operations they are asked to perform
- Providing a copy of this HASP to each contractor and subcontractor
- Updating the Site Control Program as needed
- Granting site workers site and zone access approval
- Registering all site visitors
- Establishing and maintaining security measures for this Site
- Directing how each work zone is adjusted
- Notified if emergency assistance is needed
- Supervising PPE use on this Site
- Approving any changes in PPE used on this Site
- Notified when any hazardous substance spill occurs
- Evaluating the quality and safety of response activities after every emergency incident or evacuation of this Site

- Providing site workers with notifications and training on changes to the emergency response plan
- Evaluating confined spaces and responsible for the confined space permit program
- Performing initial monitoring to identify and evaluate any hazardous atmospheres during confined space operations
- Implementing the thermal stress program
- Authorizing the hot-work plan and cutting and welding operations
- Inspecting the hot-work permit area before work is authorized
- Monitoring site activities as they pertain to health and safety at this site
- Stopping any unsafe acts that pose an immediate or imminent health and safety hazard to anyone at this site
- Ensuring that all elements of this HASP are followed and correctly implemented
- Updating the Site Health and Safety Supervisor and other applicable personnel as to changes or work progress reports that may pertain to health and safety functions at this site
- Setting up decontamination lines and the solutions appropriate for the type of chemical contamination on the Site
- Controlling the decontamination of all equipment, personnel, and samples from the contaminated areas
- Ensuring that all required decontamination equipment is available and in working order
- Providing for collection, storage, and disposal of decontamination waste (e.g., rinse water, contaminated sediment, etc.)

2.2 Site Health and Safety Supervisor

As required by *29 CFR 1910.120(b)(2)(i)(B) and 29 CFR 1926.65(b)(2)(i)(B)*, Izzy Hettleman (or designated alternate) is the Site Health and Safety Supervisor who has the responsibility and authority for all functions that may pertain to health and safety at this site. This is the individual located on a hazardous waste site that is responsible to the Site Supervisor and has the authority and knowledge necessary to implement the HASP and verify compliance with applicable safety and health requirements. The Site Health and Safety Supervisor is directly responsible for:

- Providing a copy of this HASP to each contractor and subcontractor
- Updating the Site Control Program as needed
- Notified if emergency assistance is needed
- Supervising PPE use on this Site
- Approving any changes in PPE used on this Site
- Notified when any hazardous-substance spill occurs

- Providing site workers with notifications and training on changes to the emergency response plan
- Performing initial monitoring to identify and evaluate any hazardous atmospheres during confined space operations
- Developing and implementing the HASP
- Monitoring site activities as they pertain to health and safety at this Site
- Stopping any unsafe acts that pose an immediate or imminent health and safety hazard to anyone at this Site
- Ensuring that all elements of this HASP are followed and correctly implemented
- Verifying compliance of subcontractors with respect to this HASP and reporting deviations to the Site Supervisor
- Evaluating site incidents including spills, releases of hazardous substances
- Determining the appropriate response including site evacuations
- Implementing the Emergency Response Plan
- Coordinating emergency response activities on this Site

2.3 Contractors and Subcontractors

Each contractor and subcontractor shall designate a Contractor Site Representative. The Contractor Site Representative will interface directly with the Site Supervisor, and Vektor/AMC, the Site Health and Safety Supervisor, with regards to all areas that relate to this HASP and safe and healthful performance of work conducted by the contractor and/or subcontractor workforce. Contractor/Subcontractor Site Representatives for this site are listed in the Contact Summary Table at the end of this section.

2.4 Local/State/Federal Agency Representative

Local, state, and/or federal agencies are responsible for ensuring the Site is in compliance with appropriate regulatory requirements, permits, and/or legal ruling(s). Local/State/Federal Agency Representatives for this Site are listed in the Contact Summary Table at the end of this section.

The organizational structure shall be reviewed and updated as necessary to reflect the current status of site operations.

Contact Summary Table

Position	Name	Organization	Phone
Remedial Engineer	Ariel Czemerinski	AMC Engineering	(718) 545-0474
Project Director	Ezgi Karayel	Vektor Consultants	(347) 871-0750
Project Manager	David Klein	Vektor Consultants	(347) 871-0750
Field Leader/Representative	Izzy Hettleman	Vektor Consultants	(347) 871-0750
Site Health and Safety Supervisor	Izzy Hettleman	Vektor Consultants	(347) 871-0750
Client Contact	Alex Bancu	38-18 33rd Street LLC & 32-20 38th Avenue LLC	(212) 837-4509
Project Manager	Haala Al-Hadithy	NYSDEC	(718) 482-4995
Project Manager	Josephine McCarthy	NYSDOH	(518) 402-7860
Emergency Response		FDNY	911
Spill Hotline		NYSDEC	(800) 457-7362

3.0 HAZARD ANALYSIS

This section describes the safety and health hazards associated with site work and the control measures selected to protect workers in compliance with *29 CFR 1910.120(b)(4)(ii)(A) and 29 CFR 1926.65(b)(4)(ii)(A)*. This is accomplished by creating a specific Job Hazard Analysis for each task and operation to be conducted at the Site.

The purpose of the Job Hazard Analysis is to identify and, to the extent practicable, quantify the health and safety hazards associated with each site task and operation, and to evaluate the risks of each hazard to workers. With this information, appropriate control methods are selected to eliminate the identified risks if possible, or to effectively control them. The control methods are documented in each task-specific Job Hazard Analysis.

Job Hazard Analyses contained in this HASP have been developed by Vektor Consultants and AMC Engineering, the Site Health and Safety Supervisor. The Site Supervisor is the individual responsible for reviewing and "verifying" that all Job Hazard Analyses are complete and to ensure that ongoing hazard analyses are conducted at this site.

3.1 Hazard Notification Process

The information in the Job Hazard Analysis Worksheets, Hazardous Substance Profiles, and Safety Data Sheets (SDS) is made available to all employees who could be affected in the scope of their work at the Site. This shall be done prior to beginning work activities.

New, or modifications to existing, Job Hazard Analysis Worksheets, Hazardous Substance Profiles, or SDS are communicated during routine briefings.

Consistent with *29 CFR 1910.120(i) and 29 CFR 1926.65(i)*, this information will also be made available to contractors and subcontractors.

The Site Supervisor is responsible for providing Site information, this HASP, and any modifications to it to contractors and/or subcontractors working on this Site.

3.2 Phases, Site Tasks and Hazard Analysis

This HASP applies to the implementation of the Remedial Action Work Plan at the Site. This HASP will apply to the following Tasks and/or Operations that will be accomplished during the implementation of the Remedial Action Work Plan:

1. Excavation, stockpiling, and off-site disposal of contaminated soil/fill and native soil to exceeding Track 2 Restricted Residential Use SCOs. It is expected that a Track 2 cleanup will be achieved by developmental excavation with additional localized excavation within areas in the northern portion of the site. It is estimated that 2,500 cubic yards of materials will be removed from the Site in accordance with all Federal, State, and local rules and regulations for handling, transport, and disposal.

2. Installation of support of excavation (SOE) elements to enable excavation of contaminated soil to achieve a Track 2 cleanup.
3. Screening for indications of contamination (by visual means, odor, and monitoring with a PID) of all excavated soil during any intrusive Site work.
4. Collection of post-excavation endpoint samples to evaluate the performance of the remedy with respect to attainment of Track 2 Restricted Residential Use SCOs (RRSCOs).
5. Import of clean material (i.e.: soil meeting UUSCOs, RRSCOs, virgin stone, native crushed stone) to backfill over-excavated areas to development depth.
6. Installation of permeable gravel for mitigation systems.

3.3 Chemical Hazards

Exposure to chemical hazards should always be avoided. When working around chemical hazards it is important to be protected by administrative and/or engineered controls or, if administrative and/or engineered controls are not practicable or fully protective, by use of proper personal protective equipment (PPE). A direct reading instrument must be used, as necessary, to establish potential worker exposure.

Below is a list of chemical hazards that may be encountered on this site.

Chemical Name	OSHA PEL (ppm)	OSHA PEL (mg/m^3)	NIOSH REL (ppm)	NIOSH REL (mg/m^3)	IDLH (ppm)	IDLH (mg/m^3)
Polycyclic Aromatic Hydrocarbons (PAHs)		5		0.5		50
Lead		0.05		0.05		100
Trichloroethylene (TCE)	100		25		1000	
Tetrachlorethylene (PCE)	100		N/A		150	

OSHA PEL. OSHA sets permissible exposure limits (PELs) to protect workers against the health effects of exposure to hazardous substances. PELs are regulatory limits on the amount or concentration of a substance in the air. They may also contain a skin designation. PELs are enforceable. OSHA PELs are based on an 8-hour time-weighted average (TWA) exposure.

IDLH. Immediately dangerous to life or health (IDLH) is a regulatory value defined as the maximum exposure concentration in the workplace from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects. This value should be referred to in respirator selection.

More specific chemical information is available in the Hazardous Substance Profiles included in Attachment 1 of this HASP. The Hazardous Substance Profiles are designed to assist with "chemical guidelines" in which further information may be needed, including but not limited to an SDS. This information is not intended to replace an SDS but rather to augment one.

3.4 Physical Hazards

Below is a list of physical hazards that may be encountered during the implementation of the Remedial Action Work Plan at this Site. Personal awareness, strict adherence to all safety requirements, and the use of proper PPE when applicable will help keep this work site safe.

- Hand Tool Use
- Heavy Manual Lifting/Moving
- Material Handling
- Noise (Sound Pressure Level), dBA
- Sharp Objects
- Slips/Trips/Falls
- Traffic - On or Near Site
- Utilities (electrical, gas, water, etc.) – Overhead
- Utilities (electrical, gas, water, etc.) – Underground

3.5 Biological Hazards

Below is a list of biological hazards that may be encountered during the implementation of the Remedial Action Work Plan at this Site. Personal awareness, strict adherence to all safety requirements, and the use of proper PPE when applicable will help keep this work site safe.

3.6 Radiological Hazards

Job hazard analysis indicates that workers are not expected to encounter radiological hazards at this Site for the phases, tasks and/or operations and work locations covered by this HASP.

3.7 Job Hazard Analysis Worksheets

The site-specific Job Hazard Analysis Worksheet is included in Attachment 2. A single Job Hazard Analysis Worksheet may be used for multiple locations provided that the task or operation, and hazards and control measures, are the same in each location.

The Job Hazard Analysis Worksheet lists the following information:

- Phase description
- Specific task or operation
- Specific location for task or operation
- Hazard analysis date(s) of task or operation

- Task or operation date(s)
- Person responsible for developing Job Hazard Analysis
- Person responsible for reviewing the Job Hazard Analysis
- Chemical, physical, biological and radiological hazards for each task or operation
- Specific control measures for each task or operation
- Required permit(s), if any

The Job Hazard Analysis Worksheet should be kept updated as information changes and previous copies should be retained.

4.0 TRAINING PROGRAM

The Site Safety and Health Training Program is designed to provide workers with the training necessary to work safely on this Site in compliance with *29 CFR 1910.120(b)(4)(ii)(B) and 29 CFR 1926.65(b)(4)(ii)(B)*. Training requirements for this site are based on the Job Hazard Analysis, contained in Attachment 2 of this HASP, and relevant OSHA requirements. Employees who have not been trained to a level required by their job function and responsibility are not permitted to participate in or supervise field activities.

4.1 Initial HazWoper Training

Initial training requirements for field personnel are based on the personnel's potential for exposure and compliance with the requirements of *29 CFR 1910.120(e)(3) and 29 CFR 1926.65(e)(3)*.

General Site Workers (such as equipment operators, general laborers, and supervisory personnel) engaged in hazardous substance removal or other activities that expose, or potentially expose, them to hazardous substances and health hazards shall receive a minimum of 40 hours of instruction off site, and a minimum of three days of actual field experience under direct supervision of a trained, experienced supervisor as per *29 CFR 1910.120(e)(3)(i) and 29 CFR 1926.65(e)(3)(i)*.

Specific Limited Task Workers on site only occasionally for a specific limited task (such as, but not limited to, field sampling, land surveying, geophysical surveying, or drilling) and who are unlikely to be exposed over permissible exposure limits and published exposure limits shall receive a minimum of 24 hours of instruction off site, and a minimum of one day of actual field experience under direct supervision of a trained, experienced supervisor as per *29 CFR 1910.120(e)(3)(ii) and 29 CFR 1926.65(e)(3)(ii)*.

4.2 Site-Specific Training

In addition to the initial HAZWOPER training requirements outlined above, site personnel shall be trained on the following site-specific elements:

- Names of personnel and alternates responsible for site safety and health
- Health, safety, and other hazards present
- Use of specific personal protective equipment (PPE) detailed in this HASP
- Standard work practices by which the personnel can minimize risks from the hazards detailed in this HASP
- Safe use of administrative and/or engineering controls and equipment detailed in this HASP
- Medical surveillance requirements detailed in this HASP
- Decontamination procedures detailed in this HASP
- The emergency response plan detailed in this HASP

- Heat and cold stress prevention
- Working safely around heavy equipment

4.3 Site Briefings

A site-specific briefing shall be provided to visitors who enter this Site beyond the designated entry point. For visitors, the site-specific briefing shall include information about site hazards, the site layout including work zones and places of refuge, the emergency alarm system and emergency evacuation procedures, and other pertinent safety and health requirements, as appropriate.

5.0 MEDICAL SURVEILLANCE PROGRAM

The Medical Surveillance Program is designed to medically monitor worker health to ensure that personnel are not adversely affected by site hazards in compliance with *29 CFR 1910.120(b)(4)(ii)(D) and 29 CFR 1926.65(b)(4)(ii)(D)*.

Medical surveillance is not required at this site due to:

- There is NO potential for worker exposure to hazardous substances at levels above OSHA permissible exposure limits or other published limits for 30 days or more per year, without regard to use of respiratory protection.
- Personnel DO NOT wear a respirator for 30 days or more a year or as required by *29 CFR 1910.134 and 29 CFR 1926.103*.

Any worker who is injured, becomes ill, or develops signs or symptoms of possible over-exposure to hazardous substances or health hazards on this Site shall receive a medical examination as soon as possible after the occurrence, with follow-up examinations provided as required by the attending physician. Physical Exams shall be consistent with *29 CFR 1910.120(f) and 29 CFR 1926.65(f)*.

6.0 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) will be used at this Site to protect employees from biological, chemical and physical hazards in compliance with *29 CFR 1910.120(b)(4)(ii)(C) and 29 CFR 1926.65(b)(4)(ii)(C)*. This includes hazards associated with, but not limited to, the implementation of the Remedial Action Work Plan.

With employee safety being the number one priority, site health hazards will be eliminated or reduced to the greatest extent possible through administrative and/or engineering controls and safe work practices. Where hazards are still present, a combination of administrative and/or engineering controls, work practices, and PPE will be used to protect employees.

The Site Supervisor and/or Health and Safety Supervisor are responsible for PPE use on this Site.

6.1 PPE Selection Criteria

PPE shall be selected and used to protect site workers from the hazards and potential hazards they are likely to encounter, as identified during the site characterization and Job Hazard Analysis (see Attachment 2). A PPE ensemble shall be assigned to each work task or operation.

PPE selection shall be based upon many factors. Materials providing the greatest duration of protection shall be used. Tear and seam strength of the PPE shall also be considered to ensure ensemble durability while work is performed.

When necessary, multiple layers of protection shall be used to accommodate the range of hazards that may be encountered. All PPE shall be properly fitted.

PPE selection criteria shall also include:

- Level of PPE required (Level A, B, C, or D)
- PPE components
- Chemical suit and glove compatibility

All PPE ensembles shall be consistent with Appendix B of *29 CFR 1910.120 and 29 CFR 1926.65* and used in accordance with manufacturers' recommendations.

The following criteria were used to select PPE levels at this Site:

<u>Level D Protection was selected due to the following:</u>

- The atmosphere contains no known or suspected hazardous substances at concentrations that meet or exceed the published exposure limits

- Contact with hazardous levels of any chemicals through splashes, immersion, or by other means will not occur
- There is no potential for unexpected inhalation or contact with hazardous levels of any chemical

Training In Use of PPE

Employees receive general training regarding proper selection, use and inspection of PPE during initial HAZWOPER training and subsequent refresher training. Site-specific PPE requirements, including task-specific PPE, ensemble components, cartridge and canister service times, and inspection and maintenance procedures, as applicable, shall be communicated as identified in the Training Program.

Because chemical exposure levels present do not create a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape, positive pressure self-contained breathing apparatus or positive-pressure air-line respirators equipped with an escape air supply are not required.

7.0 ENVIRONMENTAL MONITORING

This section of the HASP describes how site worker exposures to hazardous substances will be monitored in compliance with *29 CFR 1910.120(b)(4)(ii)(E) and 29 CFR 1926.65(b)(4)(ii)(E)*.

7.1 Air Monitoring Procedures

Exposures to airborne hazardous substances shall be fully characterized throughout site operations to ensure that exposure controls are effectively selected and modified as needed. Air monitoring shall be used to identify and quantify airborne levels of hazardous substances and safety and health hazards to determine the appropriate level of site worker protection needed on site. Air monitoring procedures shall be consistent with OSHA requirements in *29 CFR 1910.120(c)(6) and 29 CFR 1926.65(c)(6)*.

Air monitoring shall be conducted using direct-reading instruments. Air monitoring includes:

- Initial monitoring prior to the beginning of remedial activities to identify conditions that may cause death or serious harm and to permit preliminary selection of site controls
- Periodic monitoring throughout the implementation of the Remedial Action Work Plan
- Implementation of a Community Air Monitoring Plan (CAMP) throughout Remedial activities

7.2 Initial Monitoring Procedures

Upon initial entry, representative air monitoring shall be conducted to identify any IDLH condition, exposure over permissible exposure limits or published exposure levels, exposure over a radioactive material's dose limits, or other dangerous condition such as the presence of flammable atmospheres or oxygen-deficient environments.

7.3 Periodic Monitoring

Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed, or when there is indication that exposure may have risen over permissible exposure limits or published exposure levels since previous monitoring was conducted. Situations where it shall be considered that the possibility exposures have risen are as follows:

- When work begins on a portion of the Site that has not been previously monitored
- When contaminants other than those previously identified are being handled

- When a change in environmental conditions exist
- When site workers handle leaking drums or containers, or work in areas with obvious liquid contamination
- When site workers report or exhibit signs of exposure

7.4 Direct-Reading Instrument Monitoring Procedures

Direct-reading instrument monitoring will be used on this site as follows:

- VOCs by photoionization detector (PID)
- Dust particulate by dust monitor

Monitoring equipment calibration and maintenance procedures on this site are:

- Every morning

7.5 Community Air Monitoring Program Procedures

CAMP was developed for this site in accordance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan included within DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) and is discussed in more detail in Appendix E of the Remedial Action Work Plan. All instruments will be operated and calibrated as per the manufacturer's specifications.

CAMP instrument monitoring will be used on this site as follows:

- VOCs by photoionization detector (PID)
- Dust particulate by dust monitor

Monitoring equipment calibration and maintenance procedures on this site are:

- Every morning

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

8.0 DECONTAMINATION

This HASP element describes procedures for decontaminating site workers and equipment when exiting the Exclusion Zone in compliance with *29 CFR 1910.120(b)(4)(ii)(G) and 29 CFR 1926.65(b)(4)(ii)(G)*. This section also describes disposal of waste from decontamination processes. Site decontamination procedures are designed to achieve a safe, logical removal or neutralization of contaminants that may accumulate on site workers and/or equipment. The Site Supervisor is responsible for decontamination procedures at this site.

These procedures are intended to minimize site worker contact with contaminants and protect against the transfer of contamination to clean areas of the site and away from the site. They may also extend the useful life of personal protective equipment (PPE) by reducing the amount of time that contaminants contact and permeate or otherwise affect the surfaces of PPE.

Decontamination procedures shall be communicated to site workers and implemented before any site workers or equipment are permitted to enter areas on site where potential for exposure to hazardous substances exists.

Emergency decontamination procedures are detailed in Section 8, the Emergency Response Plan of this HASP.

The decontamination procedures described below are designed to meet the requirements of *29 CFR 1910.120(k) and 29 CFR 1926.65(k)* and include site-specific information about:

- General and Specific Decontamination Procedures for Personnel and PPE
- General and Specific Decontamination Procedures for Equipment
- Location and Type of Site Decontamination Procedures
- Disposal of Residual Waste from Decontamination
- Monitoring the Effectiveness of Decontamination Procedures

8.1 General and Specific Decontamination Procedures for Site Workers and PPE

All site workers and PPE leaving a contaminated area shall be appropriately decontaminated. General decontamination guidelines for site workers and PPE include:

- Decontamination is required for all site workers exiting a contaminated area. Site workers may only re-enter uncontaminated areas after undergoing the decontamination procedures described in the next section.
- Protective clothing is decontaminated, cleaned, laundered, maintained and/or replaced as needed to ensure its effectiveness.
- PPE used at this site is decontaminated or prepared for proper disposal.

- The site requires and trains site workers that if their permeable clothing is splashed or becomes wetted with a hazardous substance, they will immediately exit the work zone, perform applicable decontamination procedures, shower, and change into uncontaminated clothing.

8.2 General and Specific Decontamination Procedures for Equipment

All contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated. General decontamination guidelines for equipment include:

- Decontamination is required for all equipment exiting a contaminated area. Equipment may only re-enter uncontaminated areas after undergoing specific decontamination as described in the Job Hazard Analysis Worksheets.
- Particular attention is given to decontaminating tires, scoops, and other parts of heavy equipment that are directly exposed to contaminants and contaminated soil.

8.3 Location and Type of Site Decontamination Procedures

Decontamination shall be performed in areas that will minimize the exposure of uncontaminated site workers or equipment to contaminated site workers or equipment. Decontamination on this site shall be conducted in the Contamination Reduction Zone. The Contamination Reduction Zone acts as a buffer between the Exclusion Zone and Support Zone. The location and design of decontamination stations minimize the spread of contamination beyond these stations.

8.4 Disposal of Waste from Decontamination

Procedures for disposal of decontamination waste shall meet applicable local, State, and Federal regulations.

8.5 Monitoring the Effectiveness of Decontamination Procedures

Decontamination procedures shall be monitored by a representative of Vektor Consultants or AMC Engineering, the Site Health and Safety Supervisor, to determine effectiveness. If procedures are found to be deficient, appropriate steps shall be taken to correct any deficiencies.

9.0 EMERGENCY RESPONSE PLAN

This section describes the site-specific Emergency Response Plan in compliance with *29 CFR 1910.120(b)(4)(ii)(H) and 29 CFR 1926.65(b)(4)(ii)(H)*. Specifically, the Emergency Response Plan addresses potential emergencies at this site, procedures for responding to these emergencies, roles and responsibilities during emergency response, and training. This element also describes the provisions this site has made to coordinate its emergency response planning with other contractors on site and with off-site emergency response organizations.

This Emergency Response Plan shall be available for inspection and copying by site workers, their representatives, OSHA personnel, and other governmental agencies with relevant responsibilities as required by *29 CFR 1910.120(l)(1)(i) and 29 CFR 1926.65(l)(1)(i)*.

In accordance with *29 CFR 1910.120(l)(3)(ii) and 29 CFR 1926.65(l)(3)(ii)*, this Emergency Response Plan is a separate section of the HASP.

9.1 Pre-Emergency Planning

This Emergency Response Plan is compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.

This Site has been evaluated for potential emergency occurrences based on site hazards, the tasks within the work plan, the site topography, and prevailing weather conditions.

9.2 Personnel Roles, Lines of Authority, and Communication

Anyone may activate the Emergency Response Plan; however, Izzy Hettleman (or designated alternate), Site Health and Safety Supervisor, is responsible for implementing the Emergency Response Plan and coordinating emergency response activities on this Site. Izzy Hettleman (or designated alternate) also provides specific direction for emergency action based upon information available regarding the incident and response capabilities, initiates emergency procedures including protection of the public, and ensures appropriate authorities are notified.

In accordance with *29 CFR 1910.38(a) and 29 CFR 1926.35*, in the event of an emergency, site workers are evacuated and do not participate in emergency response activities.

This Site relies upon the off-site emergency response organizations listed in the Emergency Response Contact Information list to respond to site emergencies. These organizations are appropriately trained, staffed, and equipped to provide emergency response to this site.

These organizations are contacted at least annually to verify the accuracy of phone numbers and contact names.

Communication on this site will be conducted by the following methods:

- Face to face
- Cell phone
- Hand signals

9.3 Site Security and Control

In case of an on-site emergency, site security and control for this site shall be provided by:

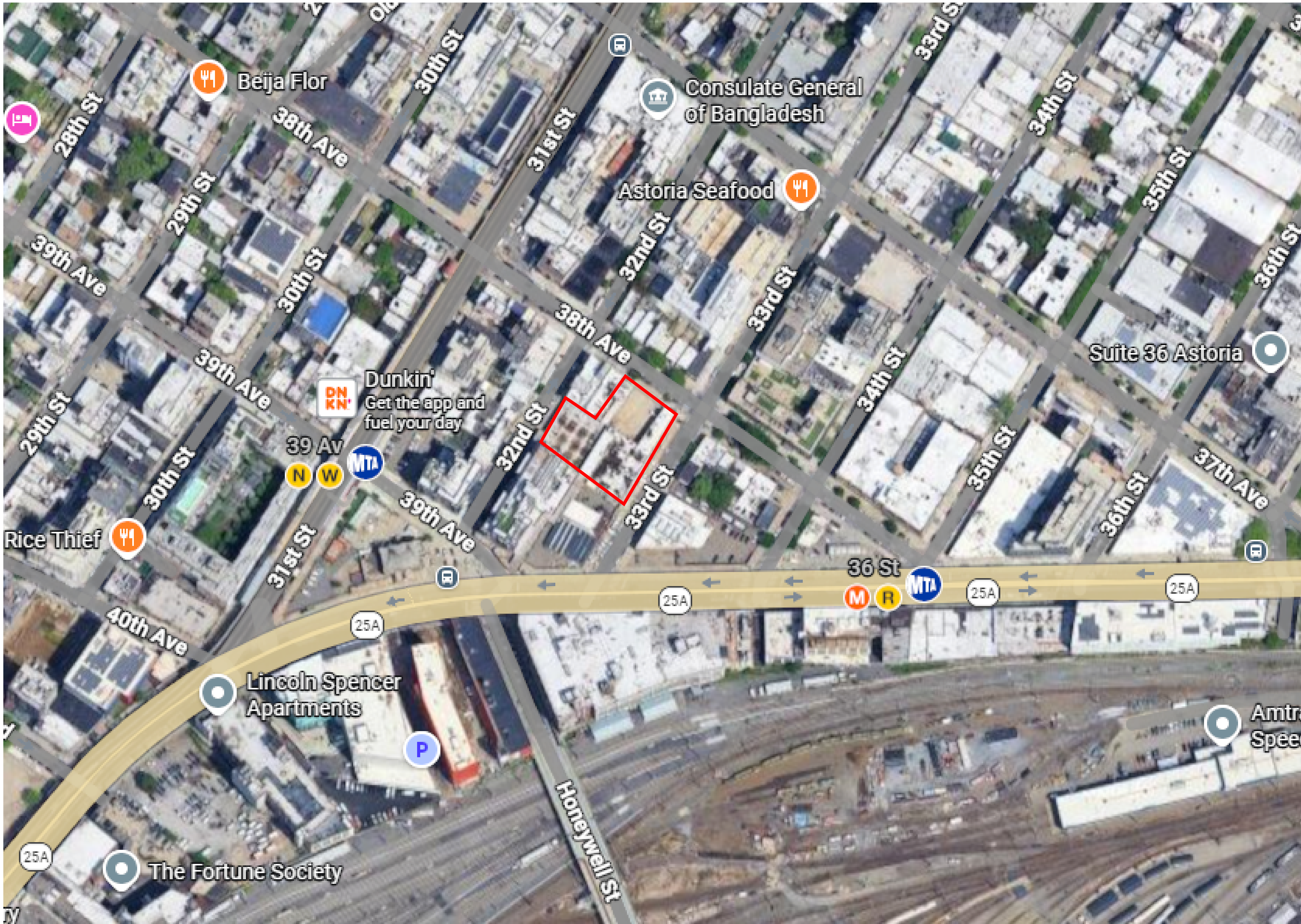
- Warning Signs
- Barrier Tape
- Locked Doors and Gates

9.4 Emergency Medical Treatment and First Aid

Any site worker who requires medical care and/or is transferred to a medical facility shall be accompanied by Hazardous Substance Profiles included in Attachment 1 of this HASP and other applicable information to apprise caregivers of the chemicals and hazards to which the victim has potentially been exposed. The emergency medical care facility for this site is:

NYC Health + Hospitals - Elmhurst
79-01 Broadway, Elmhurst, NY 11373
Tel: (212) 562-4141
Open 24 Hours

The route to the facility is shown on the map included in Attachment 4 of this HASP.



vEKtor consultants

t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

Legend:

Approximate BCP Site Boundary

Notes:

1. Base Map provided by Google Earth

Scale:

NOT TO SCALE

Figure No.	1
Figure Name:	SITE LOCATION MAP
Report:	HASP
Date:	3/20/2026
Drawn By:	KB
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK

Attachment 1

Hazardous Substance Profiles and/or SDS

Material Safety Data Sheet
PAH Contaminated Soil

ACC# 17974

Section 1 - Chemical Product and Company Identification

MSDS Name: PAH Contaminated Soil
Catalog Numbers: SRS103100
Synonyms: API separator sludge
Company Identification:
Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
Not available	Soil	78-99	unlisted
120-12-7	Anthracene	0-2	204-371-1
129-00-0	Pyrene	0-2	204-927-3
132-64-9	Dibenzofuran	0-2	205-071-3
205-99-2	Benzo(b)fluoranthene	0-2	205-911-9
206-44-0	Fluoranthene	0-2	205-912-4
208-96-8	Acenaphthylene	0-2	205-917-1
218-01-9	1,2-benzphenanthrene	0-2	205-923-4
50-32-8	Benzo(a)pyrene	0-2	200-028-5
56-55-3	1,2-Benzanthracene	0-2	200-280-6
83-32-9	Acenaphthene	0-2	201-469-6
85-01-8	Phenanthrene	0-2	201-581-5
86-73-7	Fluorene	0-2	201-695-5
87-86-5	Pentachlorophenol	0-2	201-778-6
91-20-3	Naphthalene	0-2	202-049-5
91-57-6	2-methylnaphthalene	0-2	202-078-3

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: not available solid.
Warning! May cause allergic skin reaction. Causes eye and skin irritation. May cause cancer based on animal studies.

Target Organs: Eyes, skin.

Potential Health Effects

Eye: May cause eye irritation.
Skin: May cause skin irritation. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material.
Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea. Naphthalene can cause cataracts, optical neuritis, and cornea injuries. Ingestion of large quantities may cause severe hemolytic anemia and
Inhalation: Causes respiratory tract irritation. May cause effects similar to those described for ingestion.
Chronic: May cause cancer according to animal studies. Prolonged exposure to respirable crystalline quartz may cause delayed lung injury/fibrosis (silicosis).

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: Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists.
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.
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.
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.
Flash Point: Not applicable.
Autoignition Temperature: Not applicable.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: Not published.

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. Avoid generating dusty conditions.

Section 7 - Handling and Storage

Handling: Avoid generating dusty conditions. Use with adequate ventilation. Avoid contact with skin and

eyes. Keep container tightly closed. Avoid ingestion and inhalation.
Storage: Store in a cool, dry place.

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
Soil	none listed	none listed	none listed
Anthracene	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 (benzene soluble fraction) (listed under Coal tar pitches).
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 (benzene soluble fraction) (listed under Coal tar pitches).
Dibenzofuran	none listed	none listed	none listed
Benzo(b)fluoranthene	none listed	none listed	none listed
Fluoranthene	none listed	none listed	none listed
Acenaphthylene	none listed	none listed	none listed
1,2-benzphenanthrene	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 (benzene soluble fraction) (listed under Coal tar pitches).
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 (benzene soluble fraction) (listed under Coal tar pitches).
1,2-Benzanthracene	none listed	none listed	none listed
Acenaphthene	none listed	none listed	none listed
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 (benzene soluble fraction) (listed under Coal tar pitches).
Fluorene	none listed	none listed	none listed
Pentachlorophenol	0.5 mg/m3 TWA; Skin - potential significant contribution to overall exposure by the cutaneous r oute	0.5 mg/m3 TWA 2.5 mg/m3 IDLH	0.5 mg/m3 TWA
	10 ppm TWA; 15 ppm STEL; Skin - potential	10 ppm TWA; 50 mg/m3	10 ppm TWA; 50 mg/m3

Naphthalene	significant contribution to overall exposure by the cutaneous r oute	TWA 250 ppm IDLH	TWA
2-methylnaphthalene	0.5 ppm TWA; Skin - potential significant contribution to overall exposure by the cutaneous r oute	none listed	none listed

OSHA Vacated PELs: Soil: No OSHA Vacated PELs are listed for this chemical. Anthracene: No OSHA Vacated PELs are listed for this chemical. Pyrene: No OSHA Vacated PELs are listed for this chemical. Dibenzofuran: No OSHA Vacated PELs are listed for this chemical. Benzo(b)fluoranthene: No OSHA Vacated PELs are listed for this chemical. Fluoranthene: No OSHA Vacated PELs are listed for this chemical. Acenaphthylene: No OSHA Vacated PELs are listed for this chemical. 1,2-benzphenanthrene: No OSHA Vacated PELs are listed for this chemical. Benzo(a)pyrene: No OSHA Vacated PELs are listed for this chemical. 1,2-Benzanthracene: No OSHA Vacated PELs are listed for this chemical. Acenaphthene: No OSHA Vacated PELs are listed for this chemical. Phenanthrene: No OSHA Vacated PELs are listed for this chemical. Fluorene: No OSHA Vacated PELs are listed for this chemical. Pentachlorophenol: 0.5 mg/m3 TWA Naphthalene: 10 ppm TWA; 50 mg/m3 TWA 2-methylnaphthalene: 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 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: not available
Odor: none reported
pH: Not available.
Vapor Pressure: Not applicable.
Vapor Density: Not available.
Evaporation Rate: Not applicable.
Viscosity: Not applicable.
Boiling Point: Not available.
Freezing/Melting Point: Not available.
Decomposition Temperature: Not available.
Solubility: Insoluble in water.
Specific Gravity/Density: Not available.
Molecular Formula: Mixture
Molecular Weight: Not available.

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: High temperatures.
Incompatibilities with Other Materials: None reported.

Hazardous Decomposition Products: No data available.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 120-12-7: CA9350000
CAS# 129-00-0: UR2450000; UR2450100
CAS# 132-64-9: HP4430000
CAS# 205-99-2: CU1400000
CAS# 206-44-0: LL4025000
CAS# 208-96-8: AB1254000; AB1254200
CAS# 218-01-9: GC0700000
CAS# 50-32-8: DJ3675000
CAS# 56-55-3: CV9275000
CAS# 83-32-9: AB1000000
CAS# 85-01-8: SF7175000
CAS# 86-73-7: LL5670000
CAS# 87-86-5: SM6300000; SM6314000; SM6321000
CAS# 91-20-3: QJ0525000
CAS# 91-57-6: QJ9635000
LD50/LC50:
CAS# 120-12-7:
Oral, mouse: LD50 = 4900 mg/kg;
.

CAS# 129-00-0:
Draize test, rabbit, skin: 500 mg/24H Mild;
Inhalation, rat: LC50 = 170 mg/m3;
Inhalation, rat: LC50 = 170 mg/m3;
Oral, mouse: LD50 = 800 mg/kg;
Oral, rat: LD50 = 2700 mg/kg;
.

CAS# 132-64-9:
.

CAS# 205-99-2:
.

CAS# 206-44-0:
Oral, rat: LD50 = 2 gm/kg;
Skin, rabbit: LD50 = 3180 mg/kg;
.

CAS# 208-96-8:
Oral, mouse: LD50 = 1760 mg/kg;
.

CAS# 218-01-9:
.

CAS# 50-32-8:
.

CAS# 56-55-3:
.

CAS# 83-32-9:
.

CAS# 85-01-8:
    Oral, mouse: LD50 = 700 mg/kg;
    Oral, rat: LD50 = 1.8 gm/kg;
.

CAS# 86-73-7:
.

CAS# 87-86-5:
    Draize test, rabbit, eye: 100 uL/24H Mild;
    Inhalation, mouse: LC50 = 225 mg/m3;
    Inhalation, mouse: LC50 = 225 mg/m3;
    Inhalation, rat: LC50 = 355 mg/m3;
    Inhalation, rat: LC50 = 200 mg/m3;
    Inhalation, rat: LC50 = 335 mg/m3;
    Oral, mouse: LD50 = 36 mg/kg;
    Oral, mouse: LD50 = 117 mg/kg;
    Oral, mouse: LD50 = 30 mg/kg;
    Oral, rabbit: LD50 = 200 mg/kg;
    Oral, rat: LD50 = 27 mg/kg;
    Oral, rat: LD50 = 27 mg/kg;
    Oral, rat: LD50 = 50 mg/kg;
    Skin, rat: LD50 = 96
CAS# 91-20-3:
    Draize test, rabbit, eye: 100 mg Mild;
    Inhalation, rat: LC50 = >340 mg/m3/1H;
    Oral, mouse: LD50 = 316 mg/kg;
    Oral, rat: LD50 = 490 mg/kg;
    Skin, rabbit: LD50 = >20 gm/kg;
    Skin, rat: LD50 = >2500 mg/kg;
.

CAS# 91-57-6:
    Oral, rat: LD50 = 1630 mg/kg;
.

Carcinogenicity:
CAS# 120-12-7:

- **ACGIH:** A1 - Confirmed Human Carcinogen (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).

CAS# 129-00-0:

- **ACGIH:** A1 - Confirmed Human Carcinogen (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).

CAS# 132-64-9: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
CAS# 205-99-2:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 2B carcinogen

CAS# 206-44-0: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
CAS# 208-96-8: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
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).

CAS# 50-32-8:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen

CAS# 56-55-3:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 2B carcinogen

CAS# 83-32-9: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
CAS# 85-01-8:

- **ACGIH:** A1 - Confirmed Human Carcinogen (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).

CAS# 86-73-7: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
CAS# 87-86-5:

- **ACGIH:** A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
- **California:** carcinogen, initial date 1/1/90
- **NTP:** Not listed.
- **IARC:** Group 2B carcinogen

CAS# 91-20-3:

- **ACGIH:** Not listed.
- **California:** carcinogen, initial date 4/19/02
- **NTP:** Suspect carcinogen
- **IARC:** Group 2B carcinogen

CAS# 91-57-6: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information available.
Teratogenicity: No information available.
Reproductive Effects: No information available.

Mutagenicity: No information available.
Neurotoxicity: No information 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:
CAS# 206-44-0: waste number U120.
CAS# 218-01-9: waste number U050.
CAS# 50-32-8: waste number U022.
CAS# 56-55-3: waste number U018.
CAS# 91-20-3: waste

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

Soil is not listed on the TSCA inventory. It is for research and development use only.
CAS# 120-12-7 is listed on the TSCA inventory.
CAS# 129-00-0 is listed on the TSCA inventory.
CAS# 132-64-9 is listed on the TSCA inventory.
CAS# 205-99-2 is not listed on the TSCA inventory. It is for research and development use only.
CAS# 206-44-0 is listed on the TSCA inventory.
CAS# 208-96-8 is listed on the TSCA inventory.
CAS# 218-01-9 is listed on the TSCA inventory.
CAS# 50-32-8 is listed on the TSCA inventory.
CAS# 56-55-3 is listed on the TSCA inventory.
CAS# 83-32-9 is listed on the TSCA inventory.
CAS# 85-01-8 is listed on the TSCA inventory.
CAS# 86-73-7 is listed on the TSCA inventory.

CAS# 87-86-5 is listed on the TSCA inventory.
CAS# 91-20-3 is listed on the TSCA inventory.
CAS# 91-57-6 is listed on the TSCA inventory.

Health & Safety Reporting List

CAS# 129-00-0: Effective 6/1/87, Sunset 6/1/97 CAS# 91-20-3: Effective 6/1/87, Sunset 6/1/97

Chemical Test Rules

CAS# 91-20-3: 40 CFR 799.5115

Section 12b

CAS# 91-20-3: Section 4, 0.1 % de minimus concentration

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 120-12-7: 5000 lb final RQ; 2270 kg final RQ CAS# 129-00-0: 5000 lb final RQ; 2270 kg final RQ CAS# 132-64-9: 100 lb final RQ; 45.4 kg final RQ CAS# 205-99-2: 1 lb final RQ; 0.454 kg final RQ CAS# 206-44-0: 100 lb final RQ; 45.4 kg final RQ CAS# 208-96-8: 5000 lb final RQ; 2270 kg final RQ CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ CAS# 50-32-8: 1 lb final RQ; 0.454 kg final RQ CAS# 56-55-3: 10 lb final RQ; 4.54 kg final RQ CAS# 83-32-9: 100 lb final RQ; 45.4 kg final RQ CAS# 85-01-8: 5000 lb final RQ; 2270 kg final RQ CAS# 86-73-7: 5000 lb final RQ; 2270 kg final RQ CAS# 87-86-5: 10 lb final RQ; 4.54 kg final RQ CAS# 91-20-3: 100 lb final RQ; 45.4 kg final RQ

SARA Section 302 Extremely Hazardous Substances

CAS# 129-00-0: 1000 lb lower threshold TPQ; 10000 lb upper threshold T PQ

SARA Codes

CAS # 120-12-7: immediate.
CAS # 129-00-0: immediate, delayed.
CAS # 206-44-0: immediate.
CAS # 50-32-8: immediate, delayed.
CAS # 56-55-3: delayed.
CAS # 83-32-9: immediate.
CAS # 85-01-8: immediate.
CAS # 91-20-3: immediate, delayed, fire.
CAS # 91-57-6: immediate.

Section 313

This material contains Anthracene (CAS# 120-12-7, 0-2%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

This material contains Dibenzofuran (CAS# 132-64-9, 0-2%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

This material contains Benzo(b)fluoranthene (CAS# 205-99-2, 0-2%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

This material contains Fluoranthene (CAS# 206-44-0, 0-2%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

This material contains 1,2-benzphenanthrene (CAS# 218-01-9, 0-2%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

This material contains Benzo(a)pyrene (CAS# 50-32-8, 0-2%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

This material contains 1,2-Benzanthracene (CAS# 56-55-3, 0-2%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

This material contains Phenanthrene (CAS# 85-01-8, 0-2%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

This material contains Pentachlorophenol (CAS# 87-86-5, 0-2%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

This material contains Naphthalene (CAS# 91-20-3, 0-2%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 132-64-9 is listed as a hazardous air pollutant (HAP).

CAS# 87-86-5 is listed as a hazardous air pollutant (HAP).
CAS# 91-20-3 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 87-86-5 is listed as a Hazardous Substance under the CWA. CAS# 91-20-3 is listed as a Hazardous Substance under the CWA. CAS# 120-12-7 is listed as a Priority Pollutant under the Clean Water Act. CAS# 129-00-0 is listed as a Priority Pollutant under the Clean Water Act. CAS# 205-99-2 is listed as a Priority Pollutant under the Clean Water Act. CAS# 206-44-0 is listed as a Priority Pollutant under the Clean Water Act. CAS# 208-96-8 is listed as a Priority Pollutant under the Clean Water Act. CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act. CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act. CAS# 56-55-3 is listed as a Priority Pollutant under the Clean Water Act. CAS# 83-32-9 is listed as a Priority Pollutant under the Clean Water Act. CAS# 85-01-8 is listed as a Priority Pollutant under the Clean Water Act. CAS# 86-73-7 is listed as a Priority Pollutant under the Clean Water Act. CAS# 87-86-5 is listed as a Priority Pollutant under the Clean Water Act. CAS# 91-20-3 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. CAS# 83-32-9 is listed as a Toxic Pollutant under the Clean Water Act. CAS# 87-86-5 is listed as a Toxic Pollutant under the Clean Water Act. CAS# 91-20-3 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# 120-12-7 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as Coal tar pitches), Massachusetts.

CAS# 129-00-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as Coal tar pitches), Massachusetts.

CAS# 132-64-9 can be found on the following state right to know lists: New Jersey, Pennsylvania, Massachusetts.

CAS# 205-99-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 206-44-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

CAS# 208-96-8 can be found on the following state right to know lists: New Jersey, Pennsylvania, Massachusetts.

CAS# 218-01-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 50-32-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 56-55-3 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 83-32-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

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.

CAS# 86-73-7 can be found on the following state right to know lists: New Jersey, Pennsylvania, Massachusetts.

CAS# 87-86-5 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 91-20-3 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.
CAS# 91-57-6 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

California Prop 65
WARNING: This product contains Benzo(b)fluoranthene, a chemical known to the state of California to cause cancer. WARNING: This product contains 1,2-benzphenanthrene, a chemical known to the state of California to cause cancer. WARNING: This product contains Benzo(a)pyrene, a chemical known to the state of California to cause cancer. WARNING: This product contains 1,2-Benzanthracene, a chemical known to the state of California to cause cancer. WARNING: This product contains Pentachlorophenol, a chemical known to the state of California to cause cancer. WARNING: This product contains Naphthalene, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 205-99-2: 0.096 æg/day NSRL (oral) CAS# 218-01-9: 0.35 æg/day NSRL (oral) CAS# 50-32-8: 0.06 æg/day NSRL CAS# 56-55-3: 0.033 æg/day NSRL (oral) CAS# 87-86-5: 40 æg/day NSRL CAS# 91-20-3: 5.8 æg/day NSRL

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
Not available.
Risk Phrases:

Safety Phrases:

WGK (Water Danger/Protection)
CAS# 120-12-7: 2
CAS# 129-00-0: No information available.
CAS# 132-64-9: No information available.
CAS# 205-99-2: No information available.
CAS# 206-44-0: No information available.
CAS# 208-96-8: No information available.
CAS# 218-01-9: No information available.
CAS# 50-32-8: No information available.
CAS# 56-55-3: No information available.
CAS# 83-32-9: No information available.
CAS# 85-01-8: No information available.
CAS# 86-73-7: No information available.
CAS# 87-86-5: 3
CAS# 91-20-3: 2
CAS# 91-57-6: No information available.
Canada - DSL/NDSL
CAS# 120-12-7 is listed on Canada's DSL List.
CAS# 129-00-0 is listed on Canada's DSL List.
CAS# 132-64-9 is listed on Canada's DSL List.
CAS# 218-01-9 is listed on Canada's DSL List.
CAS# 50-32-8 is listed on Canada's DSL List.
CAS# 83-32-9 is listed on Canada's DSL List.
CAS# 85-01-8 is listed on Canada's DSL List.
CAS# 86-73-7 is listed on Canada's DSL List.
CAS# 87-86-5 is listed on Canada's DSL List.
CAS# 91-20-3 is listed on Canada's DSL List.
CAS# 91-57-6 is listed on Canada's DSL List.
CAS# 206-44-0 is listed on Canada's NDSL List.
CAS# 208-96-8 is listed on Canada's NDSL List.
CAS# 56-55-3 is listed on Canada's NDSL 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# 120-12-7 is listed on the Canadian Ingredient Disclosure List.
CAS# 129-00-0 is listed on the Canadian Ingredient Disclosure List.
CAS# 205-99-2 is listed on the Canadian Ingredient Disclosure List.
CAS# 206-44-0 is listed on the Canadian Ingredient Disclosure List.
CAS# 208-96-8 is not listed on the Canadian Ingredient Disclosure List.
CAS# 218-01-9 is listed on the Canadian Ingredient Disclosure List.
CAS# 50-32-8 is listed on the Canadian Ingredient Disclosure List.
CAS# 56-55-3 is listed on the Canadian Ingredient Disclosure List.
CAS# 83-32-9 is listed on the Canadian Ingredient Disclosure List.
CAS# 85-01-8 is listed on the Canadian Ingredient Disclosure List.
CAS# 86-73-7 is not listed on the Canadian Ingredient Disclosure List.
CAS# 87-86-5 is not listed on the Canadian Ingredient Disclosure List.
CAS# 91-20-3 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997
Revision #5 Date: 11/20/2008

SAFETY DATA SHEET

Creation Date 10-Dec-2009 **Revision Date** 28-Dec-2021 **Revision Number** 6

1. Identification

Product Name	**Tetrachloroethylene**
Cat No. :	**AC445690000; ACR445690010; AC445690025; AC445691000**
CAS No	127-18-4
Synonyms	Perchloroethylene
Recommended Use	Laboratory chemicals.
Uses advised against	Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/Irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Toxic to aquatic life with long lasting effects
WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS No	Weight %
Tetrachloroethylene	127-18-4	>95

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.
Inhalation	Remove to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.
Ingestion	Clean mouth with water and drink afterwards plenty of water.
Most important symptoms and effects	None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Water spray, carbon dioxide (CO_2), dry chemical, alcohol-resistant foam.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated.

Hazardous Combustion Products
Chlorine. Phosgene. Hydrogen chloride gas.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	0	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment as required. Ensure adequate ventilation.
Environmental Precautions	Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Ensure adequate ventilation. Avoid ingestion and inhalation.
Storage.	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from sunlight. Incompatible Materials. Strong acids. Strong oxidizing agents. Strong bases. Metals. Zinc.

Amines. Aluminium.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Tetrachloroethylene	TWA: 25 ppm STEL: 100 ppm	(Vacated) TWA: 25 ppm (Vacated) TWA: 170 mg/m³ Ceiling: 200 ppm TWA: 100 ppm	IDLH: 150 ppm	TWA: 25 ppm STEL: 100 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: NIOSH - National Institute for Occupational Safety and Health

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection 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 and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection 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.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic, sweet
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-22 °C / -7.6 °F
Boiling Point/Range	120 - 122 °C / 248 - 251.6 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	6.0 (Ether = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	18 mbar @ 20 °C
Vapor Density	No information available
Density	1.619
Specific Gravity	1.625
Solubility	0.15 g/L water (20°C)
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	> 150°C
Viscosity	0.89 mPa s at 20 °C
Molecular Formula	C2 Cl4

Molecular Weight 165.83

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Exposure to moist air or water.

Incompatible Materials Strong acids, Strong oxidizing agents, Strong bases, Metals, Zinc, Amines, Aluminium

Hazardous Decomposition Products Chlorine, Phosgene, Hydrogen chloride gas

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Tetrachloroethylene	LD50 = 2629 mg/kg (Rat)	LD50 > 10000 mg/kg (Rat)	LC50 = 27.8 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
Tetrachloroethylene	127-18-4	Group 2A	Reasonably Anticipated	A3	X	A3

IARC (International Agency for Research on Cancer)
IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens
Mexico - Occupational Exposure Limits - Carcinogens
A1 - Confirmed Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Confirmed Animal Carcinogen
A4 - Not Classifiable as a Human Carcinogen
A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Tetrachloroethylene	Group II Chemical	Not applicable	Not applicable

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity
Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Tetrachloroethylene	EC50: > 500 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 12.4 - 14.4 mg/L, 96h flow-through (Pimephales promelas) LC50: 8.6 - 13.5 mg/L, 96h static (Pimephales promelas) LC50: 11.0 - 15.0 mg/L, 96h static (Lepomis macrochirus) LC50: 4.73 - 5.27 mg/L, 96h flow-through (Oncorhynchus mykiss)	EC50 = 100 mg/L 24 h EC50 = 112 mg/L 24 h EC50 = 120.0 mg/L 30 min	EC50: 6.1 - 9.0 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Insoluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility . Is not likely mobile in the environment due its low water solubility. Will likely be mobile in the environment due to its volatility.

Component	log Pow
Tetrachloroethylene	2.88

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Tetrachloroethylene - 127-18-4	U210	-

14. Transport information

DOT
UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE

Hazard Class	6.1
Packing Group	III

TDG

UN-No	UN1897
Proper Shipping Name	TETRACHLOROETHYLENE
Hazard Class	6.1
Packing Group	III

IATA

UN-No	UN1897
Proper Shipping Name	TETRACHLOROETHYLENE
Hazard Class	6.1
Packing Group	III

IMDG/IMO

UN-No	UN1897
Proper Shipping Name	TETRACHLOROETHYLENE
Hazard Class	6.1
Packing Group	III

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Tetrachloroethylene	127-18-4	X	ACTIVE	-

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
Tetrachloroethylene	127-18-4	X	-	204-825-9	X	X	X	X	X	KE-33294

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313

Component	CAS No	Weight %	SARA 313 - Threshold Values %
Tetrachloroethylene	127-18-4	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Tetrachloroethylene	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Tetrachloroethylene	X		-

OSHA - Occupational Safety and Health Administration — Not applicable

CERCLA — This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Tetrachloroethylene	100 lb 1 lb	-

California Proposition 65 — This product contains the following Proposition 65 chemicals.

Component	CAS No	California Prop. 65	Prop 65 NSRL	Category
Tetrachloroethylene	127-18-4	Carcinogen	14 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Tetrachloroethylene	X	X	X	X	X

U.S. Department of Transportation
Reportable Quantity (RQ): Y
DOT Marine Pollutant Y
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security — This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade — No information available

Authorisation/Restrictions according to EU REACH

Component	REACH (1907/2006) - Annex XIV - Substances Subject to Authorization	REACH (1907/2006) - Annex XVII - Restrictions on Certain Dangerous Substances	REACH Regulation (EC 1907/2006) article 59 - Candidate List of Substances of Very High Concern (SVHC)
Tetrachloroethylene	-	Use restricted. See item 75. (see link for restriction details)	-

https://echa.europa.eu/substances-restricted-under-reach

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
Tetrachloroethylene	127-18-4	Listed	Not applicable	Not applicable	Not applicable

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
Tetrachloroethylene	127-18-4	Not applicable	Not applicable	Not applicable	Annex I - Y45

16. Other information

Prepared By — Regulatory Affairs
Thermo Fisher Scientific

Email: EMSDS.RA@thermofisher.com

Creation Date	10-Dec-2009
Revision Date	28-Dec-2021
Print Date	28-Dec-2021
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

ThermoFisher SCIENTIFIC

SAFETY DATA SHEET

Creation Date 16-Sep-2014 **Revision Date** 26-Dec-2021 **Revision Number** 4

1. Identification

Product Name **trans-1,2-Dichloroethylene, stabilized**

Cat No. : **AC406840000; AC406840250; AC406842500**

CAS No 156-60-5
Synonyms trans-Acetylene dichloride

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 4

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Harmful if swallowed or if inhaled

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Wear protective gloves/protective clothing/eye protection/face protection
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Ingestion
Rinse mouth
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Explosion risk in case of fire
Fight fire with normal precautions from a reasonable distance
Evacuate area
Storage
Store in a well-ventilated place. Keep cool
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects

3. Composition/Information on Ingredients

Component	CAS No	Weight %
trans-1,2-Dichloroethylene	156-60-5	>95

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Get medical attention.

Inhalation Remove from exposure, lie down. Remove to fresh air. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Get medical attention. If not breathing, give artificial respiration.

Ingestion Do NOT induce vomiting. Get medical attention.

Most important symptoms and effects	Difficulty in breathing. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Water spray. Carbon dioxide (CO_2). Dry chemical. Chemical foam. Water mist may be used to cool closed containers. Water mist may be used to cool closed containers.
Unsuitable Extinguishing Media	No information available
Flash Point	6 °C / 42.8 °F
Method -	No information available
Autoignition Temperature	440 °C / 824 °F
Explosion Limits	
Upper	12.80%
Lower	9.70%
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Flammable. Vapors may travel to source of ignition and flash back. Containers may explode when heated. Vapors may form explosive mixtures with air. Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO). Carbon dioxide (CO_2). Phosgene. Hydrogen chloride gas.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	3	0	N/A

6. Accidental release measures

Personal Precautions	Remove all sources of ignition. Take precautionary measures against static discharges. Use personal protective equipment as required. Ensure adequate ventilation.
Environmental Precautions	Do not flush into surface water or sanitary sewer system. See Section 12 for additional Ecological Information. Avoid release to the environment. Collect spillage.
Methods for Containment and Clean Up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

7. Handling and storage

Handling	Wear personal protective equipment/face protection. Ensure adequate ventilation. Avoid contact with skin and eyes. Handle product only in closed system or provide appropriate exhaust ventilation. Use spark-proof tools and explosion-proof equipment. Use only non-sparking tools. Keep away from open flames, hot surfaces and sources of ignition. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded. Take precautionary measures against static discharges.
Storage.	Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep away

from heat, sparks and flame. Flammables area. Keep container tightly closed in a dry and well-ventilated place. Incompatible Materials. Bases. Strong acids. Strong oxidizing agents.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
trans-1,2-Dichloroethylene	TWA: 200 ppm			TWA: 200 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

Engineering Measures Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting equipment.

Personal Protective Equipment

Eye/face Protection 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 and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection 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.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	aromatic
Odor Threshold	No information available
pH	6.5-7.2
Melting Point/Range	-50 °C / -58 °F
Boiling Point/Range	48 °C / 118.4 °F @ 760 mmHg
Flash Point	6 °C / 42.8 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	12.80%
Lower	9.70%
Vapor Pressure	331 mmHg @ 25 °C
Vapor Density	3.34 (Air = 1.0)
Specific Gravity	1.260
Solubility	Immiscible with water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	440 °C / 824 °F
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C2 H2 Cl2
Molecular Weight	96.94

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Keep away from open flames, hot surfaces and sources of ignition. Exposure to air. Exposure to light. Incompatible products. Exposure to moist air or water.

Incompatible Materials Bases, Strong acids, Strong oxidizing agents

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2), Phosgene, Hydrogen chloride gas

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
trans-1,2-Dichloroethylene	LD50 = 1235 mg/kg (Rat)	>5 g/kg (Rabbit)	LC50 = 24100 ppm (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
trans-1,2-Dichloroethylene	156-60-5	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
trans-1,2-Dichloroethylene	Not listed	LC50: = 135 mg/L, 96h static (Lepomis macrochirus)	Not listed	Not listed

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
trans-1,2-Dichloroethylene	1.48

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
trans-1,2-Dichloroethylene - 156-60-5	U079	-

14. Transport information

DOT
- **UN-No** UN1150
- **Proper Shipping Name** 1,2-DICHLOROETHYLENE
- **Hazard Class** 3
- **Packing Group** II

TDG
- **UN-No** UN1150
- **Proper Shipping Name** 1,2-DICHLOROETHYLENE
- **Hazard Class** 3
- **Packing Group** II

IATA
- **UN-No** UN1150
- **Proper Shipping Name** 1,2-DICHLOROETHYLENE
- **Hazard Class** 3
- **Packing Group** II

IMDG/IMO
- **UN-No** UN1150
- **Proper Shipping Name** 1,2-DICHLOROETHYLENE
- **Hazard Class** 3
- **Packing Group** II

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
trans-1,2-Dichloroethylene	156-60-5	X	ACTIVE	-

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

Component	CAS No	**TSCA 12(b)** - Notices of Export

trans-1,2-Dichloroethylene	156-60-5	Section 4

International Inventories

Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
trans-1,2-Dichloroethylene	156-60-5	X	-	205-860-2	X	X	X	X	X	KE-10123

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
trans-1,2-Dichloroethylene	-	-	-	X

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
trans-1,2-Dichloroethylene	1000 lb 1 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
trans-1,2-Dichloroethylene	X	-	X	-	-

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
trans-1,2-Dichloroethylene	156-60-5	Listed	Not applicable	Not applicable	Not applicable

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
trans-1,2-Dichloroethylene	156-60-5	Not applicable	Not applicable	Not applicable	Annex I - Y45

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 16-Sep-2014
Revision Date 26-Dec-2021
Print Date 26-Dec-2021
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

ThermoFisher SCIENTIFIC

SAFETY DATA SHEET

Creation Date 03-Feb-2010 **Revision Date** 24-Dec-2021 **Revision Number** 3

1. Identification

Product Name	**Trichloroethylene**
Cat No. :	**T340-4; T341-4; T341-20; T341-500; T403-4**
CAS No	79-01-6
Synonyms	Trichloroethene (Stabilized/Technical/Electronic/Certified ACS)
Recommended Use	Laboratory chemicals.
Uses advised against	.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.200)

Skin Corrosion/Irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Germ Cell Mutagenicity	Category 2
Carcinogenicity	Category 1A
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Heart, spleen, Blood.	

Label Elements

Signal Word

Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
Suspected of causing genetic defects
May cause cancer
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects
WARNING. Cancer and Reproductive Harm - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS No	Weight %
Trichloroethylene	79-01-6	>95

4. First-aid measures

General Advice Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact	In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.
Inhalation	Remove to fresh air. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.
Ingestion	Do NOT induce vomiting. Call a physician or poison control center immediately.
Most important symptoms and effects	May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Water spray, carbon dioxide (CO2), dry chemical, alcohol-resistant foam.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	410 °C / 770 °F
Explosion Limits	
Upper	44.8 vol %
Lower	8 vol %
Oxidizing Properties	Not oxidising
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Chlorine. Phosgene. Carbon monoxide (CO). Carbon dioxide (CO_2). Hydrogen chloride gas.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment as required. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas.
Environmental Precautions	Should not be released into the environment. Do not flush into surface water or sanitary sewer system.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe mist/vapors/spray. Do not ingest. If swallowed then seek immediate medical assistance.

Storage. Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from light. Do not store in aluminum containers. Incompatible Materials. Strong oxidizing agents. Strong bases. Amines. Alkali metals. Metals. .

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Trichloroethylene	TWA: 10 ppm STEL: 25 ppm	(Vacated) TWA: 50 ppm (Vacated) TWA: 270 mg/m^3 Ceiling: 200 ppm (Vacated) STEL: 200 ppm (Vacated) STEL: 1080 mg/m^3 TWA: 100 ppm	IDLH: 1000 ppm	TWA: 10 ppm STEL: 25 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: NIOSH - National Institute for Occupational Safety and Health

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection 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 and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection 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.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-85 °C / -121 °F
Boiling Point/Range	87 °C / 188.6 °F
Flash Point	No information available
Evaporation Rate	0.69 (Carbon Tetrachloride = 1.0)

Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	44.8 vol %
Lower	8 vol %
Vapor Pressure	77.3 mbar @ 20 °C
Vapor Density	4.5 (Air = 1.0)
Specific Gravity	1.460
Solubility	Insoluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	410 °C / 770 °F
Decomposition Temperature	> 120°C
Viscosity	0.55 mPa.s (25°C)
Molecular Formula	C2 H Cl3
Molecular Weight	131.39

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Light sensitive.

Conditions to Avoid Incompatible products. Excess heat. Exposure to light. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Strong bases, Amines, Alkali metals, Metals,

Hazardous Decomposition Products Chlorine, Phosgene, Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrogen chloride gas

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Trichloroethylene	LD50 = 4920 mg/kg (Rat)	LD50 = 29000 mg/kg (Rabbit)	LC50 = 26 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization May cause sensitization by skin contact

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
Trichloroethylene	79-01-6	Group 1	Known	A2	X	A2

IARC (International Agency for Research on Cancer)
IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen

A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects Mutagenic effects have occurred in humans.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Heart spleen Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not empty into drains. The product contains following substances which are hazardous for the environment. Contains a substance which is:. Harmful to aquatic organisms. Toxic to aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Trichloroethylene	EC50: = 175 mg/L, 96h (Pseudokirchneriella subcapitata) EC50: = 450 mg/L, 96h (Desmodesmus subspicatus)	LC50: 31.4 - 71.8 mg/L, 96h flow-through (Pimephales promelas) LC50: 39 - 54 mg/L, 96h static (Lepomis macrochirus)	EC50 = 0.81 mg/L 24 h EC50 = 115 mg/L 10 min EC50 = 190 mg/L 15 min EC50 = 235 mg/L 24 h EC50 = 410 mg/L 24 h EC50 = 975 mg/L 5 min	EC50: = 2.2 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Trichloroethylene	2.4

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Trichloroethylene - 79-01-6	U228	-

14. Transport information

DOT

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1

Packing Group	III

TDG

UN-No	UN1710
Proper Shipping Name	TRICHLOROETHYLENE
Hazard Class	6.1
Packing Group	III

IATA

UN-No	UN1710
Proper Shipping Name	TRICHLOROETHYLENE
Hazard Class	6.1
Packing Group	III

IMDG/IMO

UN-No	UN1710
Proper Shipping Name	TRICHLOROETHYLENE
Hazard Class	6.1
Packing Group	III

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Trichloroethylene	79-01-6	X	ACTIVE	R;S

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

TSCA 12(b) - Notices of Export

Component	CAS No	TSCA 12(b) - Notices of Export
Trichloroethylene	79-01-6	Section 5 Section 6

International Inventories

Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
Trichloroethylene	79-01-6	X	-	201-167-4	X	X	X	X	X	X

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313

Component	CAS No	Weight %	SARA 313 - Threshold Values %
Trichloroethylene	79-01-6	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Trichloroethylene	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors

Trichloroethylene	X		-

OSHA - Occupational Safety and Health Administration | Not applicable

CERCLA | This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Trichloroethylene	100 lb 1 lb	-

California Proposition 65 | This product contains the following Proposition 65 chemicals.

Component	CAS No	California Prop. 65	Prop 65 NSRL	Category
Trichloroethylene	79-01-6	Carcinogen Developmental Male Reproductive	14 µg/day 50 µg/day	Developmental Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Trichloroethylene	X	X	X	X	X

U.S. Department of Transportation
Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security | This product does not contain any DHS chemicals.

<u>Other International Regulations</u>

Mexico - Grade | No information available

Authorisation/Restrictions according to EU REACH

Component	REACH (1907/2006) - Annex XIV - Substances Subject to Authorization	REACH (1907/2006) - Annex XVII - Restrictions on Certain Dangerous Substances	REACH Regulation (EC 1907/2006) article 59 - Candidate List of Substances of Very High Concern (SVHC)
Trichloroethylene	Carcinogenic Category 1B Article 57 Application date: October 21, 2014 Sunset date: April 21, 2016 Exemption - None	Use restricted. See item 28. (see link for restriction details) Use restricted. See item 75. (see link for restriction details)	SVHC Candidate list - 201-167-4 - Carcinogenic, Article 57a

After the sunset date the use of this substance requires either an authorization or can only be used for exempted uses, e.g. use in scientific research and development which includes routine analytics or use as intermediate.

https://echa.europa.eu/authorisation-list
https://echa.europa.eu/substances-restricted-under-reach
https://echa.europa.eu/candidate-list-table

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
Trichloroethylene	79-01-6	Listed	Not applicable	Not applicable	Not applicable

Component	CAS No	Seveso III Directive	Seveso III Directive	Rotterdam	Basel Convention

		(2012/18/EC) - Qualifying Quantities for Major Accident Notification	(2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Convention (PIC)	(Hazardous Waste)
Trichloroethylene	79-01-6	Not applicable	Not applicable	Not applicable	Annex I - Y45

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 03-Feb-2010
Revision Date 24-Dec-2021
Print Date 24-Dec-2021
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

Attachment 2

Job Hazard Analysis Worksheets

JOB HAZARD ANALYSIS WORKSHEET			
Phase Description:	RAWP		
Task or Operation:	Mobilization, Drilling, Sampling		
Specific Location:	Entire Site		
Task or Operation Start Date(s):	April 2026	**Task or Operation Duration:**	12 Months
Date of Hazard Analysis:	April 2027		
Job Hazard Analysis Developed by:		EK	
Job Hazard Analysis Reviewed by:		EK	

POTENTIAL HAZARDS DURING THIS TASK and/or OPERATION

Chemical*	Physical	Biological	Radiological
» CVOCs (Groundwater & Vapor) » Metals (Soil)	» Hand Tool Use » Heavy Manual Lifting/Moving » Material Handling » Noise (Sound Pressure Level), dBA » Sharp Objects » Slips/Trips/Falls » Traffic - On or Near Site » Utilities (electrical, gas, water, etc.) - Overhead » Utilities (electrical, gas, water, etc.) - Underground	» N/A	» N/A

HAZARD CONTROL MEASURES USED DURING THIS TASK and/or OPERATION

Administrative Controls: Log In/Out Sheets

PPE Description:

Component	Description
Level A Ensemble	
Boots, chemical-resistant, steel toe and shank	
Gloves, inner, chemical-resistant	
Gloves, outer, chemical-resistant	
Supplied Air Respirator - air-line	
Totally-encapsulating vapor tight chemical protective suit	
Level B Ensemble	
Boots, chemical-resistant, steel toe and shank	
Disposable one-piece hooded chemical resistant splash clothing suit	
Gloves, inner, chemical-resistant	
Gloves, outer, chemical-resistant	

Supplied Air Respirator - air-line

	Level C Ensemble	
	Air purifying respirator - full face	
	Boots, chemical-resistant, steel toe and shank	
	Coveralls	
	Disposable one-piece hooded chemical resistant splash clothing suit	
	Escape Mask	
	Gloves, inner, chemical-resistant	
	Gloves, outer, chemical-resistant	
	Level D Ensemble	
	Dust Mask	
	Escape Mask	
	Gloves	
Air-Purifying Respirator Cartridge/Canister Change Schedule:		
Decon Procedures for People & Equipment:	Alconox Tap Water Distilled Water	
Required Permit(s):	N/A	
Other Information:		

*Detailed Chemical Information is listed on attached Hazardous Substance Profiles and/or SDS

Attachment 3

Directions to Hospital

Directions to Hospital

32-20 38th Ave
Long Island City, NY 11101

⚠ This route has tolls.

Take 31st St to Northern Blvd

2 min (0.3 mi)

1. Head northeast toward 38th Ave
   89 ft
2. Turn left onto 38th Ave
   430 ft
3. Turn left at the 2nd cross street onto 31st St
   0.2 mi

Continue to Jackson Ave

7 min (0.9 mi)

4. Continue onto Northern Blvd
   0.2 mi
5. Continue onto Queens Plz E
   299 ft
6. Continue onto Jackson Ave
   0.7 mi

Get on I-495 W

3 min (0.5 mi)

7. Continue straight to stay on Jackson Ave
   0.3 mi
8. Turn left onto 50th Ave
   ⚠ Toll road
   0.1 mi
9. Take the ramp onto I-495 W
   ⚠ Toll road
   0.1 mi

Follow I-495 W to E 37th St in Manhattan. Take the 3 Ave/41 St exit from I-495 W

2 min (1.4 mi)

10. Merge onto I-495 W
    ⚠ Toll road
    256 ft
11. Keep right to stay on I-495 W
    ⚠ Toll road
    1.3 mi
12. Take the 3 Ave/41 St exit toward Uptown/38 St
    ⚠ Toll road
    0.1 mi
13. Take the ramp to 39th St
    ⚠ Toll road
    16 ft

Take 2nd Ave to 1st Ave.

5 min (0.8 mi)

14. Turn right onto E 37th St
    430 ft
15. Turn right onto 2nd Ave
    0.5 mi
16. Turn left onto E 26th St
    0.1 mi
17. Turn left onto 1st Ave.
    ⓘ Destination will be on the right
    397 ft

NYC Health + Hospitals / Bellevue.
462 1st Ave., New York, NY 10016

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

vEKtor consultants

t: +1.347.871.0750
f: +1.347.402.7735

info@vektorconsultants.com
www.vektorconsultants.com

QUALITY ASSURANCE PROJECT PLAN

Prepared For: 38-18 33rd Street LLC and 32-20 38th Avenue LLC

Project Name: Former Refron Inc. Gas Reclamation Site

BCP Site No: C241285

Project Location: 32-10 38th Avenue, 38-18 33rd Street and 32-20 38th Avenue, Queens, NY

Date: April 2026

555 8th Avenue, Suite 2302, New York, NY 10018

Table of Contents

Tables

Figures

Attachments

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared on behalf of 38-18 33rd Street LLC and 32-20 38th Avenue LLC (the Applicant) for the implementation of a Remedial Action Work Plan (RAWP) by Vektor Consultants, LLC (Vektor), AMC Engineering, PLLC (AMC), and their subcontractors at the property located at 32-10 38th Avenue, 38-18 33rd Street and 32-20 38th Avenue in the Long Island City section of Queens County, New York (the Site). The Site is identified by the City of New York as Borough of Brooklyn, Tax Block 381, Lots 5, 12, and 16.

38-13 33rd Street LLC and 32-20 38th Avenue LLC (the "Applicant") enrolled in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) to investigate and remediate the property located at 38-18 33rd Street and 32-20 38th Avenue in the Long Island City section of Queens County, New York (the "Site"). A Brownfield Cleanup Agreement (BCA) was executed by the NYSDEC on March 11, 2025 (Site No. C241285), with the Applicant classified as a Volunteer. The New York State Brownfield Cleanup Agreement Index Number is C241285-01-25, and the Site Number is C241285.

A BCA Amendment was then submitted to the NYSDEC on January 22, 2026, to add a tax parcel (Tax Block: 381, Lot 12) at 32-10 38th Avenue to the BCP Site, and the Amendment was approved on March 20, 2026.

This QAPP describes the protocols and procedures to be followed during the implementation of the RAWP. This QAPP was prepared in accordance with the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation and the NYSDEC BCP Guide.

1.1 Scope of Work

The proposed scope of work covered under this QAPP includes the collection and analysis of post-remedial endpoint soil samples.

The objective of the QAPP is to detail the policies, organization, objectives, functional activities, and specific quality assurance/quality control activities designed to achieve the data quality goals or objectives of the Remedial Action Work Plan. This QAPP addresses how the acquisition and handling of samples, as well as the review and reporting of data, will be documented for quality control (QC) purposes. Specifically, this QAPP addresses the following:

- The procedures to be used to collect, preserve, package, and transport samples;
- Field data collection and record keeping;
- Data management;
- Chain-of-custody procedures; and,

- Determination of precision, accuracy, completeness, representativeness, decision rules, comparability and level of quality control effort.

2.0 PROJECT TEAM

Vektor's and AMC's team of trained and experienced environmental scientists, geologists, and engineers, along with their licensed subcontractors, will perform the below-listed tasks in a manner consistent with DER-10 Technical Guidance for Site Investigation and Remediation (DER-10).

Remedial Engineer, P.E.	Ariel Czemerinski	AMC Engineering PLLC
Project Director, QEP	Ezgi Karayel	Vektor Consultants
Project Manager I	David Klein	Vektor Consultants
QA/QC Officer	Ben Neumann	Vektor Consultants
Field Leader	Izzy Hettleman	Vektor Consultants
Laboratory QA/QC Officer	Jason R. Herbert	Pace Laboratories, Inc.
Third-party Data Validator	Don Anne	Alpha Geoscience

2.1 Principal Engineer

Ariel Czemerinski, Professional Engineer, will act as the Remedial Engineer and will oversee the successful completion of this project. He will have direct responsibility for the preparation and certification of the Remedial Action Work Plan (RAWP). A field scientist/geologist, under the supervision of the PE, will provide full-time oversight during the implementation of the RAWP. Although the QEP and PE are each separately contracted by the Applicant (i.e., remedial party), the PE will oversee and certify all work performed by the QEP under this RAWP. Work conducted in accordance with this RAWP will be documented in daily field reports, monthly progress reports, and in the FER.

2.2 Project Director

Ezgi Karayel, Qualified Environmental Professional, will act as the Project Director and will work with the RE to ensure the successful implementation of the RAWP.

2.3 Project Manager

David Klein of Vektor will act as the Project Managers. They will oversee the field activities and coordinate for all elements of implementation of the RAWP. They will be responsible for coordinating with the field leader and other field crew as necessary.

2.4 QA/QC Officer

Ben Neumann will act as the QA/QC Officer for this project and will be responsible for overseeing g the implementation of this QAPP. He will ensure that all activities conducted under the RAWP comply with applicable requirements, project specifications, and approved standard operating procedures (SOPs). QA/QC Officer is responsible for reviewing all field activities, sampling procedures, chain-of-custodies, and sampling logs. He will document findings and recommend corrective actions, as needed, and report to the RE.

2.5 Field Leader

Izzy Hettleman of Vektor will lead the field activities and ensure the implementation of the Health and Safety Plan (HASP) during all field work. He has the authority to stop all work if unsafe conditions are observed. He will be responsible for coordinating with all subcontractors. He will oversee the subcontractors in the field and collect samples outlined in the RAWP and in this QAPP in coordination with the Project Manager.

2.6 Laboratory Quality Assurance/Quality Control Officer

Laboratory analysis will be completed by Pace Analytical Laboratories (Pace) of Westborough, MA. Pace is a New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) certified laboratory (NY Cert. Number 11148). Melissa Deyo is the Client Manager who will ensure that all glassware including laboratory prepared trip blanks and chain of custodies are properly packaged and shipped. QA/QC Officer is Jason R. Herbert who will ensure that quality assurance procedures are followed. Quality Assurance requirements for analytical laboratory data include accuracy, precision, sensitivity, representativeness, and completeness. Data will be supplied in Analytical Services Protocol (ASP) Category B Data Packages.

2.7 Third-Party Data Validator

Don Anne of Alpha Geoscience will be the third-party validator. Data validation will be performed in accordance with the EPA validation guidelines for organic and inorganic data review. A Data Usability Summary Report (DUSR) will be prepared by Don Anne upon receipt of the analytical laboratory reports. The DUSR will present the results of the data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness of each analytical method.

3.0 SAMPLING METHODS PROCEDURES

This section describes the field protocol and procedures to be followed during the collection of endpoint samples during the implementation of the Remedial Action Work Plan.

Table 1 provides a copy of the endpoint sampling summary. Figure 1 provides a copy of the proposed endpoint sampling plan.

3.1 Soil Sampling

A total of 68 endpoint samples are proposed to be collected; with the endpoint samples ranging from 2 feet and 15 feet below grade are proposed to assess the performance with respect to the attainment of Track 2 Restricted Residential Use SCOs at terminal excavation depths and localized excavation depths for areas with elevated concentrations metals. The total number of bottom and sidewall endpoint samples in this QAPP is estimated and the total samples collected in the field will rely on field conditions.

- A Geologist will be on Site to log the soils, visually characterize them, and field screen them with a photo ionization detector (PID) equipped with 10.6 electron Volt (eV) lamp for the presence of petroleum contamination.
- All soil samples will be collected with disposable dedicated spoons to prevent cross contamination.
- All soil samples will immediately be placed in laboratory supplied glassware and labeled properly. Sample labels include Site address, sample identification and depth, date and time of sampling, analysis to be performed, and sampler's initials.
- Soil samples will be placed in coolers with ice to maintain a temperature of 4^{o} C.
- A chain of custody that includes Site name and address, sample identification and depth, analysis to be performed, glassware summary, sampler's name and signature, turn-around-time and any additional notes will be prepared.
- All field observations including boring logs and PID readings will be recorded in a field book.
- Sampling equipment will be decontaminated between borings as further described in Section 3.0.
- All samples will be picked up from the Site on a daily basis by the laboratory's courier. The courier will sign the chain of custody upon pick up and provide a copy to Vektor or AMC.

The soil samples will be analyzed for:

- Target Compound List (TCL) volatile organic compounds (VOCs) via Environmental Protection Agency (EPA) Method 8260C/5035
- TCL semi-volatile organic compounds (SVOCs) via EPA Method 8270D
- Total analyte list (TAL) metals via EPA Method 6010D/7471B

- Polychlorinated biphenyls (PCBs) via EPA Method 8082A
- TLC pesticides via EPA Method 8081B
- NYSDEC list per and polyfluoroalkyl substances (PFAS) via EPA Method 1633
- 1,4-dioxane via EPA Method 8270 SIM.

3.2 PFAS Sampling Procedures

- PFAS samples will be collected first in order to prevent cross-contamination since sample containers for other methods may have PFAS present on the containers.
- Nitrile gloves will be using during sampling.
- No food or drink will be present during PFAS sampling.
- No waterproof field notebooks, plastic clipboards, sharpies, or adhesives will be used.
- PFAS samples will be kept in a separate cooler away from other sampling containers that may contain PFAS.
- Coolers will be filled with regular ice only.
- Only Alconox will be used for decontamination.
- Sampler will not wear clothing washed with fabric softener or containing Tyvek or PVC.
- Sampler will not use cosmetics, moisturizer, hand cream or other similar products on the day of the sampling.
- Sampler will not wear sunscreen or insect repellants.

Table 2 provides a list of the PFAS Compounds that will be analyzed along with their method detection limits (MDLs).

Attachment 1 provides a copy of the NYSDEC Guidance document for sampling and analysis, and assessment of PFAS under NYSDEC's Part 375 Remedial Programs.

Attachment 2 provides a copy of Pace Laboratories' Standard Operating Procedure Summary for PFAS in Groundwater, Surface Water, and Soils.

Attachment 3 provides a copy of Pace Laboratories' PFOS/PFOA Certification and Reporting Limits for PFAS.

Attachment 4 provides a copy of blank chain of custody samples.

3.3 Quality Assurance (QA)/ Quality Control (QC) Sampling

The accuracy, precision and completeness of the samples will be addressed by the certified laboratory for all data generated. One blind duplicate sample and one matrix spike/matrix spike duplicate (MS/MSD) sample will be collected for every 20 samples media and submitted to the laboratory for analysis of the same parameters. One field blank per sampling media will be collected and analyzed for the same parameters as the respective media. Trip blanks will be included in each cooler whenever samples are collected and transported to the laboratory for analysis of VOCs.

3.3.1 Trip Blanks

A trip blank consisting of two 40-ml vials filled with distilled, deionized water, will be provided by the laboratory. Trip blanks will be included in each cooler and will be analyzed for VOCs.

3.3.2 Field Blanks

Field blanks will be collected at a rate of one per 20 soil samples. Field blanks will be analyzed for the same analysis as the soil samples collected on the day of the sampling.

3.3.3 PFAS Field Blank

A PFAS field blank will be prepared on each day that PFAS sampling occurs. The laboratory will provide PFAS blank bottles as well as pre-filled PFAS field blank water containers. The contents of the PFAS field blank water container will be transferred into the PFAS field blank bottle. Both bottles will be returned to the laboratory along with the PFAS samples that were collected. PFAS field blank will be collected at a minimum of 1 per day on each day PFAS sampling occurs.

3.3.4 Blind Duplicate

A blind duplicate sample will be collected at a rate of one per 20 soil samples. Blind duplicates will be analyzed for the same analysis as the soil and samples collected on the day of the sampling.

3.3.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD samples will be collected at a rate of one per 20 soil samples. MS/MSD samples will be analyzed for the same analysis as the soil samples collected on the day of the sampling.

Table 3 provides laboratory analytical methods, glassware, and holding times for each analysis.

3.4 Field Instrumentation

The field instruments to be used during the implementation of the remedial action work plan will be calibrated at the beginning of each day as per the manufacturers' specifications. Calibration records will be recorded in the field book.

4.0 DECONTAMINATION

All sampling equipment will be decontaminated between sampling locations unless they are dedicated disposable tools. Decontamination of non-dedicated sampling equipment will consist of the following procedure:

- Gently tap or scrape to remove adhered soil
- Rinse with tap water
- Wash with Alconox detergent solution and scrub
- Rinse with tap water
- Rinse with distilled or deionized water

TABLES

Table 1
Endpoint Sampling Rationale and Summary
Former Refron Inc. Gas Reclamation Site
32-10 38th Avenue, 38-18 33rd Street and 32-20 38th Avenue, Queens, NY

Sample Matrix	Sample ID	Sample Interval (feet below surface grade)	Rationale	Estimated Number of Samples	Analysis
SOIL	EP-1	Collect at 2 feet below grade	To assess if Track 2 SCOs are achieved at the bottom of excavation	1	Target Compound List (TCL) volatile organic compounds (VOCs) via USEPA 8260C/5035, TCL semivolatile organic compounds (SVOCs) via USEPA 8270D, polychlorinated biphenyls (PCBs) via USEPA 8082A, Pesticides via USEPA 8081B, Total Analyte List (TAL) Metals via USEPA 6010D/7471B, Cyanide total via USEPA 9014/9010C, per- and poly-fluoroalkyl substances (PFAS) via USEPA 1633, and 1,4-dioxane via USEPA 8270SIM
	EP-2	Collect at 2 feet below grade		1	
	EP-3	Collect at 2 feet below grade		1	
	EP-4	Collect at 2 feet below grade		1	
	EP-5	Collect at 2 feet below grade		1	
	EP-6	Collect at 14 feet below grade		1	
	EP-7	Collect at 2 feet below grade		1	
	EP-8	Collect at 2 feet below grade		1	
	EP-9	Collect at 18 feet below grade		1	
	EP-10	Collect at 2 feet below grade		1	
	EP-11	Collect at 2 feet below grade		1	
	EP-12	Collect at 2 feet below grade		1	
	EP-13	Collect at 2 feet below grade		1	
	EP-14	Collect at 2 feet below grade		1	
	EP-15	Collect at 2 feet below grade		1	
	EP-16	Collect at 2 feet below grade		1	
	EP-17	Collect at 2 feet below grade		1	
	EP-18	Collect at 5 feet below grade		1	
	EP-19	Collect at 2 feet below grade		1	
	EP-20	Collect at 2 feet below grade		1	
	EP-21	Collect at 2 feet below grade		1	
	EP-22	Collect at 2 feet below grade		1	
	EP-23	Collect at 2 feet below grade		1	
	EP-24	Collect at 5 feet below grade		1	
	EP-25	Collect at 2 feet below grade		1	

* Additional soil samples may be collected based on field conditions (i.e: post excavation lab results, elevated PID readings, odor, sheen, etc.)

Table 1
Endpoint Sampling Rationale and Summary
Former Refron Inc. Gas Reclamation Site
32-10 38th Avenue, 38-18 33rd Street and 32-20 38th Avenue, Queens, NY

Sample Matrix	Sample ID	Sample Interval (feet below surface grade)	Rationale	Estimated Number of Samples	Analysis
SOIL	EP-26	Collect at 4-5 feet below grade	To assess if Track 2 SCOs are achieved at the bottom of excavation	1	Target Compound List (TCL) volatile organic compounds (VOCs) via USEPA 8260C/5035, TCL semivolatile organic compounds (SVOCs) via USEPA 8270D, polychlorinated biphenyls (PCBs) via USEPA 8082A, Pesticides via USEPA 8081B, Total Analyte List (TAL) Metals via USEPA 6010D/7471B, Cyanide total via USEPA 9014/9010C, per- and poly-fluoroalkyl substances (PFAS) via USEPA 1633, and 1,4-dioxane via USEPA 8270SIM
	EP-27	Collect at 4-5 feet below grade		1	
	EP-28	Collect at 2 feet below grade		1	
	EP-29	Collect at 2 feet below grade		1	
	EP-30	Collect at 5 feet below grade		1	
	EP-31	Collect at 15 feet below grade	To assess if Track 2 SCOs are achieved from the bottom of sidewalls of excavation	1	
	EP-32	Collect at 4-5 feet below grade		1	
	EP-33	Collect at 4-5 feet below grade		1	
	EP-34	Collect at 4-5 feet below grade		1	
	EP-35	Collect at 4-5 feet below grade		1	
	EP-36	Collect at 4-5 feet below grade		1	
	EP-37	Collect at 15 feet below grade		1	
	EP-38	Collect at 5 feet below grade		1	
	EP-39	Collect at 2 feet below grade		1	
	EP-40	Collect at 2 feet below grade		1	
	EP-41	Collect at 2 feet below grade		1	
	EP-42	Collect at 2 feet below grade		1	
	EP-43	Collect at 2 feet below grade		1	
	EP-44	Collect at 2 feet below grade		1	
	EP-45	Collect at 2 feet below grade		1	
	EP-46	Collect at 2 feet below grade		1	
	EP-47	Collect at 2 feet below grade		1	
	EP-48	Collect at 2 feet below grade		1	
	EP-49	Collect at 2 feet below grade		1	
	EP-50	Collect at 2 feet below grade		1	

* Additional soil samples may be collected based on field conditions (i.e: post excavation lab results, elevated PID readings, odor, sheen, etc.)

Table 1
Endpoint Sampling Rationale and Summary
Former Refron Inc. Gas Reclamation Site
32-10 38th Avenue, 38-18 33rd Street and 32-20 38th Avenue, Queens, NY

Sample Matrix	Sample ID	Sample Interval (feet below surface grade)	Rationale	Estimated Number of Samples	Analysis
SOIL	EP-51	Collect at 2 feet below grade	To assess if Track 2 SCOs are achieved from the bottom of sidewalls of excavation	1	Target Compound List (TCL) volatile organic compounds (VOCs) via USEPA 8260C/5035, TCL semivolatile organic compounds (SVOCs) via USEPA 8270D, polychlorinated biphenyls (PCBs) via USEPA 8082A, Pesticides via USEPA 8081B, Total Analyte List (TAL) Metals via USEPA 6010D/7471B, Cyanide total via USEPA 9014/9010C, per- and poly-fluoroalkyl substances (PFAS) via USEPA 1633, and 1,4-dioxane via USEPA 8270SIM
	EP-52	Collect at 2 feet below grade		1	
	EP-53	Collect at 2 feet below grade		1	
	EP-54	Collect at 2 feet below grade		1	
	EP-55	Collect at 2 feet below grade		1	
	EP-56	Collect at 2 feet below grade		1	
	EP-57	Collect at 2 feet below grade		1	
	EP-63	Collect at 2 feet below grade		1	
	EP-64	Collect at 4-5 feet below grade		1	
	EP-60	Collect at 18 feet below grade		1	
	EP-61	Collect at 2 feet below grade		1	
	EP-62	Collect at 2 feet below grade		1	
	EP-67	Collect at 2 feet below grade		1	
	EP-68	Collect at 2 feet below grade		1	
	EP-58	Collect at 14 feet below grade	To assess if Track 2 SCOs are achieved from the former SB-8 hotspot	1	
	EP-59	Collect at 14 feet below grade		1	
	EP-65	Collect at 14 feet below grade		1	
	EP-66	Collect at 14 feet below grade		1	
	SB-DUP-1(Depth)	Blind Duplicate: One per 20 soil samples	QA/QC	1	
	SB-DUP-2(Depth)	Blind Duplicate: One per 20 soil samples	QA/QC	1	
	SB-DUP-3(Depth)	Blind Duplicate: One per 20 soil samples	QA/QC	1	
	SB-DUP-4(Depth)	Blind Duplicate: One per 20 soil samples	QA/QC	1	
	SB-DUP-5(Depth)	One per 20 soil samples	QA/QC	1	
	SB-MS/MSD-1 (Depth)	One per 20 soil samples	QA/QC	1	
	SB-MS/MSD-2 (Depth)	One per 20 soil samples	QA/QC	1	
	SB-MS/MSD-3 (Depth)	One per 20 soil samples	QA/QC	1	
	SB-MS/MSD-4 (Depth)	One per 20 soil samples	QA/QC	1	
	SB-MS/MSD-5 (Depth)	One per 20 soil samples	QA/QC	1	

* Additional soil samples may be collected based on field conditions (i.e: post excavation lab results, elevated PID readings, odor, sheen, etc.)

Table 1
Endpoint Sampling Rationale and Summary
Former Refron Inc. Gas Reclamation Site
32-10 38th Avenue, 38-18 33rd Street and 32-20 38th Avenue, Queens, NY

Sample Matrix	Sample ID	Sample Interval (feet below surface grade)	Rationale	Estimated Number of Samples	Analysis
WATER	FB-1	Field Blank per 20 samples	QA/QC	1	Target Compound List (TCL) volatile organic compounds (VOCs) via USEPA 8260C/5035, TCL semivolatile organic compounds (SVOCs) via USEPA 8270D, polychlorinated biphenyls (PCBs) via USEPA 8082A, Pesticides via USEPA 8081B, Total Analyte List (TAL) Metals via USEPA 6010D/7471B, Cyanide total via USEPA 9014/9010C, per- and poly-fluoroalkyl substances (PFAS) via USEPA 1633, and 1,4-dioxane via USEPA 8270SIM
	FB-2	Field Blank per 20 samples	QA/QC	1	
	FB-3	Field Blank per 20 samples	QA/QC	1	
	FB-4	Field Blank per 20 samples	QA/QC	1	
	FB-5	Field Blank per 20 samples	QA/QC	1	
	TB-1	Trip Blank: 1 per cooler per day (Lab-prepared)	QA/QC	5	TCL VOCs via USEPA 8260

Totals

Sample #s	Rationale	Total
EP-1 through EP-33 and EP-52, EP-67, EP-68	Assess Track 2 at Remedial Depth	36
EP-34 through EP-51, EP-53 through EP-57, and EP-60 through EP-64	Assess Track 2 at Remedial Depth along Sidewalls	28
EP-58, EP-59, EP-65, EP-66	Assess former SB-8 hotspot and Track 2 at Remedial Depth	4
Field Duplicate	QA/QC	5
MS/MSD		5
Field Blank**		5
Trip Blank		5
Total Samples		88

* Additional soil samples may be collected based on field conditions (i.e: post excavation lab results, elevated PID readings, odor, sheen, etc.)
**** PFAS Field Blank will be collected on each day when a PFAS sample is collected**

Table 2
List of PFAS Compounds, Reporting Limits, and Method Detection Limits in Soil

Analyte	CAS #	RL	MDL	Units
Perfluorobutanoic Acid (PFBA)	375-22-4	0.8	0.536	ng/g
Perfluoropentanoic Acid (PFPeA)	2706-90-3	0.4	0.08	ng/g
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	0.2	0.05	ng/g
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	757124-72-4	0.8	0.154	ng/g
Perfluorohexanoic Acid (PFHxA)	307-24-4	0.2	0.164	ng/g
Perfluoropentanesulfonic Acid (PFPeS)	2706-91-4	0.2	0.028	ng/g
Perfluoroheptanoic Acid (PFHpA)	375-85-9	0.2	0.072	ng/g
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	0.2	0.05	ng/g
Perfluorooctanoic Acid (PFOA)	335-67-1	0.2	0.044	ng/g
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	0.8	0.48	ng/g
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	0.2	0.034	ng/g
Perfluorononanoic Acid (PFNA)	375-95-1	0.2	0.032	ng/g
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	0.2	0.104	ng/g
Perfluorodecanoic Acid (PFDA)	335-76-2	0.2	0.05	ng/g
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	0.8	0.236	ng/g
Perfluorononanesulfonic Acid (PFNS)	68259-12-1	0.2	0.094	ng/g
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	2355-31-9	0.2	0.096	ng/g
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	0.2	0.088	ng/g
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	0.2	0.094	ng/g
Perfluorooctanesulfonamide (FOSA)	754-91-6	0.2	0.114	ng/g
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	0.2	0.078	ng/g
Perfluorododecanoic Acid (PFDoA)	307-55-1	0.2	0.1	ng/g
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	0.2	0.092	ng/g
Perfluorotetradecanoic Acid (PFTA)	376-06-7	0.2	0.146	ng/g
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanc	13252-13-6	0.8	0.16	ng/g
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	919005-14-4	0.8	0.284	ng/g
Perfluorododecane Sulfonic Acid (PFDoDS)	79780-39-5	0.2	0.094	ng/g
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS	756426-58-1	0.8	0.156	ng/g
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3	763051-92-9	0.8	0.396	ng/g
N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)	31506-32-8	0.2	0.06	ng/g
N-Ethyl Perfluorooctane Sulfonamide (NEtFOSA)	4151-50-2	0.2	0.066	ng/g
N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)	24448-09-7	2	0.25	ng/g
N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)	1691-99-2	2	0.242	ng/g
Perfluoro-3-Methoxypropanoic Acid (PFMPA)	377-73-1	0.4	0.036	ng/g
Perfluoro-4-Methoxybutanoic Acid (PFMBA)	863090-89-5	0.4	0.052	ng/g
Perfluoro(2-Ethoxyethane)Sulfonic Acid (PFEESA)	113507-82-7	0.4	0.048	ng/g
Nonafluoro-3,6-Dioxaheptanoic Acid (NFDHA)	151772-58-6	0.4	0.12	ng/g
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	356-02-5	1	0.346	ng/g
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	914637-49-3	5	1.404	ng/g
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	812-70-4	5	1.95	ng/g
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*			
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*			

Table 2
PFAS Compounds, Reporting Limits, and Method Detection Limits in Water

Analyte	CAS #	RL	MDL	Units
Perfluorobutanoic Acid (PFBA)	375-22-4	6.4	4.288	ng/l
Perfluoropentanoic Acid (PFPeA)	2706-90-3	3.2	0.64	ng/l
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	1.6	0.512	ng/l
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	757124-72-4	6.4	1.488	ng/l
Perfluorohexanoic Acid (PFHxA)	307-24-4	1.6	1.312	ng/l
Perfluoropentanesulfonic Acid (PFPeS)	2706-91-4	1.6	0.368	ng/l
Perfluoroheptanoic Acid (PFHpA)	375-85-9	1.6	0.496	ng/l
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	1.6	0.704	ng/l
Perfluorooctanoic Acid (PFOA)	335-67-1	1.6	0.4	ng/l
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	6.4	3.84	ng/l
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	1.6	0.496	ng/l
Perfluorononanoic Acid (PFNA)	375-95-1	1.6	0.256	ng/l
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	1.6	1.232	ng/l
Perfluorodecanoic Acid (PFDA)	335-76-2	1.6	0.416	ng/l
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	6.4	3.056	ng/l
Perfluorononanesulfonic Acid (PFNS)	68259-12-1	1.6	0.528	ng/l
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	2355-31-9	1.6	1.152	ng/l
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	1.6	0.704	ng/l
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	1.6	0.752	ng/l
Perfluorooctanesulfonamide (FOSA)	754-91-6	1.6	0.912	ng/l
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	1.6	0.736	ng/l
Perfluorododecanoic Acid (PFDoA)	307-55-1	1.6	0.8	ng/l
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	1.6	0.736	ng/l
Perfluorotetradecanoic Acid (PFTA)	376-06-7	1.6	1.168	ng/l
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propano	13252-13-6	6.4	0.944	ng/l
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	919005-14-4	6.4	1.248	ng/l
Perfluorododecane Sulfonic Acid (PFDoDS)	79780-39-5	1.6	0.752	ng/l
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS	756426-58-1	6.4	1.248	ng/l
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3	763051-92-9	6.4	3.168	ng/l
N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)	31506-32-8	1.6	0.624	ng/l
N-Ethyl Perfluorooctane Sulfonamide (NEtFOSA)	4151-50-2	1.6	0.464	ng/l
N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)	24448-09-7	16	1.696	ng/l
N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)	1691-99-2	16	1.44	ng/l
Perfluoro-3-Methoxypropanoic Acid (PFMPA)	377-73-1	3.2	0.144	ng/l
Perfluoro-4-Methoxybutanoic Acid (PFMBA)	863090-89-5	3.2	0.832	ng/l
Perfluoro(2-Ethoxyethane)Sulfonic Acid (PFEESA)	113507-82-7	3.2	0.4	ng/l
Nonafluoro-3,6-Dioxaheptanoic Acid (NFDHA)	151772-58-6	3.2	0.944	ng/l
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	356-02-5	8	2.064	ng/l
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	914637-49-3	40	11.488	ng/l
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	812-70-4	40	12.08	ng/l
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*			
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*			

Table 3
Preservation and Holding Times
Former Refron Inc. Gas Reclamation Site
32-10 38th Avenue, 38-18 33rd Street, and 32-20 38th Avenue, Queens, NY

Sample Matrix	Analysis	EPA Method	Container	Preservation	Holding Time
Soil and Soil QA/QC Samples	VOCs	8260C/5035	Glass, Four 40-ml vials with teflon-lined cap: 2 VOA vials with 5-ml H_2O, 1 VOA vial with MeOH, and 1 blank vial or 5-g Encore samplers	Cool, 4^oC	14 days
	SVOCs	8270D	Glass, 8-oz teflon-line cap	Cool, 4^oC	14 days to extract, 40 days after extraction to analyze
	PCBs & Pesticides	8082A & 8081B	Glass, 100-g tefloned-lined cap	Cool, 4^oC	14 days to extract, 40 days after extraction to analyze
	Metals	6010D/7471B	Glass, 2-oz teflon-lined cap	Cool, 4^oC	6 months (except for mercury 28 days)
	PFAS	1633	8-oz HDPE bottles	Cool, 4^oC	28 days
	1,4-Dioxane	8270SIM	Glass, Four 40-ml vials with teflon-lined cap: 2 VOA vials with 5-ml H2O, 1 VOA vial with MeOH, and 1 blank vial or 5-g Encore samplers	Cool, 4^oC	14 days

FIGURES

vEKtor consultants
t: +1.347.871.0750
f: +1.347.402.7735
e: info@vektorconsultants.com
www.vektorconsultants.com

Legend:

Site Boundary

EP-X End Point Sample ID and Location

Scale:

0 25' 50'

Figure No.	1
Figure Name:	PROPOSED END POINT SAMPLING PLAN
Report:	QAPP
Date:	4/6/2026
Drawn By:	KB
Site Address:	32-10 38TH AVENUE, 32-20 38TH AVENUE & 38-13 33RD STREET QUEENS, NEW YORK

ATTACHMENTS

ATTACHMENT 1

NYSDEC Guidance for PFAS Sampling

NEW YORK
STATE OF
OPPORTUNITY.

Department of
Environmental
Conservation

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC's Part 375 Remedial Programs

April 2023

www.dec.ny.gov

Table of Contents

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

ERRATA SHEET for

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) Under NYSDEC's Part 375 Remedial Programs Issued January 17, 2020

Citation and Page Number	Current Text	Corrected Text	Date
Title of Appendix I, page 32	Appendix H	Appendix I	2/25/2020
Document Cover, page 1	Guidelines for Sampling and Analysis of PFAS	Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs	9/15/2020
Data Assessment and Application to Site Cleanup Page 3	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published	Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published	3/28/2023
Water Sample Results Page 3	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below.	NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These guidance values also include criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt).Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.	3/28/2023
Soil Sample Results Page 3	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values:	NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:	3/28/2023
Protection of Groundwater Page 3	PFOA (ppb) 1.1 PFOS (ppb) 3.7	PFOA (ppb) 0.8 PFOS (ppb) 1.0	3/28/2023

Citation and Page Number	Current Text	Corrected Text	Date
Footnote 2 Page 3	The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	3/28/2023
Testing for Imported Soil Page 4	If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.	If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable.	3/28/2023
Routine Analysis, page 9	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101."	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533."	9/15/2020
Additional Analysis, page 9, new paragraph regarding soil parameters	None	"In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils."	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Data Assessment and Application to Site Cleanup Page 10	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.	9/15/2020
Water Sample Results Page 10	PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (…) If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (…) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Soil Sample Results, page 10	"The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase."	"Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. " [Interim SCO Table] "PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP. As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf. "	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Testing for Imported Soil Page 11	Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs. If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable. PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	9/15/2020

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Citation and Page Number	Current Text	Corrected Text	Date
Footnotes	None	[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. [2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	9/15/2020
Additional Analysis, page 9	In cases… soil parameters, such as Total Organic Carbon (EPA Method 9060), soil…	In cases… soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil…	1/8/2021
Appendix A, General Guidelines, fourth bullet	List the ELAP-approved lab(s) to be used for analysis of samples	List the ELAP- certified lab(s) to be used for analysis of samples	1/8/2021
Appendix E, Laboratory Analysis and Containers	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101.	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101	1/8/2021
Water Sample Results Page 9	"In addition, further assessment of water may be warranted if either of the following screening levels are met: a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L"	Deleted	6/15/2021

Citation and Page Number	Current Text	Corrected Text	Date
Routine Analysis, Page XX	Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP)… criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids).	Deleted	5/31/2022
Analysis and Reporting, Page XX	As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.	Deleted	5/31/2022
Routine Analysis, Page XX	LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media.	EPA Method 1633 is the procedure to use for environmental samples.	
Soil Sample Results, Page XX	Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6	
Appendix A	"Include in the text… LC-MS/MS for PFAS using methodologies based on EPA Method 537.1"	"Include in the text ….EPA Method 1633"	
Appendix A	"Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101"	Deleted	
Appendix B	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	

Citation and Page Number	Current Text	Corrected Text	Date
Appendix C	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	
Appendix D	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	
Appendix G		Updated to include all forty PFAS analytes in EPA Method 533	
Appendix H		Deleted	
Appendix I	Appendix I	Appendix H	
Appendix H	"These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report."	"These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER)."	
Appendix H	"The holding time is 14 days…"	"The holding time is 28 days…"	
Appendix H, Initial Calibration	"The initial calibration should contain a minimum of five standards for linear fit…"	"The initial calibration should contain a minimum of six standards for linear fit…"	
Appendix H, Initial Calibration	Linear fit calibration curves should have an R^2 value greater than 0.990.	Deleted	
Appendix H, Initial Calibration Verification	Initial Calibration Verification Section	Deleted	
Appendix H	secondary Ion Monitoring Section	Deleted	
Appendix H	Branched and Linear Isomers Section	Deleted	

Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments, or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.

Analysis and Reporting

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third-party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix G) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

EPA Method 1633 is the procedure to use for environmental samples. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist. Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.[1]

---

[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These human health criteria should also be applied to surface water that is used as a water supply. This guidance also includes criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt). Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:

Guidance Values for Anticipated Site Use	PFOA (ppb)	PFOS (ppb)
Unrestricted	0.66	0.88
Residential	6.6	8.8
Restricted Residential	33	44
Commercial	500	440
Industrial	600	440
Protection of Groundwater[2]	0.8	1.0

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These

[2] The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).

additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf.

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
    - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP certified lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an "Analytical Methods/Quality Assurance Summary Table" specifying:
    - Matrix type
    - Number or frequency of samples to be collected per matrix
    - Number of field and trip blanks per matrix
    - Analytical parameters to be measured per matrix
    - Analytical methods to be used per matrix with minimum reporting limits
    - Number and type of matrix spike and matrix spike duplicate samples to be collected
    - Number and type of duplicate samples to be collected
    - Sample preservation to be used per analytical method and sample matrix
    - Sample container volume and type to be used per analytical method and sample matrix
    - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by EPA Method 1633
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
    - Reporting Limits should be less than or equal to:
        - Aqueous – 2 ng/L (ppt)
        - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
-
- Include detailed sampling procedures
    - Precautions to be taken
    - Pump and equipment types
    - Decontamination procedures
    - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the current SOP developed by the Division of Fish and Wildlife (DFW) entitled "General Fish Handling Procedures for Contaminant Analysis" (Ver. 8). This SOP should be followed when collecting fish for contaminant analysis. Note, however, that the Bureau of Ecosystem Health will not be supplying bags or tags. All supplies are the responsibility of the collector

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

   1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

   2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

   3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

   1. Project and Site Name.

   2. DEC Region.

   3. All personnel (and affiliation) involved in the collection.

   4. Method of collection (gill net, hook and line, etc.)

   5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

   1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

   2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

   3. Date collected.

   4. Sample location (waterway and nearest prominent identifiable landmark).

   5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate "Age" column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish's tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **The Bureau of Ecosystem Health will supply the bags.** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

    No materials containing Teflon.
    No Post-it notes.
    No ice packs; only water ice or dry ice.
    Any gloves worn must be powder free nitrile.
    No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
    No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
    Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
    Wash hands after handling any food containers or packages as these may contain PFCs. Keep pre-wrapped food containers and wrappers isolated from fish handling.
    Wear clothing washed at least six times since purchase.
    Wear clothing washed without fabric softener.
    Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with "fluor" in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name ____ DEC Region ____________

Collections made by (include all crew) ____

Sampling Method: ☐Electrofishing ☐Gill netting ☐Trap netting ☐Trawling ☐Seining ☐Angling ☐Other ____________________

Preservation Method: ☐Freezing ☐Other ____________________ Notes (SWFDB survey number): ____________________

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, ______________________________, of ____ collected the
(Print Name) (Print Business Address)

following on ____________________, 20____ from ____
(Date) (Water Body)

in the vicinity of ____
(Landmark, Village, Road, etc.)

Town of _______________________________________, in _________________________________ County.

Item(s) ____

____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on ___________________________________, 20______.

____ ___________________________
Signature Date

I, __________________________________, received the above mentioned sample(s) on the date specified and assigned identification number(s) ____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_______________________________________ ___________________
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonic acids	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorononanesulfonic acid	PFNS	68259-12-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
	Perfluorododecanesulfonic acid	PFDoS	79780-39-5
Perfluoroalkyl carboxylic acids	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUnA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTeDA	376-06-7
Per- and Polyfluoroether carboxylic acids	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
	Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
	Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Fluorotelomer sulfonic acids	4:2 Fluorotelomer sulfonic acid	4:2-FTS	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2-FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2-FTS	39108-34-4
Fluorotelomer carboxylic acids	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5
	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
	7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4
Perfluorooctane sulfonamides	Perfluorooctane sulfonamide	PFOSA	754-91-6
	N-methylperfluorooctane sulfonamide	NMeFOSA	31506-32-8
	N-ethylperfluorooctane sulfonamide	NEtFOSA	4151-50-2
Perfluorooctane sulfonamidoacetic acids	N-methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6
Perfluorooctane sulfonamide ethanols	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
	N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2

Group	Chemical Name	Abbreviation	CAS Number
Ether sulfonic acids	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)	9Cl-PF3ONS	756426-58-1
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)	11Cl-PF3OUdS	763051-92-9
	Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7

Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER). Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 28 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of six standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

ATTACHMENT 2

Laboratory Standard Operating Procedure Summary for PFAS & Reporting Limits for PFAS

Method 1633 Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, Oil and Tissue Samples by LC-MS/MS

References: Method 1633 - Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, Oil and Tissue Samples by LC-MS/MS (2^{nd} Draft -June 2022)

DOD QSM (US Department of Defense Quality Systems Manual for Environmental Laboratories, version 5.4, 20221)

1. Scope and Application

Matrices: Drinking water, Non-potable Water, Tissues, Oils, Biosolids and Solid Matrices

Definitions: Refer to Alpha Analytical Quality Manual.

1.1 Method 1633 is for use in the Clean Water Act (CWA) for the determination of the per- and polyfluoroalkyl substances (PFAS) in Table 1 in aqueous, solid (soil, biosolids, sediment) and tissue samples by liquid chromatography/mass spectrometry (LC-MS/MS).

1.2 The method calibrates and quantifies PFAS analytes using isotopically labeled standards. Where linear and branched isomers are present in the sample and either qualitative or quantitative standards containing branched and linear isomers are commercially available, the PFAS analyte is reported as a single analyte consisting of the sum of the linear and branched isomer concentrations

1.3 This is a liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected perfluorinated alkyl substances (PFAS) in Non-Drinking Water, tissue soil and biosolid Matrices. Accuracy and precision data have been generated for the compounds listed in Table 1.

1.4 The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

1.5 This method is restricted to use by or under the supervision of analysts experienced in the operation of the LC/MS/MS and in the interpretation of LC/MS/MS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

2.1 Environmental samples are prepared and extracted using method-specific procedures. Sample extracts are subjected to cleanup procedures designed to remove interferences. Analyses of the sample extracts are conducted by LC-MS/MS in the multiple reaction monitoring (MRM) mode. Sample concentrations are determined by isotope dilution or extracted internal standard quantification using isotopically labeled compounds added to the samples before extraction.

2.2 Aqueous samples are spiked with isotopically labeled standards, extracted using solid-phase extraction (SPE) cartridges and undergo cleanup using carbon before analysis.

2.3 Solid and Oil samples are spiked with isotopically labeled standards, extracted into basic methanol, and cleaned up by carbon and SPE cartridges before analysis

2.4 Tissue samples are spiked with isotopically labeled standards, extracted in potassium hydroxide and acetonitrile followed by basic methanol, and cleaned up by carbon and SPE cartridges before analysis.

2.5 A sample extract is injected into an LC equipped with a C18 column that is interfaced to an MS/MS). The analytes are separated and identified by comparing the acquired mass spectra and retention times to reference spectra and retention times for calibration standards acquired under identical LC/MS/MS conditions. The concentration of each analyte is determined by using the isotope dilution technique. Extracted Internal Standards (EIS) analytes are used to monitor the extraction efficiency of the method analytes.

2.6 Method Modifications from Reference

N/A

3. Reporting Limits

The reporting limit for PFAS's are listed in Table 8.

4. Interferences

4.1 PFAS standards, extracts and samples should not come in contact with any glass containers or pipettes as these analytes can potentially adsorb to glass surfaces. PFAS analyte and EIS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers.

4.2 Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The method analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, SPE sample transfer lines, etc. All items such as these must be routinely demonstrated to be free from interferences (less than 1/2 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.1. Subtracting blank values from sample results is not permitted.

4.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent. Total organic carbon (TOC) is a good indicator of humic content of the sample.

4.4 SPE cartridges can be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

5. Health and Safety

5.1 The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

5.2 All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.3 PFOA has been described as “likely to be carcinogenic to humans.” Pure standard materials and stock standard solutions of these method analytes should be handled with suitable protection to skin and eyes, and care should be taken not to breathe the vapors or ingest the materials.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection for Aqueous Samples

6.1.1 Samples must be collected in two (2) 500-mL or 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap. All sample containers must have linerless HDPE or polypropylene caps.

6.1.2 The sample handler must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.

6.1.3 Open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 min). Collect samples from the flowing system.

6.1.4 Fill sample bottles. Samples do not need to be collected headspace free.

6.1.5 After collecting the sample and cap the bottle. Keep the sample sealed from time of collection until extraction.

6.1.6 Maintain all aqueous samples protected from light at 0 - 6 ºC from the time of collection until shipped to the laboratory. Samples must be shipped as soon as practical with sufficient ice to maintain the sample temperature below 6 ºC during transport and be received by the laboratory within 48 hours of collection. The laboratory must confirm that the sample temperature is 0 - 6 ºC upon receipt. Once received by the laboratory, the samples must be stored at ≤ -20 ºC until sample preparation.

6.2 Sample Collection for Solid and Oil samples.

6.2.1 Grab samples are collected in polypropylene containers. Sample containers and contact surfaces containing PTFE shall be avoided. Samples should fill no more than ¾ full.

6.2.2 Maintain solid samples protected from light (in HDPE containers) at 0 - 6 ºC from the time of collection until receipt at the laboratory. The laboratory must confirm that the sample temperature is 0 - 6 ºC upon receipt. Once received by the laboratory, the samples must be stored at ≤ -20 ºC until sample preparation.

6.3 Sample Collection for fish and other tissue samples

6.3.1 If the time of collection to the time of receipt at the laboratory is expected to exceed 24 hours, the tissue samples must be frozen upon collection and shipped to the laboratory on dry ice.

6.3.2 Once received by the laboratory, the samples must be maintained protected from light at ≤ -20 ºC until prepared. Store unused samples in HDPE containers or wrapped in aluminum foil at ≤ -20 ºC.

6.3.3 The nature of the tissues of interest may vary by project. Field sampling plans and protocols should explicitly state the samples to be collected and if any processing will be conducted in the field (e.g., filleting of whole fish or removal of organs). All field procedures must involve materials and equipment that have been shown to be free of PFAS.

6.4 Sample Preservation

Not applicable.

6.5 Sample Shipping

Samples must be chilled during shipment and must not exceed 0 – 6 °C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 0 – 6 °C when the samples are received at the laboratory. Samples stored in the lab must be held at or below 6 °C until extraction but should not be frozen.

NOTE: Samples that are significantly above 0 – 6 ° C, at the time of collection, may need to be iced or refrigerated for a period of time, in order to chill them prior to shipping. This will allow them to be shipped with sufficient ice to meet the above requirements.

6.6 Sample Handling

6.6.1 Aqueous samples (including leachates) should be analyzed as soon as possible; however, samples may be held in the laboratory for up to 90 days from collection, when stored at ≤ -20 ºC and protected from the light. When stored at 0 - 6 ºC and protected from the light, aqueous samples may be held for up to 28 days, with the caveat that issues were observed with certain perfluorooctane sulfonamide ethanols and perfluorooctane sulfonamidoacetic acids after 7 days. These issues are more likely to elevate the observed concentrations of other PFAS compounds via the transformation of these precursors if they are present in the sample.

6.6.2 Solid samples (soils and sediments), Oil and tissue samples may be held for up to 90 days, if stored by the laboratory in the dark at either 0 - 6 ºC or ≤ -20 ºC, with the caveat that samples may need to be extracted as soon as possible if NFDHA is an important analyte.

6.6.3 Biosolids samples may be held for up to 90 days, if stored by the laboratory in the dark at 0 - 6 ºC or at -20 ºC. Because microbiological activity in biosolids samples at 0 - 6 ºC may lead to production of gases which may cause the sample to be expelled from the container when it is opened, as well as producing noxious odors, EPA recommends that samples be frozen if they need to be stored for more than a few days before extraction. Store sample extracts in the dark at less than 0 - 4 ºC until analyzed. If stored in the dark at less than 0 - 4 ºC, sample extracts may be stored for up to 90 days, with the caveat that issues were observed for some ether sulfonates after 28 days. These issues may elevate the observed concentrations of the ether sulfonates in the extract over time. Samples may need to be extracted as soon as possible if NFDHA is an important analyte.

7. Equipment and Supplies

7.1 SAMPLE CONTAINERS – 500-mL or 250-mL high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.2 SAMPLE JARS – 8-ounce wide mouth high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.3 POLYPROPYLENE BOTTLES – 4-mL narrow-mouth polypropylene bottles.

7.4 CENTRIFUGE TUBES – 50-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts.

7.5 AUTOSAMPLER VIALS – Polypropylene 0.7-mL autosampler vials with polypropylene caps.

7.5.1 NOTE: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, so evaporation occurs after injection. Thus, multiple injections from the same vial are not possible.

7.6 POLYPROPYLENE GRADUATED CYLINDERS – Suggested sizes include 25, 50, 100 and 1000-mL cylinders.

7.7 Auto Pipets – Suggested sizes include 5, 10, 25, 50, 100, 250, 500, 1000, 5000 and 10,000-µls.

7.8 PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets.

7.9 Silanized glass wool (Sigma-Aldrich, Cat # 20411 or equivalent) – store in a clean glass jar and rinsed with methanol (2 times) prior to use.

7.10 Disposable syringe filter, 25-mm, 0.2-µm Nylon membrane, PALL/Acrodisc or equivalent

7.11 Variable volume pipettes with disposable HDPE or polypropylene tips (10 µL to 5 mL) used for preparation of calibration standards and spiked samples.

7.12 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.0001 g.

7.13 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.1 g.

7.14 SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES

7.14.1 SPE CARTRIDGES – (Phenomenex WAX 150 or 250mg or equivalent). The SPE sorbent must have a pKa above 8 so that it remains positively charged during the extraction.

7.14.1.1 Note: SPE cartridges with different bed volume (e.g., 500 mg) may be used; however, the laboratory must demonstrate that the bed volume does not negatively affect analyte absorption and elution, by performing the initial demonstration of capability analyses described in Section 13.

7.14.2 VACUUM EXTRACTION MANIFOLD – A manual vacuum manifold with large volume sampler for cartridge extractions, or an automatic/robotic sample preparation system designed for use with SPE cartridges, may be used if all QC requirements discussed in Section 9 are met. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. Care must be taken with automated SPE systems to ensure the PTFE commonly used in these systems does not contribute to unacceptable analyte concentrations in the MB.

7.14.3 SAMPLE DELIVERY SYSTEM – Use of a polypropylene transfer tube system, which transfers the sample directly from the sample container to the SPE cartridge, is recommended, but not mandatory. Standard extraction manifolds come equipped with PTFE transfer tube systems. These can be replaced with 1/8” O.D. x 1/16” I.D. polypropylene or polyethylene tubing cut to an appropriate length to ensure no sample contamination from the sample transfer lines. Other types of non-PTFE tubing may be used provided it meets the MB and LCS QC requirements.

7.15 EXTRACT CONCENTRATION SYSTEM – Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 55 °C.

7.16 LABORATORY OR ASPIRATOR VACUUM SYSTEM – Sufficient capacity to maintain a vacuum of approximately 10 to 15 inches of mercury for extraction cartridges.

7.17 LIQUID CHROMATOGRAPHY (LC)/TANDEM MASS SPECTROMETER (MS/MS) WITH DATA SYSTEM

7.17.1 LC SYSTEM – Instrument capable of reproducibly injecting up to 10-µL aliquots and performing binary linear gradients at a constant flow rate near the flow rate used for development of this method (0.4 mL/min). The LC must be capable of pumping the water/methanol mobile phase without the use of a degasser which pulls vacuum on the mobile phase bottle (other types of degassers are acceptable). Degassers which pull vacuum on the mobile phase bottle will volatilize the ammonium acetate mobile phase causing the analyte peaks to shift to earlier retention times over the course of the analysis batch. The usage of a column heater is optional.

7.17.2 LC/TANDEM MASS SPECTROMETER – The LC/MS/MS must be capable of negative ion electrospray ionization (ESI) near the suggested LC flow rate of 0.4 mL/min. The system must be capable of performing MS/MS to produce unique product ions for the method analytes within specified retention time segments. A minimum of 10 scans across the chromatographic peak is required to ensure adequate precision.

7.17.3 DATA SYSTEM – An interfaced data system is required to acquire, store, reduce, and output mass spectral data. The computer software should have the capability of processing stored LC/MS/MS data by recognizing an LC peak within any given retention time window. The software must allow integration of the ion abundance of any specific ion within specified time or scan number limits. The software must be able to calculate relative response factors, construct linear regressions or quadratic calibration curves, and calculate analyte concentrations.

7.17.4 INSTRUMENT COLUMNS

7.17.4.1 ANALYTICAL: C18 column, 1.7 µm, 50 x 2.1 mm (Waters Acquity UPLC® BEH or equivalent)

7.17.4.2 OPTIONAL GUARD COLUMN: (Phenomenex Kinetex® Evo C18 or equivalent)

8. Reagents and Standards

8.1 GASES, REAGENTS, AND SOLVENTS – Reagent grade or better chemicals must be used.

8.1.1 REAGENT WATER – Purified water which does not contain any measurable quantities of any method analytes or interfering compounds greater than 1/2 the RL for each method analyte of interest. Prior to daily use, at least 3 L of reagent water should be flushed from the purification system to rinse out any build-up of analytes in the system's tubing.

8.1.2 METHANOL (CH_3OH, CAS#: 67-56-1) – High purity, demonstrated to be free of analytes and interferences.

8.1.3 AMMONIUM ACETATE ($NH_4C_2H_3O_2$, CAS#: 631-61-8) – High purity, demonstrated to be free of analytes and interferences. Store at 2-8° and replace 2 years after opening date.

8.1.4 ACETIC ACID (H_3CCOOH, CAS#: 64-19-7) - High purity, demonstrated to be free of analytes and interferences and stored at room temperature.

8.1.4.1 Acetic Acid (0.1%) – Dissolve acetic acid (1 mL) in reagent water (1 L), store at room temperature, replace after 3 months.

8.1.5 1M AMMONIUM ACETATE/REAGENT WATER – High purity, demonstrated to be free of analytes and interferences.

8.1.6 2mM AMMONIUM ACETATE/METHANOL:WATER (5:95) – To prepare, mix 2 ml of 1M AMMONIUM ACETATE,1 ml ACETIC ACID and 50 ml METHANOL into I Liter of REAGENT WATER.

8.1.7 ACETONITRILE – UPLC grade or equivalent, store at room temperature

8.1.8 TOLUENE – HPLC grade or equivalent.

8.1.9 ACETONE – pesticide grade or equivalent

8.1.10 AMMONIUM HYDROXIDE (NH_3, CAS#: 1336-21-6) – High purity, demonstrated to be free of analytes and interferences, and stored at room temperature.

8.1.11 AQUEOUS AMMONIUM HYDROXIDE (3%) – Add ammonium hydroxide (10 mL, 30%) to reagent water (90 mL), store at room temperature, replace after 3 months.

8.1.12 METHANOLIC AMMONIUM HYDROXIDE (0.3%) - add ammonium hydroxide (1 mL, 30%) to methanol (99 mL), store at room temperature, replace after 1 month

8.1.13 METHANOLIC AMMONIUM HYDROXIDE (1%) - add ammonium hydroxide (3.3 mL, 30%) to methanol (97 mL), store at room temperature, replace after 1 month

8.1.14 METHANOLIC AMMONIUM HYDROXIDE (2%) - add ammonium hydroxide (6.6 mL, 30%) to methanol (93.4 mL), store at room temperature, replace after 1 month

8.1.15 METHANOLIC POTASSIUM HYDROXIDE (0.05 M) – add 3.3 g of potassium hydroxide to 1 L of methanol, store at room temperature, replace after 3 months

8.1.16 METHANOL WITH 4% WATER, 1% AMMONIUM HYDROXIDE AND 0.625% ACETIC ACID - add ammonium hydroxide (3.3 mL, 30%), reagent water (1.7 mL) and acetic acid (0.625 mL) to methanol (92 mL), store at room temperature, replace after 1 month. This solution is used to prepare the instrument blank and calibration standards (Section 8.3.2).

8.1.17 FORMIC ACID – (greater than 96% purity or equivalent). Store at room temperature and replace after 2 years.

8.1.18 FORMIC ACID (aqueous, 0.1 M) - dissolve formic acid (4.6 g) in reagent water (1 L), store at room temperature, replace after 2 years.

8.1.19 FORMIC ACID (aqueous, 0.3 M) - dissolve formic acid (13.8 g) in reagent water (1 L), store at room temperature, replace after 2 years.

8.1.20 FORMIC ACID (aqueous, 5% v/v) - mix 5 mL formic acid with 95 mL reagent water, store at room temperature, replace after 2 years.

8.1.21 FORMIC ACID (methanolic 1:1, 0.1 M formic acid/methanol) - mix equal volumes of methanol and 0.1 M formic acid, store at room temperature, replace after 2 years.

8.1.22 FORMIC ACID (aqueous, 50% v/v) - mix 50 mL formic acid with 50 mL reagent water, store at room temperature, replace after 2 years.

8.1.23 POTASSIUM HYDROXIDE – certified ACS or equivalent, store at room temperature, replace after 2 years.

8.1.24 CARBON - – EnviCarb® 1-M-USP or equivalent, verified by lot number before use, stored at room temperature. Loose carbon allows for better adsorption of interferent organics. Note: The single-laboratory validation laboratory achieved better performance with loose carbon than carbon cartridges. Loose carbon will be used for the multi-laboratory validation to set statistically based method criteria.

8.1.25 NITROGEN – Used for the following purposes: Nitrogen aids in aerosol generation of the ESI liquid spray and is used as collision gas in some MS/MS instruments. The nitrogen used should meet or exceed instrument manufacturer's specifications. In addition, Nitrogen is used to concentrate sample extracts (Ultra High Purity or equivalent).

8.1.26 ARGON – Used as collision gas in some MS/MS instruments. Argon should meet or exceed instrument manufacturer's specifications. Nitrogen gas may be used as the collision gas provided sufficient sensitivity (product ion formation) is achieved.

8.2 REFERENCE MATRICES - Matrices in which PFAS and interfering compounds are not detected by this method. These matrices are to be used to prepare the batch QC samples, LOQ/MDL, and IDOC samples.

8.2.1 Reagent water - purified water, Type I

8.2.2 Solid reference matrix Ottawa Sand or equivalent

8.2.3 Tissue Reference matrix – Cod loin or other animal tissue demonstrated to be PFAS free.

8.3 STANDARD SOLUTIONS – When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. PFAS analyte and IS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers and are stored at ≤4 °C. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples.

8.3.1 Stock standards and diluted stock standards are stored at ≤4 °C. Prepare a spiking solution, containing the method analytes listed in Table 1, in methanol from prime stocks. The solution is used to prepare the calibration standards and to spike the known reference QC samples that are analyzed with every batch. Quantitative standards containing a mixture of branched and linear isomers must be used for method analytes if they are commercially available. Currently, these include PFOS, PFHxS, NEtFOSAA, and NMeFOSAA.

8.3.2 Calibration standard solutions – A series of calibration solutions containing the target analytes and the Labeled extracted internal standards (EIS) and non-extracted internal standards (NIS) is used to establish the initial calibration of the analytical instrument. Table 4 represents the concentrations of the native, EIS and NIS analytes of the calibration curve. Calibration standard solutions are made using the solution described in section 8.1.16.

8.3.3 ISOTOPE DILUTION EXTRACTED INTERNAL STANDARD (EIS) – Isotopically labelled analogs of the target analytes to be used for the quantification of target analytes. EIS stock standard solutions are purchased in glass ampoules and are stored in accordance with the manufacturer's recommendations. The EIS stock solution to be used for the fortification of samples and QC in accordance with the isotope dilution procedure. Table 2 represents the EIS concentrations and nominal sample amounts added to each field sample and QC element.

8.3.4 ISOTOPE DILUTION NON-EXTRACTED INTERNAL STANDARDS (NIS) – Isotopically labelled analogs to be added post extraction for the measurement of EIS extraction efficiency and is added to the final volume of all extractions. Table 3 represents the EIS concentrations and nominal sample amounts added to each field sample and QC element.

9. Quality Control

9.1 Method Blank

9.1.1 A Method Blank (MB) is required with each extraction batch to confirm that potential background contaminants are not interfering with the identification or quantitation of method analytes. An aliquot of reagent water that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents and standards. Prep and analyze a MB for every 20 samples. If the MB produces a peak within the retention time window of any analyte that would prevent the determination of that analyte, determine the source of contamination, and eliminate the interference before processing samples. Background contamination must be reduced to an acceptable level before proceeding. Background from method analytes or other contaminants that interfere with the measurement of method analytes must be below the RL. If the method analytes are detected in the MB at concentrations equal to or greater than this level, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.

9.2 Laboratory Control Sample (LCS)

9.2.1 Low Level LCS or OPR (Ongoing Precision Recovery) sample is required with each extraction batch. A LLCS or OPR samples is a method blank spiked with known quantities of analytes. The fortified concentration of the LCS is spiked at 2X the LOQ. Default limits of 70-130% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (%*R*) for each analyte using the equation:

9.2.2 An LCS or OPR (Ongoing Precision Recovery) sample is required with each extraction batch. A LCS or OPR samples is a method blank spiked with known quantities of analytes. The fortified concentration of the LCS is spiked at the midpoint of the calibration curve. Default limits of 70-130% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (%*R*) for each analyte using the equation:

$$\%R = \frac{A \times 100}{B}$$

Where:

A = measured concentration in the fortified sample
B =fortification concentration.

9.1.1 Where applicable, in the absence of additional sample volume required to perform matrix specific QC, LCSD's are to be extracted and analyzed. The concentration and analyte recovery criteria for the LCSD must be the same as the batch LCS The RSD's must fall within ≤30% of the true value for medium and high-level replicates, and ≤50% for low level replicates. Calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation:

$$RPD = \frac{|LCS - LCSD|}{(LCS + LCSD) / 2} \times 100$$

9.1.2 If the LCS and or LCSD results do not meet these criteria for method analytes, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.

9.3 Non-extracted Internal Standard Area (NIS)

Each time an initial calibration is performed, use the data from all the initial calibration standards used to meet the linearity test in Section 10.3.3.3 to calculate the mean area response for each of the NIS compounds, using the equation below.

$$\text{Mean Area}_{\text{NISi}} = \sum \text{AREA}_{\text{NISi}} / n$$

where:

AreaNISi = Area counts for the ith NIS, where i ranges from 1 to 7, for the seven NIS compounds listed in Table 1
n = The number of ICAL standards (the default value is n = 6). If a different number of standards is used for the ICAL, for example, to increase the calibration range or by dropping a point at either end of the range to meet the linearity criterion, change 6 to match the actual number of standards used)

Record the mean areas for each NIS for use in evaluating results for sample analyses. There is no acceptance criterion associated with the mean NIS area data.

9.4 Extracted Internal Standards (EIS)

9.4.1 The EIS standard is fortified into all samples, CCVs, MBs, LCSs, MSs, MSDs, FD, and FRB prior to extraction. It is also added to the CAL standards. The EIS is a means of assessing method performance from extraction to final chromatographic measurement. Calculate the recovery (%R) for the EIS using the following equation:

$$\%R = (A / B) \times 100$$

Where:

A = calculated EIS concentration for the QC or Field Sample
B = fortified concentration of the EIS.

9.4.2 Default limits of 50-150% may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. A low or high percent recovery for a sample, blank, or CCV does not require discarding the analytical data but it may indicate a potential problem with future analytical data. When EIS recovery from a sample, blank, or CCV are outside control limits, check 1) calculations to locate possible errors, 2) standard solutions for degradation, 3) contamination, and 4) instrument performance. For CCVs and QC elements spiked with all target analytes, if the recovery of the corresponding target analytes meet the acceptance criteria for the EIS in question, the data can be used but all potential biases in the recovery of the EIS must be documented in the sample report. If the associated target analytes do not meet the acceptance criteria, the data must be reanalyzed.

9.5 Matrix Spike (MS/MSD)

9.5.1 Analysis of an MS is prepared one per preparation batch (if required).

9.5.2 Aliquots of field samples that have been fortified with a known concentration of target compounds, prior to sample preparation and extraction, and analyzed to measure the effect of matrix interferences. The use of MS/MSD samples is generally not required in isotope dilution methods because the labeled compounds added to every sample provide more performance data than spiking a single sample in each preparation batch. Aliquots of field samples

9.5.3 Analyte recoveries may exhibit matrix bias. For samples fortified at or above their native concentration, recoveries should range between 50-150%. If the accuracy of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCS, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.6 Laboratory Duplicate

9.6.1 FIELD DUPLICATE OR LABORATORY FORTIFIED SAMPLE MATRIX DUPLICATE (FD or MSD) – Within each extraction batch (not to exceed 20 Field Samples), a minimum of one FD or MSD must be analyzed. Duplicates check the precision associated with sample collection, preservation, storage, and laboratory procedures. If method analytes are not routinely observed in Field Samples, an MSD should be analyzed rather than an FD.

9.6.2 Calculate the relative percent difference (*RPD*) for duplicate measurements (*FD1* and *FD2*) using the equation:

$$RPD = \frac{|FD1 - FD2|}{(FD1 + FD2) / 2} \times 100$$

9.6.3 RPDs for FDs should be ≤30%. Greater variability may be observed when FDs have analyte concentrations that are within a factor of 2 of the RL. At these concentrations, FDs should have RPDs that are ≤50%. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCV, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.6.4 If an MSD is analyzed instead of a FD, calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation:

$$RPD = \frac{|MS - MSD|}{(MS + MSD) / 2} \times 100$$

9.6.5 RPDs for duplicate MSs should be ≤30% for samples fortified at or above their native concentration. Greater variability may be observed when MSs are fortified at analyte concentrations that are within a factor of 2 of the RL. MSs fortified at these concentrations should have RPDs that are ≤50% for samples fortified at or above their native concentration. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCSD where applicable, the result is judged to be matrix biased. If no LCSD is present, the associated MS and MSD are to be re-analyzed to determine if any analytical has occurred. If the resulting RPDs are still outside control limits, the result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7 Bile Salt Interference Check

9.7.1 The laboratory must analyze a TDCA standard after the initial calibration, prior to the analysis of tissue samples, to check for interferences caused by bile salts. If an interference is present, the chromatographic conditions must be modified to eliminate the interference from TDCA (e.g., changing the retention time of TDCA such that it falls outside the

9.8 Initial Calibration Verification (ICV)

9.8.1 After each ICAL, analyze a QCS sample from a source different from the source of the CAL standards. If a second vendor is not available, then a different lot of the standard should be used. The QCS should be prepared and analyzed just like a CCV. Acceptance criteria for the QCS are identical to the CCVs; the calculated amount for each analyte must be ± 30% of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedure to locate and correct the problem.

9.9 Instrument Sensitivity Check (ISC)

9.9.1 At the start of each 12-hour shift, analyze a standard at the LOQ. The signal-to-noise ratio of the ISC standard must be greater than or equal to 3:1. If the requirements cannot be met, the problem must be corrected before analyses can proceed.

9.10 Continuing Calibration Verification (CCV)

9.10.1 CCV Standards must be analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch.

9.10.2 The recovery of native and isotopically labeled compounds for the CVs must be within 70 - 130%

9.11 Method-specific Quality Control Samples

9.11.1 Instrument Blank – During the analysis of a batch of samples, a solvent blank is analyzed after samples containing high level of target compounds (e.g., calibration, CV) to monitor carryover from the previous injection. The injection blank consists of the solution in Section 8.1.16 fortified with the EIS and NIS for quantitation purposes.

9.12 Example Method Sequence

- INSTRUMENT BLANK
- INSTRUMENT SENSITIVITY CHECK
- CALIBRATION VERIFICATION STANDARD
- QUALITATIVE IDENTIFICATION STANDARDS
- TDCA STANDARD (only if analyzing tissues)
- INSTRUMENT BLANK
- METHOD BLANK
- LOW-LEVEL LCS/OPR
- OPR/LCS
- SAMPLE (10 or fewer)
- CALIBRATION VERIFICATION STANDARD
- INSTRUMENT BLANK
- SAMPLE (10 or fewer)
- CALIBRATION VERIFICATION STANDARD
- INSTRUMENT BLANK

10. Procedure

10.1 Equipment Set-up

10.1.1 This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the MBs should be rotated among the ports to ensure that all the valves and tubing meet the MB requirements.

10.1.2 Some of the PFAS's adsorb to surfaces, including polypropylene. Therefore, the aqueous sample bottles must be rinsed with the elution solvent whether extractions are performed manually or by automation. The bottle rinse is passed through the cartridge to elute the method analytes and is then collected.

10.1.3 The SPE cartridges and sample bottles described in this section are designed as single use items and should be discarded after use. They may not be refurbished for reuse in subsequent analyses.

10.1.4 All SPE apparatus, including manifolds, tubing and sample ports must be thoroughly rinsed following each use with 1% methanolic ammonium hydroxide, followed by Methanol and then DI water. Additionally, sample manifold ports and transfer tubing should be inspected regularly for signs of wear and/or discoloration. When such observations are made, the associated components should be replaced.

10.1.5 Prior to the start of any extraction, sample site information must be evaluated for any potentially high level PFAS concentrations or sample matrix irregularities that may impact the extraction process. If such samples are identified, aqueous samples may be pre-screened via direct aqueous injection prior to analysis to estimate the potential PFAS concentrations present.

10.1.6 To perform a direct aqueous injection (DAI) screen, the sample should be inverted several times to try and evenly disperse any organic matter present. A 1 ml aliquot (or less depending on the matrix) is to be taken from the parent sample, volume adjusted to 1 ml with reagent water if less than 1ml, fortified with EIS and NIS spiking solutions to match the concentrations of an extracted sample (typically 5 µl per 1 ml DAI), and then analyzed under the same analytical conditions as field samples.

10.2 Sample Preparation of Aqueous Samples

10.2.1 Samples are preserved, collected, and stored as presented in Section 6.

10.2.2 Determine sample volume. Weigh all samples to the nearest 1g. If visible sediment is present, centrifuge and decant into a new HDPE bottle and record the weight of the new container.

NOTE: Some of the PFAS's adsorb to surfaces, thus the sample volume may not be transferred to a graduated cylinder for volume measurement.

10.2.3 The MB, LCS and FRB may be prepared by measuring reagent water with a polypropylene graduated cylinder or filling an HDPE sample bottle near the top.

10.2.4 Check that the pH is 6.5 ± 0.5. If necessary, adjust pH with 50% formic acid or ammonium hydroxide and 3% aqueous ammonium hydroxide. The extract is now ready for solid-phase extraction (SPE) and cleanup.

10.2.5 Add 20 µL of the EIS to each sample and QC, cap and invert to mix.

10.2.6 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.3 Sample Prep and Extraction Protocol for Solids.

10.3.1 Homogenize and weigh 5 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 5 grams of clean sand is used.

10.3.1.1 For Biosolids and other complex matrices, a small aliquot may be required due to co-extracted matrix interferences.

10.3.1.2 For batch QC samples using 5 g of reference solid, add 2.5 g of reagent water. The addition of reagent water to the sand provides a matrix closer in composition to real-world samples.

10.3.2 Add 20 µL of the EIS to each sample and QC.

10.3.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.3.4 Vortex the samples to evenly disperse the spiking solutions and allow to equilibrate for 30 minutes.

10.3.5 To all samples, add 10 ml of 0.3% methanolic ammonium hydroxide, cap, vortex for 25 seconds.

10.3.6 Following mixing, shake each sample for 30 minutes on a shaker table.

10.3.7 Centrifuge each sample at 2800RPM for 10 minutes.

10.3.8 Remove the supernatant and transfer to a clean 50 ml polypropylene centrifuge tube.

10.3.9 Repeat steps 10.3.4 to 10.3.7, with 15 ml of 0.3% methanolic ammonium hydroxide, combining the supernatants.

10.3.10 Add 5ml of 0.3% methanolic ammonium hydroxide to the sample, vortex for 25 seconds and centrifuge each sample at 2800RPM for 10 minutes.

10.3.11 Remove the supernatant and transfer to the same 50 ml polypropylene centrifuge tube containing eluates from the previous cycles.

10.3.12 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking for no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50 ml polypropylene centrifuge tube.

10.3.13 Dilute to approximately 35 mL with reagent water. Samples containing more than 50% water may yield extracts that are greater than 35 mL in volume; therefore, do not add water to these. Determine the water content in the sample as follows (percent moisture is determined from the % solids):

Water Content in Sample = (Sample Weight * Percent moisture) / 100

10.3.14 Concentrate each extract at approximately 55 ºC with a gentle N2 flow to a final volume that is based on the water content of the sample (see table below). Allow extracts to concentrate for 10 minutes, then mix (by vortex if the volume is < 20. Continue concentrating and mixing every 5 minutes until the extract has been reduced to the required volume as specified in the table below. If the extract volume appears to stop dropping, the concentration must be stopped and the volume at which it was stopped recorded.

Water Content in Sample	Concentrated Final Volume
< 5 grams	15 ml
5-8 grams	15-20 ml
8-9 grams	20-22.5 ml
9-10 grams	22.5-25 ml

10.3.15 Add 40 - 50 mL of reagent water to the extract and vortex. Check that the pH is 6.5 ±0.5 and adjust as necessary with 50% formic acid or 30% ammonium hydroxide, or with 5% formic acid and 3% aqueous ammonium hydroxide. The extracts are ready for SPE and cleanup.

10.4 Sample Prep and Extraction Protocol for Oils.

10.4.1 Weigh 1-2 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 1 grams of mineral oil is used.

10.4.1.1 For batch QC samples use 1 g of reference oil.

10.4.2 Add 20 µL of the EIS to each sample and QC.

10.4.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.4.4 Vortex the samples to evenly disperse the spiking solutions and allow to equilibrate for 30 minutes.

10.4.5 To all samples, add 10 ml of 0.3% methanolic ammonium hydroxide, cap, vortex for 25 seconds.

10.4.6 Following mixing, shake each sample for 30 minutes on a shaker table.

10.4.7 Centrifuge each sample at 2800RPM for 10 minutes.

10.4.8 Remove the supernatant and transfer to a clean 50 ml polypropylene centrifuge tube.

10.4.9 Repeat steps 10.3.4 to 10.3.7, with 15 ml of 0.3% methanolic ammonium hydroxide, combining the supernatants.

10.4.10 Add 5ml of 0.3% methanolic ammonium hydroxide to the sample, vortex for 25 seconds and centrifuge each sample at 2800RPM for 10 minutes.

10.4.11 Remove the supernatant and transfer to the same 50 ml polypropylene centrifuge tube containing eluates from the previous cycles.

10.4.12 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking for no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50 ml polypropylene centrifuge tube.

10.5 Sample Prep and Extraction Protocol for Tissues.

10.5.1 Homogenize and weigh 2 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 2 grams of clean tissue is used.

10.5.2 Add 20 µL of the EIS PDS to each sample and QC.

10.5.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.5.4 Add 10 mL of 0.05M KOH in methanol to each sample. Vortex to disperse the tissue then place tubes on a mixing table to extract for at 16 hours. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant in a 50-mL polypropylene centrifuge tube.

10.5.5 Add 10 mL of acetonitrile to remaining tissue in the 50-mL centrifuge tube, vortex to mix and disperse the tissue. Sonicate for 30 minutes. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant, adding it to the 50-mL centrifuge tube containing the initial extract.

10.5.6 Add 5 mL of 0.05M KOH in methanol to the remaining sample in each centrifuge tube. Vortex to disperse the tissue and hand mix briefly. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant, adding it to the 50-mL centrifuge tube containing the first two extracts.

10.5.7 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking over a period of no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50-mL centrifuge tube.

10.5.8 Add 1 mL of reagent water to each tube and concentrate each extract at approximately 55 ºC with a gentle N2 flow to a final volume of 2.5 ml.

10.5.9 Add reagent water to each evaporation/concentrator tube to dilute the extracts to 50 mL. Check that the pH = 6.5 ± 0.5 and adjust as needed with 50% formic acid, or ammonium hydroxide or with 5% formic acid and 3% aqueous ammonium hydroxide. The extracts are ready for SPE and cleanup.

10.6 SPE Extract: All matrices

10.6.1 Pack clean silanized glass wool to half the height of the WAX SPE cartridge barrel.

10.6.2 Pre-condition the cartridges by washing them with 3 X 5 mL of 1% methanolic ammonium hydroxide, discarding the wash volumes.

10.6.3 Rinse the cartridge with 5 mL of 0.3M formic acid, allowing the cartridge to drain using gravity only, discarding the rinse volume. Do not allow the cartridge to go dry

10.6.4 Adjust the vacuum so that the approximate flow rate is ~5 mL/min and load the sample across the cartridge. Do not allow the cartridge to go dry before all the sample has passed through.

10.6.5 Once all the sample has passed across the cartridge, rinse the walls of the reservoir with 2 X 5 mL reagent water, loading the rinse across the cartridge.

10.6.6 Rinse the walls of the reservoir with 5 mL of 1:1 0.1M formic acid/methanol and pass the rinse through the cartridge using vacuum. Dry the cartridge by pulling air through for 15 seconds.

10.6.7 Rinse the inside of the sample bottle with 5 mL of 1% methanolic ammonium hydroxide. Use vacuum to pull the elution solvent through the cartridge and into the collection tubes. When the cartridge bed and glass wool are submerged, stop the cartridge flow by closing the valve, keeping the sorbent bed and wool submerged.

10.6.8 Let the wetted sorbent bed and wool soak for 1 minute.

10.6.9 Open the cartridge valve and collect the eluate into a 15 ml polypropylene collection tube.

10.6.10 Add 25 µL of concentrated acetic acid to each sample eluted in the collection tubes and vortex to mix.

10.6.11 Add 10 mg of carbon to each sample and batch QC extract, using a 10-mg scoop. Handshake occasionally for no more than 5 minutes. It is important to minimize the time the sample extract is in contact with the carbon. Immediately vortex (30 seconds) and centrifuge at 2800 rpm for 10 minutes.

10.6.12 Add NIS solution to a clean collection tube. Place a syringe filter (25-mm filter, 0.2-µm nylon membrane) on a 5-mL polypropylene syringe. Take the plunger out and carefully decant the sample supernatant into the syringe barrel. Replace the plunger and filter the entire extract into the new collection tube containing the NIS.

10.6.13 Vortex to mix and transfer a portion of the extract into a .7-mL polypropylene LC vial for LC-MS/MS analysis. Cap the collection tube containing the remaining extract and store at 4 °C

10.7 Sample Volume Determination

10.7.1 If using weight to determine volume, weigh the empty bottle to the nearest 1 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight. Assume a sample density of 1.0 g/mL. In either case, the sample volume will be used in the final calculations of the analyte concentration.

10.8 Initial Calibration - Demonstration and documentation of acceptable initial calibration is required before any samples are analyzed. After the initial calibration is successful, a CCV is required at the beginning and end of each period in which analyses are performed, and after every tenth Field Sample.

10.8.1 ESI-MS/MS TUNE

10.8.1.1 Calibrate the mass scale of the MS with the calibration compounds and procedures prescribed by the manufacturer.

10.8.1.2 Optimize the [M-H]- or [M-CO_2]- for each method analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (0.4 mL/min). This tune can be done on a mix of the method analytes. The MS parameters (voltages, temperatures, gas flows, etc.) are varied until optimal analyte responses are determined. The method analytes may have different optima requiring some compromise between the optima.

The Mass spec conditions found in Table 7 show the Sciex Triple Quad 5500+ operation conditions used in this method.

10.8.1.3 Optimize the product ion for each analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS/MS parameters (collision gas pressure, collision energy, etc.) are varied until optimal analyte responses are determined. Typically, the carboxylic acids have very similar MS/MS conditions, and the sulfonic acids have similar MS/MS conditions.

The conditions found on table 5 are representative of expected tune optimizations for each analyte. If conditions other the ones close to the values provided in table 5 are achieved, the process should be re-performed and/or instrument maintenance performed to resolve the problem.

10.8.2 Establish LC operating parameters that optimize resolution and peak shape. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

Table 6 represents the operation conditions of a Sciex Exion LC system when running this method.

10.8.3 Inject 2µl of a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. Divide the chromatogram into retention time windows each of which contains one or more chromatographic peaks. During MS/MS analysis, fragment a small number of selected precursor ions ([M-H]-) for the analytes in each window and choose the most abundant product ion. For maximum sensitivity, small mass windows of ±0.5 daltons around the product ion mass were used for quantitation.

10.8.4 Inject a mid-level CAL standard under optimized LC/MS/MS conditions to ensure that each method analyte is observed in its MS/MS window and that there are at least 10 scans across the peak for optimum precision.

NOTE: PFHxS, PFOS, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 7 due to chromatographic resolution of the linear and branched isomers of these compounds. Most PFAS's are produced by two different processes. One process gives rise to linear PFAS's only while the other process produces both linear and branched isomers. Thus, both branched and linear PFAS's can potentially be found in the environment. For the aforementioned compounds that give rise to more than one peak, all the chromatographic peaks observed in the standard must be integrated and the areas totaled. Chromatographic peaks in a sample must be integrated in the same way as the CAL standard.

10.8.5 Prepare a set of CAL standards as outlined in table 5. The lowest concentration CAL standard must be at or below the LOQ.

10.8.6 The LC/MS/MS system is calibrated using the isotope dilution technique. Target analytes are quantitated against their isotopically labeled analog (Extracted Internal Standard) where commercially available. If a labeled analog is not commercially available, the extracted internal standard with the closest retention time and /or closest chemical similarity is to be used. Use the LC/MS/MS data system software to generate a linear regression or quadratic calibration curve for each of the analytes. This curve must always be forced through zero and may be concentration weighted, if necessary. Forcing zero allows for a better estimate of the background levels of method analytes. A minimum of 6 calibration points are required for a linear or quadratic calibration model.

10.8.7 **CALIBRATION ACCEPTANCE CRITERIA** – A linear fit is acceptable if the calculated RSD or RSE for each target analyte is ≤20%. If linear or Quadratic regressions are used, coefficient of determination (r^2) values must be greater than 0.99. When quantitated using the initial calibration curve, each calibration point at or above the LOQ for each analyte must calculate to be within 70-130% of its true value. The calculate value of each EIS analyte must be within 50-150% of its true value. If these criteria cannot be met, corrective action is taken to reanalyze the CAL standards, restrict the range of calibration.

10.8.8 **Bile salts interference check -** The laboratory must analyze a TDCA standard after the initial calibration, prior to the analysis of tissue samples, to check for interferences caused by bile salts. If an interference is present, the chromatographic conditions must be modified to eliminate the interference from TDCA (e.g., changing the retention time of TDCA such that it falls outside the retention window for PFOS by at least one minute), and the initial calibration repeated.

10.9 CONTINUING CALIBRATION CHECK (CCV) – Minimum daily calibration verification is as follows. Verify the initial calibration at the beginning and end of each group of analyses, and after every tenth sample during analyses. In this context, a "sample" is considered to be a Field Sample. MBs, CCVs, LCSs, MSs, FDs FRBs and MSDs are not counted as samples. The beginning CCV of each analysis batch must be at or below the RL in order to verify instrument sensitivity prior to any analyses. If standards have been prepared such that all low CAL points are not in the same CAL solution, it may be necessary to analyze two CAL standards to meet this requirement. Alternatively, the analyte concentrations in the analyte PDS may be customized to meet these criteria. Subsequent CCVs should alternate between a medium and Low concentration CAL standard.

10.9.1 Inject an aliquot of the appropriate concentration CAL standard and analyze with the same conditions used during the initial calibration.

10.9.2 Calculate the concentration of each analyte and EIS in the CCV. The calculated amount for each native and EIS analyte for medium level CCVs must be within ± 30% of the true. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken which may require recalibration. Any Field or QC Samples that have been analyzed since the last acceptable calibration verification should be reanalyzed after adequate calibration has been restored, with the following exception. If the CCV fails because the calculated concentration is greater than 130% for a particular method analyte, and Field Sample extracts show no detection for that method analyte, non-detects may be reported without re-analysis.

10.9.3 REMEDIAL ACTION – Failure to meet CCV QC performance criteria may require remedial action. Major maintenance, such as cleaning the electrospray probe, atmospheric pressure ionization source, cleaning the mass analyzer, replacing the LC column, etc., requires recalibration and verification of sensitivity by analyzing a CCV at or below the LOQ.

10.10 EXTRACT ANALYSIS

10.10.1 The same operating conditions used for the initial calibration and summarized in Tables 6 and 7 are to be used.

10.10.2 Prior to analysis of sample extracts, the Instrument mass calibration verification must be performed using standards whose mass range brackets the masses of interest and performed in the negative ion mode. The mass calibration is verified if the calculated mass is within ± .2 daltons of the specified mass.

10.10.3 Establish an appropriate retention time window for each analyte. This should be based on measurements of actual retention time variation for each method analyte in CAL standard solutions analyzed on the LC over the course of time. A value of plus or minus three times the standard deviation of the retention time obtained for each method analyte while establishing the initial calibration can be used to calculate a suggested window size. However, the experience of the analyst should weigh heavily on the determination of the appropriate retention window size.

10.10.4 Calibrate the system by either the analysis of a calibration curve or by confirming the initial calibration is still valid by analyzing a CCV.

10.10.5 Begin analyzing Field Samples, including QC samples, at their appropriate frequency by injecting the same size aliquots under the same conditions used to analyze the CAL standards.

10.10.6 For concentrations at or above the method LOQ, the total (branched and linear isomer) quantification ion response to the total (branched and linear isomer) confirmation ion response ratio must fall within ± 50% of the ratio observed in the midpoint initial calibration standard.

10.10.7 At the conclusion of data acquisition, use the same software that was used in the calibration procedure to identify peaks of interest in predetermined retention time windows. Use the data system software to examine the ion abundances of the peaks in the chromatogram. Identify an analyte by comparison of its retention time with that of the corresponding method analyte peak in a reference standard.

10.10.7.1 Method analyte, EIS analyte, and NIS analyte RTs must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial daily CV, whichever was used to establish the RT window position for the analytical batch. All branched isomer peaks identified in either the calibration standard or the qualitative (technical grade) standard must fall within in the retention time window for that analyte.

10.10.7.2 For all method analytes with exact corresponding isotopically labeled analogs, method analytes must elute within 0.1 minutes of the associated EIS.

10.10.8 The analyst must not extrapolate beyond the established calibration range. If an analyte peak area exceeds the range of the initial calibration curve, the sample should be re-extracted with a reduced sample volume in order to bring the out of range target analytes into the calibration range. If a smaller sample size would not be representative of the entire sample, the following options are recommended. Re-extract an additional aliquot of sufficient size to ensure that it is representative of the entire sample. Spike it with a higher concentration of internal standard. Prior to LC/MS analysis, dilute the sample so that it has a concentration of internal standard equivalent to that present in the calibration standard. Then, analyze the diluted extract.3

10.10.9 In instances where re-extraction is not an option, dilute a subsample of the sample extract with 0.1% acetic acid by a factor no greater than 10x adjust the amount of the NIS in the diluted extract, and analyze the diluted extract. If the responses for each EIS in the diluted extract meet the S/N and retention time, and the EIS recoveries from the analysis of the diluted extract are greater than 5%, then the compounds associated with those EISs may be quantified using isotope dilution. Use the EIS recoveries from the original analysis to select the dilution factor, with the objective of keeping the EIS recoveries in the dilution above that 5% lower limit. If the adjusted EIS recoveries are below 5%, the dilution is assumed invalid. If the adjusted EIS recoveries are greater than 5%, adjust the compound concentrations, detection limits, and minimum levels to account for the dilution.

11. Data Evaluation, Calculations and Reporting

11.1 Complete chromatographic resolution is not necessary for accurate and precise measurements of analyte concentrations using MS/MS. In validating this method, concentrations were calculated by measuring the product ions listed in Table 9.

11.2 Calculate analyte concentrations using the multipoint calibration established in Section 10.9. Do not use daily calibration verification data to quantitate analytes in samples. Adjust final analyte concentrations to reflect the actual sample volume determined in Section 10.8

C_{ex} = (Area of target analyte * Concentration of Labeled analog) / (area of labeled analog * CF)

C_s = (C_{ex} / sample volume in ml) * 1000

C_{ex} = The concentration of the analyte in the extract
CF = calibration factor from calibration.

11.3 Prior to reporting the data, the chromatogram should be reviewed for any incorrect peak identification or poor integration.

11.4 PFHxS, PFOS, PFOA, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 7 due to the linear and branch isomers of these compounds (Sect. 10.10.4.). The areas of all the linear and branched isomer peaks observed in the CAL standards for each of these analytes must be summed and the concentrations reported as a total for each of these analytes.

11.5 Calculations must utilize all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

12.1 Section 9.0 outlines sample batch QC acceptance criteria. If non-compliant organic compound results are to be reported, the Organic Section Head and/or the Laboratory Director, and the Operations Manager must approve the reporting of these results. The laboratory Project Manager shall be notified and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst, Data Reviewer, or Department Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

12.2 All results for the organic compounds of interest are reportable without qualification if extraction and analytical holding times are met, preservation requirements (including cooler temperatures) are met, all QC criteria are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

13.1.1 The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP ID 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

13.2.1 Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.

13.2.2 The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

14.1 Refer to Alpha's Chemical Hygiene Plan and Hazardous Waste Management and Disposal SOP for further pollution prevention and waste management information.

14.2 This method utilizes SPE to extract analytes from water. It requires the use of very small volumes of organic solvent and very small quantities of pure analytes, thereby minimizing the potential hazards to both the analyst and the environment as compared to the use of large volumes of organic solvents in conventional liquid-liquid extractions.

14.3 The analytical procedures described in this method generate relatively small amounts of waste since only small amounts of reagents and solvents are used. The matrices of concern are finished drinking water or source water. However, laboratory waste management practices must be conducted consistent with all applicable rules and regulations, and that laboratories protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations, particularly the hazardous waste identification rules and land disposal restrictions.

15. Referenced Documents

Chemical Hygiene Plan – ID 2124

SOP ID 1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) SOP

SOP ID 1739 Demonstration of Capability (DOC) Generation SOP

SOP ID 1728 Hazardous Waste Management and Disposal SOP

16. Attachments

Table 1: Names, Abbreviations, and CAS Registry Numbers for Target PFAS, Extracted Internal Standards and Non-extracted Internal Standards

Parameter	Acronym	CAS
PER- and POLYFLUOROALKYLETHER CARBOXYLIC ACIDS (PFECAs)		
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	HFPO-DA	13252-13-6
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
PERFLUOROALKYLCARBOXILIC ACIDS (PFCAs)		
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTrDA	72629-94-8
Perfluoorotetradecanoic acid	PFTeDA	376-06-7
PERFLUOROALKYL SULFONIC ACIDS (PFASs)		
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5
CHLORO-PERFLUOROALKYLSULFONATE		
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
FLUOROTELOMER CARBOXYLIC ACIDS		
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5
2H,2H,3H,3H-Perfluorooctanoic acid	5:3FTCA	914637-49-3
Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4
PERFLUOROOCTANESULFONAMIDES		

Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methylperfluoro-1-octanesulfonamide	NMeFOSA	31506-32-8
N-ethylperfluoro-1-octanesulfonamide	NEtFOSA	4151-50-2
PERFLUOROCTANE SULFONAMIDE ETHANOLS		
N-Methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2
TELOMER SULFONIC ACIDS		
1H,1H,2H,2H-perfluorohexanesulfonic acid (4:2)	4:2FTS	757124-72-4
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	6:2FTS	27619-97-2
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	8:2FTS	39108-34-4
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS		
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
PERFLUOROETHER AND POLYETHER CARBOXYLIC ACIDS		
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6

Table 2: Stock and Nominal Extracted Internal Standard Concentrations

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Nominal amount of EIS added to extracts (ng)
M4PFBA	2000	40
M5PFPeA	1000	20
M5PFHxA	500	10
M4PFHpA	500	10
M8PFOA	500	10
M9PFNA	250	5
M6PFDA	250	5
M7PFUdA	250	5
MPFDoA	250	5
M2PFTeDA	250	5
M3PFBS	466	9.32
M3PFHxS	474	9.48
M8PFOS	479	9.58
M2-4:2FTS	938	18.8
M2-6:2FTS	951	19
M2-8:2FTS	960	19.2
M8FOSA	500	10
d3-N-MeFOSA	500	10
d5-N-EtFOSA	500	10
d3-N-MeFOSAA	1000	20
d5-N-EtFOSAA	1000	20
d7-N-MeFOSE	5000	100
d9-N-EtFOSE	5000	100
M3HFPO-DA	2000	40

Table 3: Stock and Nominal Non-Extracted Internal Standard Concentrations

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Nominal amount of EIS added to extracts (ng)
M3PFBA	1000	40
M2PFHxA	500	10
M4PFOA	500	10
M5PFNA	250	5
M2PFDA	250	5
18O2PFHxS	474	9.48
M4PFOS	479	9.58

Table 4: Initial Calibration levels and Concentrations

Analyte	Cal A	Cal B (LOQ)	CAL C	Cal D	Cal E (CCV)	Cal F	Cal G	Cal H	Cal I
PFBA	.4	.8	2	5	10	20	50	250	500
PFPeA	.2	.4	1	2.5	5	10	25	125	250
PFHxA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFHpA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFOA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFNA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFDA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFUnA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFDoA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFTrDA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFTA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFBS	0.089	0.177	0.444	1.11	2.22	4.44	11.1	55.4	111
PFPeS	0.094	0.188	0.471	1.18	2.35	4.71	11.8	58.8	118
PFHxS	0.091	0.183	0.457	1.14	2.29	4.57	11.4	57.1	114
PFHpS	0.095	0.191	0.477	1.19	2.38	4.77	11.9	59.6	119
PFOS	0.093	0.186	0.464	1.16	2.32	4.64	11.6	58	116
PFNS	0.096	0.192	0.481	1.20	2.41	4.81	12	60.1	120
PFDS	0.097	0.193	0.483	1.21	2.41	4.83	12.1	60.3	121
PFDOS	0.097	0.194	0.485	1.21	2.43	4.85	12.1	60.6	121.
4:2FTS	0.375	0.75	1.88	4.69	9.38	18.8	46.9	234	469
6:2FTS	0.38	0.76	1.9	4.75	9.5	19	47.5	238	475
8:2FTS	0.384	0.768	1.92	4.8	9.6	19.2	48	240	480
PFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NEtFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSAA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NEtFOSAA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSE	1	2	5	12.5	25	50	125	625	1250
NEtFOSE	1	2	5	12.5	25	50	125	625	1250
HFPO-DA	.4	.8	2	5	10	20	50	250	500
ADONA	0.378	0.756	1.89	4.73	9.45	18.9	47.3	236	473
9Cl-PFONS	0.374	0.748	1.87	4.68	9.35	18.7	46.8	234	468
11Cl-PFOUdS	0.378	0.756	1.89	4.73	9.45	18.9	47.3	236	473
PFMPA	.2	.4	1	2.5	5	10	25	125	250
PFMBA	.2	.4	1	2.5	5	10	25	125	250
PFEESA	0.178	0.356	0.89	2.23	4.45	8.9	22.3	111	223
NFDHA	.2	.4	1	2.5	5	10	25	125	250

3:3FTCA	.5	1	2.5	6.25	12.5	25	62.5	312	624
5:3FTCA	2.5	5	12.5	31.3	62.5	125	312	1560	3120
7:3FTCA	2.5	5	12.5	31.3	62.5	125	312	1560	3125
M4PFBA	10	10	10	10	10	10	10	10	10
M5PFPeA	5	5	5	5	5	5	5	5	5
M5PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M4PFHpA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M8PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M9PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M6PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M7PFUdA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
MPFDoA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M2PFTeDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M3PFBS	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
M3PFHxS	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
M8PFOS	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
M2-4:2FTS	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69
M2-6:2FTS	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
M2-8:2FTS	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
M8FOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d3-N-MeFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d5-N-EtFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d3-N-MeFOSAA	5	5	5	5	5	5	5	5	5
d5-N-EtFOSAA	5	5	5	5	5	5	5	5	5
d7-N-MeFOSE	25	25	25	25	25	25	25	25	25
d9-N-EtFOSE	25	25	25	25	25	25	25	25	25
M3HFPO-DA	10	10	10	10	10	10	10	10	10
M3PFBA	5	5	5	5	5	5	5	5	5
M2PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M4PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M5PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M2PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
18O2PFHxS	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
M4PFOS	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4

Table 5: Expected Mass Transitions and instrument conditions.

Q1	Q2	Analyte	DP Volts	CE Volts
213.032	169.022	PFBA	-50	-14
263.039	219.03	PFPeA	-55	-12
263.039	68.9	PFPeA_2	-55	-55
313.047	269.037	PFHxA	-45	-12
313.047	119	PFHxA_2	-45	-28
363.055	319.045	PFHpA	-60	-12
363.055	169.022	PFHpA_2	-60	-24
413.063	369.053	PFOA	-65	-14
413.063	169.022	PFOA_2	-65	-23
463.071	419.061	PFNA	-70	-14
463.071	219.03	PFNA_2	-70	-24
513.078	469.069	PFDA	-80	-16
513.078	219.03	PFDA_2	-80	-30
563.086	519.076	PFUnA	-85	-18
563.086	269.037	PFUnA_2	-85	-25
613.094	569.084	PFDoA	-85	-18
613.094	319.045	PFDoA_2	-85	-28
663.102	619.092	PFTrDA	-85	-20
663.102	169.022	PFTrDA_2	-85	-36
713.11	669.1	PFTA	-70	-22
713.11	169.022	PFTA_2	-70	-38
299.092	80.062	PFBS	-100	-65
299.092	99.061	PFBS_2	-100	-40
349.1	80.062	PFPeS	-100	-75
349.1	99.061	PFPeS_2	-100	-60
399.107	80.062	PFHxS	-120	-75
399.107	99.061	PFHxS_2	-120	-80
449.115	80.062	PFHpS	-140	-95
449.115	99.061	PFHpS_2	-140	-80
499.113	80.062	PFOS	-145	-108
499.113	99.061	PFOS_2	-145	-85
549.131	80.062	PFNS	-180	-100
549.131	99.061	PFNS_2	-180	-100
599.139	80.062	PFDS	-170	-110
599.138	99.061	PFDS_2	-170	-100
699.154	80.062	PFDoS	-160	-150
699.154	99.061	PFDoS_2	-160	-130

327.146	307.139	4:2FTS	-100	-28
327.146	81.07	4:2FTS_2	-100	-50
427.161	407.155	6:2FTS	-120	-33
427.161	81.07	6:2FTS_2	-120	-65
527.177	507.17	8:2FTS	-140	-39
527.177	81.07	8:2FTS_2	-140	-85
498.146	78.07	FOSA	-150	-90
498.146	478	FOSA_2	-150	-35
512.163	219.03	NMeFOSA	-130	-35
512.163	169.022	NMeFOSA_2	-130	-40
526.192	219.03	NEtFOSA	-140	-35
526.192	169.022	NEtFOSA_2	-140	-35
570.202	419.061	NMeFOSAA	-100	-28
570.202	483	NMeFOSAA_2	-100	-22
584.229	419.061	NEtFOSAA	-100	-28
584.229	526.192	NEtFOSAA_2	-100	-38
616.1	58.9	NMeFOSE	-90	-70
630	58.9	NEtFOSE	-80	-75
285.035	169.022	HFPO-DA	-60	-12
285.035	184.9	HFPO-DA_2	-60	-18
377.06	251.028	ADONA	-65	-18
377.06	84.8	ADONA_2	-65	-48
530.8	351.05	9Cl-PFONS	-130	-38
532.8	353	9Cl-PFONS_2	-130	-38
630.9	451.031	11Cl-PFOUdS	-145	-41
632.9	452.9	11Cl-PFOUdS_2	-145	-41
241.085	177.069	3:3FTCA	-60	-12
241.085	117	3:3FTCA_2	-60	-50
341.101	237.072	5:3FTCA	-70	-20
341.101	217	5:3FTCA_2	-70	-35
441.117	316.9	7:3FTCA	-85	-30
441.117	337.088	7:3FTCA_2	-85	-20
315.093	135.013	PFEESA	-100	-35
315.093	82.9	PFEESA_2	-100	-25
229.032	85.006	PFMPA	-40	-25
279.042	85.006	PFMBA	-45	-25
295.032	201	NFDHA	-30	-15
295.032	84.9	NFDHA_2	-30	-40
217.001	171.999	MPFBA	-50	-14

268.001	222.999	M5PFPeA	-55	-12
318.009	273.007	M5PFHxA	-45	-12
367.024	322.022	M4PFHpA	-60	-12
421.002	376	M8PFOA	-65	-14
472.002	427	M9PFNA	-70	-14
519.033	474.03	M6PFDA	-80	-16
570.033	525.031	M7-PFUdA	-85	-18
615.079	570.033	MPFDoA	-85	-18
715.094	670.092	M2PFTeDA	-70	-22
302.069	80.062	M3PFBS	-100	-65
402.084	80.062	M3PFHxS	-120	-74
507.062	80.062	M8PFOS	-145	-85
329.13	81.07	M2-4:2FTS	-100	-50
429.162	81.07	M2-6:2FTS	-120	-65
529.162	81.07	M2-8:2FTS	-140	-85
506.077	78.07	M8FOSA	-150	-90
515.183	219.03	d3-NMeFOSA	-130	-35
531.222	219.03	d5-NEtFOSA	-140	-35
573.22	419.061	d3-NMeFOSAA	-75	-28
589.259	419.061	d5-NEtFOSAA	-90	-28
623.2	58.9	d7-NMeFOSE	-100	-28
639.2	58.9	d9-NEtFOSE	-100	-28
287.02	169.022	M3HFPO-DA	-60	-12
216.009	171.999	M3PFBA	-50	-14
315.032	270.03	M2PFHxA	-45	-12
417.032	372.03	M4PFOA	-65	-14
468.032	423.03	M5PFNA	-70	-14
515.063	470.061	M2PFDA	-80	-16
403.107	84.062	18O2-PFHxS	-120	-74
503.093	80.062	M4PFOS	-145	-85

Table 6: LC Method Conditions

Time (min)	2 mM Ammonium Acetate (5:95 CH/H_2O)	100% Acetonitrile	Gradient Curve
Initial	100.0	0.0	0
.2	100.0	0.0	2
4	70	30	7
7	45	55	8
9	25	80	8
10	5	95	6
10.4	98	2	10
11.8	100	0	7
12	100	0	1
Waters Aquity UPLC ® BEHC_{18} 2.1 x 50 mm packed with 1.7 µm BEH C_{18} stationary phase Flow rate of 0.4 mL/min 2 µL injection			

Table 7: ESI-MS Method Conditions

ESI Conditions	
Polarity	Negative ion
Curtain Gas	30
Collision gas	9
Ion Spray Voltage	-4500
Desolvation gas temp.	500 ºC
Ion Source Gas 1	30
Ion Source Gas 2	50
Entrance Poitential	-10
Exic Cell Potential	-11

Table 8. Reporting Limits by Matrix

Compound	Aqueous (ng/L)	Solid (ng/g)	Tissue (ng/g)
PFBA	6.4	0.8	2
PFPeA	3.2	0.4	1
PFHxA	1.6	0.2	0.5
PFHpA	1.6	0.2	0.5
PFOA	1.6	0.2	0.5
PFNA	1.6	0.2	0.5
PFDA	1.6	0.2	0.5
PFUnA	1.6	0.2	0.5
PFDoA	1.6	0.2	0.5
PFTrDA	1.6	0.2	0.5
PFTA	1.6	0.2	0.5
PFBS	1.6	0.2	0.5
PFPeS	1.6	0.2	0.5
PFHxS	1.6	0.2	0.5
PFHpS	1.6	0.2	0.5
PFOS	1.6	0.2	0.5
PFNS	1.6	0.2	0.5
PFDS	1.6	0.2	0.5
PFDoS	1.6	0.2	0.5
4:2FTS	6.4	0.8	2
6:2FTS	6.4	0.8	2
8:2FTS	6.4	0.8	2
FOSA	1.6	0.2	2
NMeFOSA	1.6	0.2	0.5
NEtFOSA	1.6	0.2	0.5
NMeFOSAA	1.6	0.2	0.5
NEtFOSAA	1.6	0.2	0.5
NMeFOSE	16	2	5
NEtFOSE	16	2	5
HFPO-DA	6.4	0.8	2
ADONA	6.4	0.8	2
9Cl-PFONS	6.4	0.8	2
11Cl-PFOUdS	6.4	0.8	2
3:3FTCA	8	1	2.5
5:3FTCA	40	5	12.5
7:3FTCA	40	5	12.5
PFEESA	3.2	0.4	1
PFMPA	3.2	0.4	1
PFMBA	3.2	0.4	1
NFDHA	3.2	0.4	1

17. TOP Assay SOP Addendum

The following modifications are applied to this SOP;

Section 7: Water Bath – Capable of monitoring recording to .1 C maintaining 85 C.

Section 8.1

1. Sodium Hydroxide (NaOH, CAS#: 1310-73-2) – High purity, demonstrated to be free of analytes and interferences.

2. Potassium Persulfate ($K_2S_2O_8$, CAS#: 7727-21-1) - High purity, demonstrated to be free of analytes and interferences.

3. Hydrochloric Acid (HCl, CAS#: 7647-01-0) - High purity, demonstrated to be free of analytes and interferences.

Table 1

Isotope Labeled Standard	Conc. Top Surr Stock (ng/mL)	Vol. of Top Surr Stock (µl)	Final Vol. of Top Surr PDS (mL)	Final Conc. of Top Surr PDS (ng/mL)
$^{13}C_2$-PFOA	50,000	40	4.0	500
$^{13}C_2D_4$-4:2FTS	50,000	80	4.0	1000

Section 10

1. Pretreatment of Samples - For Aqueous samples, prior to Section 10.1, add to each 125 ml sample with Potassium Persulfate until 60 mM (about 2 grams). Add Sodium Hydroxide until the sample is 125 mM (about .625 grams). Sample should have a pH >12.

2. Fortify each sample with 20 µl of TOP pre-assay surrogate containing 1 negative control surrogates and 1 positive control surrogates from table 1.

3. Place sample in a water bath at 85 C for 6 hours.

4. Remove sample from water bath and adjust pH 6-8 with Hydrochloric Acid.

5. Following pre-treatment, follow the aqueous extraction protocol from section 10 of SOP 45852 unaltered.

Section 11 - An additional calculation is added for the final reporting of the TOP assay results.

TOP Assay = Result of Post TOP assay extraction – Result of analysis from Pre-Top Assay extraction.

ATTACHMENT 3

Laboratory Certification

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised June 10, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES AIR AND EMISSIONS
All approved analytes are listed below:

Polychlorinated Biphenyls

PCBs and Aroclors	EPA TO-10A
	EPA TO-4A

Polynuclear Aromatics

Acenaphthene	EPA TO-13A
Acenaphthylene	EPA TO-13A
Anthracene	EPA TO-13A
Benzo(a)anthracene	EPA TO-13A
Benzo(a)pyrene	EPA TO-13A
Benzo(b)fluoranthene	EPA TO-13A
Benzo(g,h,i)perylene	EPA TO-13A
Benzo(k)fluoranthene	EPA TO-13A
Chrysene	EPA TO-13A
Dibenzo(a,h)anthracene	EPA TO-13A
Fluoranthene	EPA TO-13A
Fluorene	EPA TO-13A
Indeno(1,2,3-cd)pyrene	EPA TO-13A
Naphthalene	EPA TO-13A
Phenanthrene	EPA TO-13A
Pyrene	EPA TO-13A

Serial No.: 71083

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Metals I

Arsenic, Total	EPA 200.8 Rev. 5.4
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Iron, Total	EPA 200.7 Rev. 4.4
Lead, Total	EPA 200.8 Rev. 5.4
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Mercury, Total	EPA 245.1 Rev. 3.0
Selenium, Total	EPA 200.8 Rev. 5.4
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Metals II

Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.8 Rev. 5.4
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Thallium, Total	EPA 200.8 Rev. 5.4

Serial No.: 70542

Expires 12:01 AM April 01, 2026
Issued April 01, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Metals II

Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Metals III

Boron, Total	EPA 200.7 Rev. 4.4
Calcium, Total	EPA 200.7 Rev. 4.4
Magnesium, Total	EPA 200.7 Rev. 4.4
Potassium, Total	EPA 200.7 Rev. 4.4
Sodium, Total	EPA 200.7 Rev. 4.4

Miscellaneous

1,4-Dioxane	EPA 522

Non-Metals

Calcium Hardness	EPA 200.7 Rev. 4.4

Perfluorinated Alkyl Acids

11Cl-PF3OUdS	EPA 533
	EPA 537.1, Version 2
4:2FTS	EPA 533
6:2FTS	EPA 533
8:2FTS	EPA 533
9Cl-PF3ONS	EPA 533
	EPA 537.1, Version 2
ADONA	EPA 533
	EPA 537.1, Version 2
HFPO-DA (GenX)	EPA 533
	EPA 537.1, Version 2
NEtFOSAA	EPA 537.1, Version 2
NFDHA	EPA 533

Serial No.: 70542

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Perfluorinated Alkyl Acids

NMeFOSAA	EPA 537.1, Version 2
Perflourotridecanoic Acid (PFTrDA)	EPA 537.1, Version 2
Perfluordecanoic Acid (PFDA)	EPA 533
	EPA 537.1, Version 2
Perfluoro-3-Methoxypropanoic Acid (F	EPA 533
Perfluoro-4-Methoxybutanoic Acid (PF	EPA 533
Perfluorobutanesulfonic Acid (PFBS)	EPA 533
	EPA 537.1, Version 2
Perfluorobutanoic Acid (PFBA)	EPA 533
Perfluorododecanoic Acid (PFDoA)	EPA 533
	EPA 537.1, Version 2
Perfluoroheptanesulfonic Acid (PFHpS	EPA 533
Perfluoroheptanoic Acid (PFHpA)	EPA 533
	EPA 537.1, Version 2
Perfluorohexanesulfonic Acid (PFHxS	EPA 533
	EPA 537.1, Version 2
Perfluorohexanoic Acid (PFHxA)	EPA 533
	EPA 537.1, Version 2
Perfluorononanoic Acid (PFNA)	EPA 533
	EPA 537.1, Version 2
Perfluorooctanesulfonic Acid (PFOS)	EPA 533
	EPA 537.1, Version 2
Perfluorooctanoic Acid (PFOA)	EPA 533
	EPA 537.1, Version 2
Perfluoropentanesulfonic Acid (PFPeS	EPA 533
Perfluoropentanoic Acid (PFPeA)	EPA 533
Perfluorotetradecanoic Acid (PFTeDA)	EPA 537.1, Version 2

Serial No.: 70542

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Perfluorinated Alkyl Acids

Perfluoroundecanoic Acid (PFUnA)	EPA 533
	EPA 537.1, Version 2
PFEESA	EPA 533

Serial No.: 70542

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE *NY Lab Id No: 11627*
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Amines

1,2-Diphenylhydrazine	EPA 8270E
2-Nitroaniline	EPA 8270E
3-Nitroaniline	EPA 8270E
4-Chloroaniline	EPA 8270E
4-Nitroaniline	EPA 8270E
Aniline	EPA 8270E
Carbazole	EPA 8270E
Pyridine	EPA 8270E

Benzidines

3,3'-Dichlorobenzidine	EPA 8270E
Benzidine	EPA 8270E

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
delta-BHC	EPA 8081B
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B

Serial No.: 71165

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Chlorinated Hydrocarbon Pesticides

Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Isodrin	EPA 8081B
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Mirex	EPA 8081B
PCNB	EPA 8270E
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,4,5-Tetrachlorobenzene	EPA 8270E
1,2,4-Trichlorobenzene	EPA 8270E
2-Chloronaphthalene	EPA 8270E
Hexachlorobenzene	EPA 8081B
	EPA 8270E
Hexachlorobutadiene	EPA 8270E
Hexachlorocyclopentadiene	EPA 8270E
Hexachloroethane	EPA 8270E

Fuel Oxygenates

Ethanol	EPA 8015D
tert-amyl alcohol	EPA 8015D
tert-butyl alcohol	EPA 8015D

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 8270E

Serial No.: 71165

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Haloethers

4-Bromophenylphenyl ether	EPA 8270E
4-Chlorophenylphenyl ether	EPA 8270E
Bis(2-chloroethoxy)methane	EPA 8270E
Bis(2-chloroethyl)ether	EPA 8270E

Low Level Polynuclear Aromatics

Acenaphthene Low Level	EPA 8270E SIM
Acenaphthylene Low Level	EPA 8270E SIM
Anthracene Low Level	EPA 8270E SIM
Benzo(a)anthracene Low Level	EPA 8270E SIM
Benzo(a)pyrene Low Level	EPA 8270E SIM
Benzo(b)fluoranthene Low Level	EPA 8270E SIM
Benzo(g,h,i)perylene Low Level	EPA 8270E SIM
Benzo(k)fluoranthene Low Level	EPA 8270E SIM
Chrysene Low Level	EPA 8270E SIM
Dibenzo(a,h)anthracene Low Level	EPA 8270E SIM
Fluoranthene Low Level	EPA 8270E SIM
Fluorene Low Level	EPA 8270E SIM
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270E SIM
Naphthalene Low Level	EPA 8270E SIM
Phenanthrene Low Level	EPA 8270E SIM
Pyrene Low Level	EPA 8270E SIM

Metals I

Barium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)

Serial No.: 71165

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Metals I

Cadmium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Calcium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Chromium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Copper, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Iron, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Lead, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Magnesium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B

Serial No.: 71165

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Metals I

Magnesium, Total	EPA 200.8, Rev. 5.4 (1994)
Manganese, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Nickel, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Potassium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Silver, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Sodium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Strontium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B

Metals II

Aluminum, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D

Serial No.: 71165

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Metals II

Aluminum, Total	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Antimony, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Arsenic, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Beryllium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Mercury, Low Level	EPA 245.7, Rev. 2.0 (2005)
	EPA 1631E
Mercury, Total	EPA 245.1, Rev. 3.0 (1994)
	EPA 7470A
Selenium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Vanadium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Zinc, Total	EPA 200.7, Rev. 4.4 (1994)

Serial No.: 71165

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Metals II

Zinc, Total	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)

Metals III

Cobalt, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Molybdenum, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Thallium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Tin, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
Titanium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D

Mineral

Calcium Hardness	EPA 200.7, Rev. 4.4 (1994)
Hardness, Total	SM 2340B-2011

Miscellaneous

Boron, Total	EPA 200.7, Rev. 4.4 (1994)

Serial No.: 71165

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Miscellaneous

Boron, Total	EPA 6010D
	EPA 6020B
Silica, Dissolved	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 8270E
2,6-Dinitrotoluene	EPA 8270E
Isophorone	EPA 8270E
Nitrobenzene	EPA 8270E

Nitrosoamines

N-Nitrosodimethylamine	EPA 8270E
N-Nitrosodi-n-propylamine	EPA 8270E
N-Nitrosodiphenylamine	EPA 8270E

Organophosphate Pesticides

Atrazine	EPA 8270E

Perfluorinated Alkyl Acids

11Cl-PF3OUdS	EPA 1633A
3:3 FTCA	EPA 1633A
4:2FTS	EPA 1633A
5:3 FTCA	EPA 1633A
6:2FTS	EPA 1633A
7:3 FTCA	EPA 1633A
8:2FTS	EPA 1633A
9Cl-PF3ONS	EPA 1633A
ADONA	EPA 1633A
HFPO-DA (GenX)	EPA 1633A

Serial No.: 71165

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Perfluorinated Alkyl Acids

NEtFOSA	EPA 1633A
NEtFOSAA	EPA 1633A
NEtFOSE	EPA 1633A
NFDHA	EPA 1633A
NMeFOSA	EPA 1633A
NMeFOSAA	EPA 1633A
NMeFOSE	EPA 1633A
Perflourotridecanoic Acid (PFTrDA)	EPA 1633A
Perfluordecanoic Acid (PFDA)	EPA 1633A
Perfluoro-3-Methoxypropanoic Acid (F	EPA 1633A
Perfluoro-4-Methoxybutanoic Acid (PF	EPA 1633A
Perfluorobutanesulfonic Acid (PFBS)	EPA 1633A
Perfluorobutanoic Acid (PFBA)	EPA 1633A
Perfluorodecanesulfonic acid (PFDS)	EPA 1633A
Perfluorododecanesulfonic acid (PFDc	EPA 1633A
Perfluorododecanoic Acid (PFDoA)	EPA 1633A
Perfluoroheptanesulfonic Acid (PFHpS	EPA 1633A
Perfluoroheptanoic Acid (PFHpA)	EPA 1633A
Perfluorohexanesulfonic Acid (PFHxS	EPA 1633A
Perfluorohexanoic Acid (PFHxA)	EPA 1633A
Perfluorononanesulfonic acid (PFNS)	EPA 1633A
Perfluorononanoic Acid (PFNA)	EPA 1633A
Perfluorooctanesulfonamide (PFOSA)	EPA 1633A
Perfluorooctanesulfonic Acid (PFOS)	EPA 1633A
Perfluorooctanoic Acid (PFOA)	EPA 1633A
Perfluoropentanesulfonic Acid (PFPeS	EPA 1633A
Perfluoropentanoic Acid (PFPeA)	EPA 1633A

Serial No.: 71165

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Perfluorinated Alkyl Acids

Perfluorotetradecanoic Acid (PFTeDA)	EPA 1633A
Perfluoroundecanoic Acid (PFUnA)	EPA 1633A
PFEESA	EPA 1633A

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015D

Phthalate Esters

Benzyl butyl phthalate	EPA 8270E
Bis(2-ethylhexyl) phthalate	EPA 8270E
Diethyl phthalate	EPA 8270E
Dimethyl phthalate	EPA 8270E
Di-n-butyl phthalate	EPA 8270E
Di-n-octyl phthalate	EPA 8270E

Polychlorinated Biphenyls

Aroclor 1016 (PCB-1016)	EPA 8082A
Aroclor 1221 (PCB-1221)	EPA 8082A
Aroclor 1232 (PCB-1232)	EPA 8082A
Aroclor 1242 (PCB-1242)	EPA 8082A
Aroclor 1248 (PCB-1248)	EPA 8082A
Aroclor 1254 (PCB-1254)	EPA 8082A
Aroclor 1260 (PCB-1260)	EPA 8082A
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A

Polynuclear Aromatics

Acenaphthene	EPA 8270E
Acenaphthylene	EPA 8270E
Anthracene	EPA 8270E

Serial No.: 71165

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Polynuclear Aromatics

Benzo(a)anthracene	EPA 8270E
Benzo(a)pyrene	EPA 8270E
Benzo(b)fluoranthene	EPA 8270E
Benzo(g,h,i)perylene	EPA 8270E
Benzo(k)fluoranthene	EPA 8270E
Chrysene	EPA 8270E
Dibenzo(a,h)anthracene	EPA 8270E
Fluoranthene	EPA 8270E
Fluorene	EPA 8270E
Indeno(1,2,3-cd)pyrene	EPA 8270E
Naphthalene	EPA 8270E
Phenanthrene	EPA 8270E
Pyrene	EPA 8270E

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270E
2,4,5-Trichlorophenol	EPA 8270E
2,4,6-Trichlorophenol	EPA 8270E
2,4-Dichlorophenol	EPA 8270E
2,4-Dimethylphenol	EPA 8270E
2,4-Dinitrophenol	EPA 8270E
2-Chlorophenol	EPA 8270E
2-Methyl-4,6-dinitrophenol	EPA 8270E
2-Methylphenol	EPA 8270E
2-Nitrophenol	EPA 8270E
3-Methylphenol	EPA 8270E
4-Chloro-3-methylphenol	EPA 8270E
4-Methylphenol	EPA 8270E

Serial No.: 71165

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Priority Pollutant Phenols

4-Nitrophenol	EPA 8270E
Pentachlorophenol	EPA 8270E
Phenol	EPA 8270E

Semi-Volatile Organics

1,1'-Biphenyl	EPA 8270E
1,2-Dichlorobenzene, Semi-volatile	EPA 8270E
1,3-Dichlorobenzene, Semi-volatile	EPA 8270E
1,4-Dichlorobenzene, Semi-volatile	EPA 8270E
2-Methylnaphthalene	EPA 8270E
Acetophenone	EPA 8270E
Benzaldehyde	EPA 8270E
Benzoic Acid	EPA 8270E
Benzyl alcohol	EPA 8270E
Caprolactam	EPA 8270E
Dibenzofuran	EPA 8270E

Volatiles Organics

1,4-Dioxane	EPA 8270E SIM
Ethylene Glycol	EPA 8015D
Isobutyl alcohol	EPA 8015D
Methanol	EPA 8015D
Propylene Glycol	EPA 8015D

Sample Preparation Methods

	EPA 3015A
	EPA 3005A
	EPA 3510C

Serial No.: 71165

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Amines

1,2-Diphenylhydrazine	EPA 8270E
2-Nitroaniline	EPA 8270E
3-Nitroaniline	EPA 8270E
4-Chloroaniline	EPA 8270E
4-Nitroaniline	EPA 8270E
Aniline	EPA 8270E
Carbazole	EPA 8270E

Benzidines

3,3'-Dichlorobenzidine	EPA 8270E
Benzidine	EPA 8270E

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
delta-BHC	EPA 8081B
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B
Endrin aldehyde	EPA 8081B

Serial No.: 71166

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Chlorinated Hydrocarbon Pesticides

Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Mirex	EPA 8081B
Pentachloronitrobenzene	EPA 8270E
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,4,5-Tetrachlorobenzene	EPA 8270E
1,2,4-Trichlorobenzene	EPA 8270E
2-Chloronaphthalene	EPA 8270E
Hexachlorobenzene	EPA 8270E
Hexachlorobutadiene	EPA 8270E
Hexachlorocyclopentadiene	EPA 8270E
Hexachloroethane	EPA 8270E

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 8270E
4-Bromophenylphenyl ether	EPA 8270E
4-Chlorophenylphenyl ether	EPA 8270E
Bis(2-chloroethoxy)methane	EPA 8270E
Bis(2-chloroethyl)ether	EPA 8270E

Low Level Polynuclear Aromatic Hydrocarbons

Acenaphthene Low Level	EPA 8270E SIM
Acenaphthylene Low Level	EPA 8270E SIM

Serial No.: 71166

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Low Level Polynuclear Aromatic Hydrocarbons

Anthracene Low Level	EPA 8270E SIM
Benzo(a)anthracene Low Level	EPA 8270E SIM
Benzo(a)pyrene Low Level	EPA 8270E SIM
Benzo(b)fluoranthene Low Level	EPA 8270E SIM
Benzo(g,h,i)perylene Low Level	EPA 8270E SIM
Benzo(k)fluoranthene Low Level	EPA 8270E SIM
Chrysene Low Level	EPA 8270E SIM
Dibenzo(a,h)anthracene Low Level	EPA 8270E SIM
Fluoranthene Low Level	EPA 8270E SIM
Fluorene Low Level	EPA 8270E SIM
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270E SIM
Naphthalene Low Level	EPA 8270E SIM
Phenanthrene Low Level	EPA 8270E SIM
Pyrene Low Level	EPA 8270E SIM

Metals I

Barium, Total	EPA 6010D
	EPA 6020B
Cadmium, Total	EPA 6010D
	EPA 6020B
Calcium, Total	EPA 6010D
	EPA 6020B
Chromium, Total	EPA 6010D
	EPA 6020B
Copper, Total	EPA 6010D
	EPA 6020B
Iron, Total	EPA 6010D
	EPA 6020B

Serial No.: 71166

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Metals I

Lead, Total	EPA 6010D
	EPA 6020B
Magnesium, Total	EPA 6010D
	EPA 6020B
Manganese, Total	EPA 6010D
	EPA 6020B
Nickel, Total	EPA 6010D
	EPA 6020B
Potassium, Total	EPA 6010D
	EPA 6020B
Silver, Total	EPA 6010D
	EPA 6020B
Sodium, Total	EPA 6010D
	EPA 6020B
Strontium, Total	EPA 6010D
	EPA 6020B

Metals II

Aluminum, Total	EPA 6010D
	EPA 6020B
Antimony, Total	EPA 6010D
	EPA 6020B
Arsenic, Total	EPA 6010D
	EPA 6020B
Beryllium, Total	EPA 6010D
	EPA 6020B
Lithium, Total	EPA 6010D
Mercury, Total	EPA 7471B

Serial No.: 71166

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Metals II

Mercury, Total	EPA 7474
Selenium, Total	EPA 6010D
	EPA 6020B
Vanadium, Total	EPA 6010D
	EPA 6020B
Zinc, Total	EPA 6010D
	EPA 6020B

Metals III

Cobalt, Total	EPA 6010D
	EPA 6020B
Molybdenum, Total	EPA 6010D
	EPA 6020B
Thallium, Total	EPA 6010D
	EPA 6020B
Tin, Total	EPA 6010D
	EPA 6020B
Titanium, Total	EPA 6010D

Miscellaneous

Boron, Total	EPA 6010D

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 8270E
2,6-Dinitrotoluene	EPA 8270E
Isophorone	EPA 8270E
Nitrobenzene	EPA 8270E
Pyridine	EPA 8270E

Serial No.: 71166

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Nitrosoamines

N-Nitrosodimethylamine	EPA 8270E
N-Nitrosodi-n-propylamine	EPA 8270E
N-Nitrosodiphenylamine	EPA 8270E

Perfluorinated Alkyl Acids

11Cl-PF3OUdS	EPA 1633A
3:3 FTCA	EPA 1633A
4:2FTS	EPA 1633A
5:3 FTCA	EPA 1633A
6:2FTS	EPA 1633A
7:3 FTCA	EPA 1633A
8:2FTS	EPA 1633A
9Cl-PF3ONS	EPA 1633A
ADONA	EPA 1633A
HFPO-DA (GenX)	EPA 1633A
NEtFOSA	EPA 1633A
NEtFOSAA	EPA 1633A
NEtFOSE	EPA 1633A
NFDHA	EPA 1633A
NMeFOSA	EPA 1633A
NMeFOSAA	EPA 1633A
NMeFOSE	EPA 1633A
Perflourotridecanoic Acid (PFTrDA)	EPA 1633A
Perfluordecanoic Acid (PFDA)	EPA 1633A
Perfluoro-3-Methoxypropanoic Acid (F	EPA 1633A
Perfluoro-4-Methoxybutanoic Acid (PF	EPA 1633A
Perfluorobutanesulfonic Acid (PFBS)	EPA 1633A
Perfluorobutanoic Acid (PFBA)	EPA 1633A

Serial No.: 71166

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE *NY Lab Id No: 11627*
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Perfluorinated Alkyl Acids

Perfluorodecanesulfonic acid (PFDS)	EPA 1633A
Perfluorododecanesulfonic acid (PFDc	EPA 1633A
Perfluorododecanoic Acid (PFDoA)	EPA 1633A
Perfluoroheptanesulfonic Acid (PFHpS	EPA 1633A
Perfluoroheptanoic Acid (PFHpA)	EPA 1633A
Perfluorohexanesulfonic Acid (PFHxS	EPA 1633A
Perfluorohexanoic Acid (PFHxA)	EPA 1633A
Perfluorononanesulfonic acid (PFNS)	EPA 1633A
Perfluorononanoic Acid (PFNA)	EPA 1633A
Perfluorooctanesulfonamide (PFOSA)	EPA 1633A
Perfluorooctanesulfonic Acid (PFOS)	EPA 1633A
Perfluorooctanoic Acid (PFOA)	EPA 1633A
Perfluoropentanesulfonic Acid (PFPeS	EPA 1633A
Perfluoropentanoic Acid (PFPeA)	EPA 1633A
Perfluorotetradecanoic Acid (PFTeDA)	EPA 1633A
Perfluoroundecanoic Acid (PFUnA)	EPA 1633A
PFEESA	EPA 1633A

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015D

Phthalate Esters

Benzyl butyl phthalate	EPA 8270E
Bis(2-ethylhexyl) phthalate	EPA 8270E
Diethyl phthalate	EPA 8270E
Dimethyl phthalate	EPA 8270E
Di-n-butyl phthalate	EPA 8270E
Di-n-octyl phthalate	EPA 8270E

Serial No.: 71166

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE *NY Lab Id No: 11627*
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Polychlorinated Biphenyls

Aroclor 1016 (PCB-1016)	EPA 8082A
Aroclor 1221 (PCB-1221)	EPA 8082A
Aroclor 1232 (PCB-1232)	EPA 8082A
Aroclor 1242 (PCB-1242)	EPA 8082A
Aroclor 1248 (PCB-1248)	EPA 8082A
Aroclor 1254 (PCB-1254)	EPA 8082A
Aroclor 1260 (PCB-1260)	EPA 8082A
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A

Polynuclear Aromatic Hydrocarbons

Acenaphthene	EPA 8270E
Acenaphthylene	EPA 8270E
Anthracene	EPA 8270E
Benzo(a)anthracene	EPA 8270E
Benzo(a)pyrene	EPA 8270E
Benzo(b)fluoranthene	EPA 8270E
Benzo(g,h,i)perylene	EPA 8270E
Benzo(k)fluoranthene	EPA 8270E
Chrysene	EPA 8270E
Dibenzo(a,h)anthracene	EPA 8270E
Fluoranthene	EPA 8270E
Fluorene	EPA 8270E
Indeno(1,2,3-cd)pyrene	EPA 8270E
Naphthalene	EPA 8270E
Phenanthrene	EPA 8270E
Pyrene	EPA 8270E

Serial No.: 71166

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270E
2,4,5-Trichlorophenol	EPA 8270E
2,4,6-Trichlorophenol	EPA 8270E
2,4-Dichlorophenol	EPA 8270E
2,4-Dimethylphenol	EPA 8270E
2,4-Dinitrophenol	EPA 8270E
2-Chlorophenol	EPA 8270E
2-Methyl-4,6-dinitrophenol	EPA 8270E
2-Methylphenol	EPA 8270E
2-Nitrophenol	EPA 8270E
3-Methylphenol	EPA 8270E
4-Chloro-3-methylphenol	EPA 8270E
4-Methylphenol	EPA 8270E
4-Nitrophenol	EPA 8270E
Pentachlorophenol	EPA 8270E
Phenol	EPA 8270E

Semi-Volatile Organics

1,1'-Biphenyl	EPA 8270E
1,2-Dichlorobenzene, Semi-volatile	EPA 8270E
1,3-Dichlorobenzene, Semi-volatile	EPA 8270E
1,4-Dichlorobenzene, Semi-volatile	EPA 8270E
2-Methylnaphthalene	EPA 8270E
Acetophenone	EPA 8270E
Benzaldehyde	EPA 8270E
Benzoic Acid	EPA 8270E
Benzyl alcohol	EPA 8270E
Caprolactam	EPA 8270E

Serial No.: 71166

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025
Revised July 16, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
PACE ANALYTICAL SERVICES, LLC - MANSFIELD, MA (320 FORBES)
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Semi-Volatile Organics

Dibenzofuran	EPA 8270E

Volatile Organics

1,4-Dioxane	EPA 8270E SIM
Ethylene Glycol	EPA 8015D
Isobutyl alcohol	EPA 8015D
tert-butyl alcohol	EPA 8015D

Sample Preparation Methods

	EPA 3570
	EPA 3580A
	EPA 3050B
	EPA 3051A

Serial No.: 71166

ATTACHMENT 4

Chain of Custody Examples

Pace® Location Requested (City/State):

CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields

LAB USE ONLY- Affix Workorder/Login Label Here

Scan QR Code for instructions

Company Name:

Contact/Report To:

Street Address:

Phone #:

E-Mail:

Cc E-Mail:

Customer Project #:

Invoice to:

Project Name:

Invoice E-mail:

Site Collection Info/Facility ID (as applicable):

Purchase Order # (if applicable):

Quote #:

Time Zone Collected: [ ] AK [ ] PT [ ] MT [ ] CT [ ] ET

County / State origin of sample(s):

Data Deliverables:

[ ] Level II [ ] Level III [ ] Level IV

[ ] EQUIS

[ ] Other_______________________

Regulatory Program (DW, RCRA, etc.) as applicable:

Reportable [ ] Yes [ ] No

Rush (Pre-approval required):

[ ] Same Day [ ] 1 Day [ ] 2 Day [ ] 3 Day Other _______________

Date Results Requested:

DW PWSID # or WW Permit # as applicable:

Field Filtered (if applicable): [ ] Yes [ ] No

Analysis:

Specify Container Size **

**Container Size: (1) 1L, (2) 500mL, (3) 250mL, (4) 125mL, (5) 100mL, (6) 40mL vial, (7) EnCore, (8) TerraCore, (9) 90mL, (10) Other

Identify Container Preservative Type***

*** Preservative Types: (1) None, (2) HNO3, (3) H2SO4, (4) HCl, (5) NaOH, (6) Zn Acetate, (7) NaHSO4, (8) Sod. Thiosulfate, (9) Ascorbic Acid, (10) MeOH, (11) Other

Analysis Requested

Lab Use Only

Proj. Mgr:

AcctNum / Client ID:

Table #:

Profile / Template:

Prelog / Bottle Ord. ID:

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SS), Oil (OL), Wipe (WP), Tissue (TS), Bioassay (B), Vapor (V), Surface Water (SW),Sediment (SED), Sludge (SL), Caulk (CK), Leachate (LL), Biosolid (BS), Other (OT)

Customer Sample ID	Matrix *	Comp / Grab	Composite Start		Collected or Composite End		# Cont.	Residual Chlorine												Sample Comment	Preservation non-conformance identified for sample.
			Date	Time	Date	Time		Result	Units												

Additional Instructions from Pace® :

Collected By:

Printed Name

Signature

Customer Remarks / Special Conditions / Possible Hazards:

# Coolers:	Thermometer ID:	Correction Factor (°C):	Obs. Temp. (°C):	Corrected Temp. (°C):	[ ] On Ice

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	Tracking Number:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	Delivered by: [ ] In- Person [ ] Courier
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	[ ] FedEX [ ] UPS [ ] Other
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	**Page: of**

Chain of Custody Instructions

***Pace Location Requested**: City and State of Pace Laboratory testing is to be performed at.
***Company Name**: Client's company name
***Street Address**: Client's mailing address
***City, State, Zip**: Client's city, state and zip code for mailing
***Contact/ Report to**: Person to receive results
Customer Project # and Project Name: Client's reference to the project or work involved with these samples.
Site Collection Info/ Facility ID: Client's location of project
Time Zone: Check time zone of sample to ensure proper hold times are met.
Purchase Order #: Client specific number to be listed on project invoice for client billing purposes.
Invoice To: Client contact the project invoice needs to be emailed to.
Invoice Email: Email address that project invoice will need to be emailed to
***Phone #**: Client's contact phone number
E-mail: Client's e-mail for correspondence and final report
Regulatory Program: List the program that is guiding the work to ensure proper regulations are followed: DW, RCRA, etc.
Data Deliverable: Please select or enter required deliverables.
***County/State Origin of Samples**: Enter the county to ensure proper handling of regulated soils. State required to ensure proper reporting.
Field Filtered: Indicate if samples have been filtered in the field. If samples are required to be field filtered and filtering is not indicated, a qualifier will be added to all associated data.

***Customer Sample ID**: The unique sample ID you want to appear on the analytical report
***Collected Date**: Date sample was collected. For composite samples, please fill in both beginning and end date.
***Collected Time**: Time sample was collected. For composite samples, please fill in both beginning and end time.
***Comp/Grab**: Please denote "GRAB" if the sample was collected at one time from one specific location. Please denote "COMP" if the sample is a composite of samples collected at one or more times or locations and combined to make one sample.
***Matrix**: Select from list provided list. If prepopulated chain is provided for you matrix codes may vary.
***Number and Type of Containers**: Total number of containers per container type submitted for the samples
***Container Size:** Specify container size from list.
***Container Preservation Type**: Specify sample preservation from provided list.
***Analysis Requested**: Write the analysis name (or an abbreviation), the name of a group of tests, or the method number you would like us to perform. Examples are BOD, TCLP Metals, PCBs, Method 624, etc. Place a check mark in the small boxes that correspond to the sample(s) on which you want these tests performed.

Sample Comment: List any notes or important information about the individual sample here. Please identify in the sample comment if a sample should be used for MS/MSD.

Customer Remarks/Special Conditions/Possible Hazards: List special instructions about the sample here. If the sample is known or suspected to be hazardous indicate that here and attach SDS if possible. This space can also be used for listing additional analyses, or to request an extra copy of the report to be sent to an alternate person/address, etc.

Rush request: If faster than standard turnaround time results are needed. Circle one of the rush options and note the day the results are requested by. All rush requests require preapproval by the laboratory. Surcharges will apply for non- standard turnaround times. Results will be due by the end of business on the date due based on standard turnaround time unless other arrangements have been made with your Project Manager.

Summarized Sample Acceptance Policy Requirements:

- Proper, full and completed chain-of-custody documentation
- Readable unique sample container identification written in indelible ink
- Appropriate sample container
- Sufficient sample volume to perform requested tests
- Received within required holding time
- Received within temperature preservation requirements
- Sample containers received in good condition (not leaking or broken)
- Any custody seal intact
- Properly preserved
- No headspace in volatile water samples
- **Note:** When sample specific Quality Control is required (e.g. MS/MSD) please ensure necessary sample containers and sample volume is provided.

A data qualifier and/or case narrative will be added to the final test report when the above sample acceptance requirements are not met.

Location Specific Sample Acceptance Policy available from your Project Manager

***Collected By**: Printed name of sample collector
***Collected By Signature**: Signature of sample collector

***Relinquished By/Received By:** This form **must be signed** each time the sample(s) changes hands. Custody seals are available upon request if needed.

***Required field**: Failure to fill in a required field may result in a sample(s) being put on hold until information can be obtained. This may result in a delay in receiving results.

ATTACHMENT 5

Resumes

AMC Engineering PLLC
18-36 42nd Street
Astoria, NY 11105
Phone: (516) 417-8588

ARIEL CZEMERINSKI, P.E.
Email: Ariel@AMC-Engineering.com

SUMMARY:
New York State Professional Engineer. Chemical and Environmental Engineer, with 29 years of experience in the chemical and environmental areas. Areas of expertise include inspections and sign off on Large Scale Vapor Barrier Installations at Various NYC schools, Design and inspections of Sub Slab Depressurization Systems, wastewater treatment systems, Large scale dewatering system design for construction, process control and automation, process optimization, productivity improvement, quality systems, environmental compliance, Phase I Environmental Site Assessments, Phase II Environmental Investigations, Phase III: Remedial Activities, process and plant safety, and management of a production facility. Special Inspector with New York City Department of Buildings. Registered PE in NY.

Professional Experience:
AMC: 18 Years
Prior: 6 years

Education
Master of Science in Chemical Engineering, Columbia University, New York, NY, Feb. 1990.
Bachelor of Science in Chemical Engineering, University Of Buenos Aires, Buenos Aires, Argentina, May 1987

Areas of Expertise
- Vapor Intrusion - Barrier and Sub Slab Venting System Design
- Environmental Assessment Statements under CEQR, ULURP
- Remedial Program Design and Management
- Environmental Compliance, Clean Water Act, Clean Air Act, Hazardous Materials
- Dewatering & Treatment System Design
- SWPPP design and implementation. Preparation and Submittal of NOIs.
- NYCDEP Sewer Discharge Permitting
- Transfer Station Permitting and Compliance
- Wastewater Treatment Systems and Permitting, SPDES, LI Well permit, Water Withdrawal Permit.
- Air Permits and Registration
- Zoning Regulations and Permitting
- Safety and Environmental Training
- Waste Management Plans
- Professional Certifications
- OSHA 40-hr HAZWOPER
- OSHA 10-hr Construction Safety and Health

Project Experience

Project: Bergen Basin Sewer - CS-JA-BBS -Queens, NY
Project Description: NYC infrastructure (sewer, water) upgrade, drainage channel installation. Dewatering Design. Permits with NYCDEP and NYSDEC. Soil contaminated with petroleum requiring excavation, soil management and disposal under a Materials Handling Plan, Construction Health and Safety Plan. SWPPP design and implementation.
Client: JR Cruz - NYCDDC
Regulatory Authority: NYSDEC, NYCDEP
Role: Mr. Czemerinski served as the Environmental Consultant for the project.

Project: SER002326- Storm and Sanitary Sewers in Wardwell Avenue, Staten Island, New York
Project Description: NYC infrastructure (sewer, water) upgrade.
Dewatering Design. Permits with NYCDEP and NYSDEC. SWPPP design and implementation.
Client: E.E. Cruz - NYCDDC
Regulatory Authority: NYSDEC, NYCDEP
Role: Mr. Czemerinski served as the Environmental Consultant for the project.

Project: HED568-Installation of New 20” Subaqueous water main extension, and new 12” sub-aqueous high pressure gas main from the Bronx to Randall’s Island, New York
Project Description: NYC infrastructure (gas, water) upgrade.
Soil contaminated with petroleum requiring excavation, soil management and disposal under a Materials Handling Plan, Construction Health and Safety Plan. Dewatering Design. Permits with NYCDEP and NYSDEC.
Client: E.E. Cruz - NYCDDC
Regulatory Authority: NYSDEC, NYCDEP
Role: Mr. Czemerinski served as the Environmental Consultant for the project.

Project: Domsey Fiber Corp. - 431 Kent Avenue, Brooklyn NY
Project Description: NYS Brownfield cleanup project / NYC E-Designation. Soil contaminated with chlorinated solvents, petroleum and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: Express Builders
Regulatory Authority: NYSDEC, NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project: SE-807 –Construction of Storm and Sanitary Sewers and Water Main in 20th Ave between 126th St and US Bulkhead Line Area, College Point, Queens, NY
Project Description: NYC Residential infrastructure (sewer, water) upgrade, outfall reconstruction, Soil characterization, soil management and disposal under a Materials Handling Plan, Construction Health and Safety Plan and Community Air Monitoring Plan. SWPPP design and implementation, Public Participation Plan, Marine HASP, Dewatering Design and permit application.

Client: EIC Associates
Regulatory Authority: NYCDDC
Role: Mr. Czemerinski served as the Environmental Consultant for the project.

Project: Springfield Gardens Residential Area BMP - Springfield Gardens, Queens, NY
Project Description: NYC Residential infrastructure (sewer, gas, water) upgrade, drainage channel installation and pond restoration. Soil contaminated with, petroleum and heavy metals requiring excavation, soil management and disposal under a Materials Handling Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: EIC Associates - NYCEDC
Regulatory Authority: NYSDEC, NYCParks
Role: Mr. Czemerinski served as the Environmental Consultant for the project.

Project: Former Domino Sugar Site - Kent Avenue, Brooklyn NY
Project Description: NYC E-Designation. Soil contaminated with semi-volatile organic compounds and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: Two Trees Management
Regulatory Authority: NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project: Former Uniforms For Industry Site - Jamaica Avenue, Queens NY
Project Description: NYS Brownfield cleanup project / NYC E-Designation. Soil contaminated with chlorinated solvents, petroleum, mop oil and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: The Arker Companies
Regulatory Authority: NYSDEC, NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project

Project: Former Sunbelt Equipment Site – 25 Kent Avenue, Brooklyn, NY
Project Description: NYS Brownfield cleanup project. Soil contaminated with petroleum, and heavy metals and coal tar, requiring deep excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan, Dewatering Design and implementation, SWPPP design and implementation
Client: 19 Kent Acquisition LLC
Regulatory Authority: NYSDEC
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project Experience

Project: Former Charles Pfizer & Co. Site - 407 Marcy Avenue, Brooklyn, NY
Project Description: NYS Brownfield cleanup project / NYC E-Designation. Soil contaminated with chlorinated solvents, petroleum, and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: The Rabsky Group
Regulatory Authority: NYSDEC, NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project: Former East Coast Industrial Uniforms Site - 39 Skillman Street, Brooklyn, NY
Project Description: NYS Brownfield cleanup project / NYC E-Designation. Soil contaminated with chlorinated solvents, petroleum, and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: Riverside Builders
Regulatory Authority: NYSDEC, NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project: Former BP Amoco Service Station Site - 1800 Southern Boulevard, Bronx, NY
Project Description: NYS Brownfield cleanup project / NYC E-Designation. Soil contaminated with petroleum, and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: SoBro, Joy Construction
Regulatory Authority: NYSDEC, NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project: Former Dico G Auto & Truck Repair Site - 3035 White Plains Road, Bronx, NY
Project Description: NYS Brownfield cleanup project. Soil contaminated with petroleum, and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: The Arker Companies
Regulatory Authority: NYSDEC
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Ezgi Karayel

Principal

Contact

347.871.0750
ezgi@vektorconsultants.com

Ezgi Karayel is an environmental engineer with extensive experience in brownfield redevelopment. She is the founder and Principal of Vektor Consultants and serves as Operations Officer of the firm. Ms. Karayel guides firm's clients through their due diligence processes. She manages all aspects of the firm strongly focusing on brownfield redevelopment and E-Designation projects across New York Metropolitan area. She has worked with major real estate developers and shareholders by developing strategic approaches to the environmental challenges of complex real estate transactions and brownfield redevelopment. Her experience also includes a broad range of environmental services including regulatory compliance, due diligence assessments, acquisition support, design and implementation of engineering controls and remediation systems, excavation support and soil disposal plans, and facility decommissioning.

She is the chair of the Partnership's Scholarship Program and works closely with committee members to support the education and training of students who are pursuing environmental careers.

Education

B.S. Environmental Engineering
University at Buffalo

Professional Registration

OSHA 10-hour Construction and 40-hour General Industry
OSHA 40-hour HAZWOPER and 8-hour HAZWOPER Refresher
Certified Environmental Manager and Certified Environmental Inspector

Affiliations

New York City Brownfield Partnership, President

Brownfield Coalition of the Northeast, Advisory Board Member

Select Projects

Linden Boulevard, Queens, New York – Site Investigation and Remediation of a 7-acre former landfill with a Restrictive Declaration. The scope of work for the project included preparation of a Remedial Investigation Work Plan for review and approval by the NYCOER, NYSDEC and NYCDOH, implementation of Remedial Investigation, preparation of Remedial Investigation Report, Remedial Action Work Plan, preparation and implementation of a waste characterization plan for soils for proper disposal, supervision of site remediation activities, coordination with remediation engineer to design a methane mitigation system as well as vapor barrier system and managing field staff during remediation.

Former Tunnel Diner, Jersey City, New Jersey – Remedial Investigation (RI) of a 1⁄2-acre property in accordance with the New Jersey Technical Requirements for Site Remediation. Ms. Karayel worked closely with the Licensed Site Remediation Professional (LSRP) of the project. Followed by the approval of the RAWP prepared by her, Ms. Karayel directed remediation activities at the site and managed field staff on a daily basis. Upon completion of remediation, she has prepared Remedial Action Outcome for review and certification of the LSRP.

249 North 7th Street, Brooklyn, New York – As a Project Director for a Remedial Investigation of a former auto repair shop with an active spill, Ms. Karayel was responsible for remediation of the property under the direct supervision of NYCOER and NYSDEC. Her responsibilities consisted of preparing the required reports and supervision of remediation including excavation, and installation of engineering controls. By successful coordination with NYCOER, she has managed to enroll the project in City's Clean Soil Bank program and saving the client over $160,000 for soil disposal.

9029 Flatlands Avenue, Brooklyn, New York – E-Designation for HazMat. She conducted a Phase I ESA prior to development, followed by remedial investigation and preparation of Remedial Investigation Report and Remedial Action Work Plan for the remediation. Remediation for the project included design and implementation of an active sub-slab depressurization system. For the engineering controls design and implementation, Ms. Karayel worked closely with the Professional Engineer for the project and performed all required pilot tests, initial start-up and inspections.

37-23 33rd Street, Queens, New York – Removal of "P" Designation. Ms. Karayel managed to prevent the property from becoming a Class II site by performing a thorough due-diligence and disproving the prior consultant's findings and recommendations. Furthermore, her due-diligence study and evaluation saved the client over $1,000,000 clean-up costs, regulatory and legal fees.

261 Grand Concourse, Bronx, New York – Brownfield Redevelopment
1-9 Wythe Avenue, Brooklyn, New York – Brownfield Redevelopment
42 Reeve Place, Brooklyn, New York – Spill Closure
21-01 21st Street, Queens, New York – Former Gasoline Station Decommissioning and Storage Tank Removal
260-262 Van Brunt Street, Brooklyn, New York – Brownfield Cleanup
299 East 161st Street, Bronx, New York – Voluntary Cleanup Program
122 East 32nd Street, New York, New York – Community Center, Remediation under Voluntary Cleanup Program
346 Metropolitan Avenue, Brooklyn, New York – Voluntary Cleanup Program
574 Broome Street, New York, New York – Voluntary Cleanup Program
173-175 McGuinness Boulevard, Brooklyn, New York – Voluntary Cleanup Program
4790 Broadway, New York, New York – Voluntary Cleanup Program

David B. Klein

Project Manager

Contact

347.871.0750
dklein@vektorconsultants.com

David B. Klein is a project manager with Vektor Consultants. David authored Remedial Action Work Plans, Remedial Investigation Reports, Remedial Action Reports, Final Engineering Reports, Noise Sampling Reports, Soil Vapor/Air Sampling Work Plans, Construction Health and Safety Plans, Interim Remedial Measures Summary Reports, Brownfield Cleanup Program Applications, Volunteer Cleanup Program Applications, Disposal Facility Applications, Underground Storage Tank Closure Reports, Phase I and Phase II Environmental Site Assessment Reports. David manages construction activities, drilling teams, excavations, tank removals, and waste disposals at multiple sites concurrently.

Education

B.S. Environmental Science & Minor in Geology
University at Albany

Professional Registration

OSHA 10-hour Construction
OSHA 40-hour HAZWOPER and 8-hour HAZWOPER Refresher
10-Hour Site Safety Training
SWPPP Certification

Affiliations

New York City Brownfield Partnership

Select Projects

Far Rockaway Project Phases I, II, III, IV, and V, Queens, New York
Responsible for oversight and preparation of the Remedial Action Work Plan, Remedial Action Report, Final Engineering Report, Interim Remedial Measures Summary Report, NYSDEC Letter reports, and daily reports. Managed construction, drilling, excavation, waste disposal oversight of multiple phases concurrently.

Cropsey Avenue LLC, Brooklyn, New York
Authored Indoor Air Sampling Work Plan, Construction Health and Safety Plan, Interim Remedial Measures Summary Report and managed pilot tests for sub-slab depressurization system design and provided oversight during the installation of the engineering controls.

1815 West Farms Road, Bronx, New York – Voluntary Cleanup Program
315 Grand Concourse, Bronx, New York – Brownfield Redevelopment
261 Grand Concourse, Bronx, New York – Brownfield Redevelopment
960 Franklin Avenue, Brooklyn, New York – Brownfield Redevelopment

Ben Neumann

Assistant Project Manager

Contact

347.871.0750
bneumann@vektorconsultants.com

Ben Neumann is an Assistant Project Manager with Vektor Consultants. He is responsible for conducting and overseeing field investigations and site assessments. In addition, Ben authors Phase I and Phase II Environmental Site Assessments, Remedial Investigation Workplans, Remedial Investigation Reports, Remedial Action Workplans, Remedial Action Reports, and Installation Reports. His responsibilities include providing environmental oversight at construction project sites in the New York City Metropolitan area, performing site visits, conducting subsurface investigations and waste characterization sampling. Ben's experience and education in environmental remediation and project management provides valuable knowledge and insight for navigating projects through different regulatory programs.

Education

B.S. Environmental Science
Environmental Engineering & Technology Focus
Union College, Schenectady, NY

Professional Registration

Project Management Professional (PMP)

OSHA 30-hour Construction

OSHA 40-hour HAZWOPER

10-Hour Site Safety Training (SST)

Affiliations

The New York City Brownfield Partnership

Select Projects & Prior Experience

1533-1541 60th Street – Voluntary Cleanup Program
1547-1555 60th Street – Voluntary Cleanup Program
601 Union Street – Brownfield Cleanup Program

Prior to joining Vektor, Ben assisted Licensed Site Remediation Professionals (LSRPs) and carried out project management duties on over 100 projects within the New Jersey Department of Environmental Protection's (NJDEP) Site Remediation Program (SRP). Ben performed and oversaw Site Investigation, Remedial Investigation, and Remedial Action activities to achieve site remediation goals and obtain project closure via the issuance of Response Action Outcome (RAO) and No Further Action (NFA) Letters.

Izzy Hettleman

Environmental Scientist

Contact

410.428.2370

ihettleman@vektorconsultants.com

Izzy Hettleman is an Environmental Scientist with Vektor Consultants. Izzy authored Remedial Action Work Plans, Remedial Investigation Reports, Remedial Action Reports, Final Engineering Reports, Noise Sampling Reports, Soil Vapor/Air Sampling Work Plans, Brownfield Cleanup Program Applications, Underground Storage Tank Closure Reports, Phase I and Phase II Environmental Site Assessment Reports. His experience and education with sampling processes, environmental analysis, and environmental conservation provides knowledge and insight for navigating projects through different regulatory programs.

Education

B.A. Environmental Analysis

Focus in Natural Science

Washington University in St. Louis

Professional Registration

OSHA 30-hour Construction

OSHA 40-hour HAZWOPER and 8-hour HAZWOPER Refresher

10-Hour Site Safety Training

Select Projects

Consumers Park Brewery Site, Brooklyn, New York

Responsible for oversight and execution of the remedial action including excavation, installation of engineering controls, waste characterization, and reporting. Authored sampling plans, underground storage tank closure reports, and soil disposal and import requests.

CSB Forbell Stockpile – Clean Soil Bank

Responsible for day-to-day oversight of operations at the NYC OER lead CSB Forbell Clean Soil Bank, including management of all imports and exports, record-keeping, and soil testing.

Other Projects:

2892 Nostrand Avenue, Brooklyn, New York

Remedial Action Report, Installation Report

918 Atlantic Avenue, Brooklyn, New York

Remedial Action Plan (Noise and Air Quality), Remedial Investigation

54-11 Queens Boulevard, Queens, New York

Remedial Action Work Plan, Phase II Investigation

PROFESSIONAL PROFILE

Qualifications Summary

- Over 20 years of experience in the environmental field and analytical laboratories.
- Four years of experience as Quality Assurance Officer in an environmental laboratory setting.
- Wide-ranging knowledge of laboratory operations involving metals analysis and validation of organic and inorganic data.
- Performed solid and aqueous sample digestions and extractions, including TCLP, in preparation for metals analysis.
- Analyzed heavy metals by Atomic Absorption (Flame, Cold Vapor, and Graphite Furnace) and Inductively Coupled Plasma (ICP).
- Participated in all aspects of Proficiency Testing, including preparation, analysis and reporting.
- Comprehensive understanding of Health and Safety and Hazardous Waste operations.
- Written and maintained control documents including SOP's, Hazardous Waste Management plans and Contingency plans.
- Conducts employee training including Ethics and Health and Safety.

Jason R. Hebert
Quality Manager

Fields of Expertise

Responsible for the implementation of and support of the Quality Program, policies, and procedures from a functional and/or technical perspective for sites within the division. Provides advisement to management staffing quality-related matters, including performance, regulatory compliance, and data quality and usability.

Metals Analysis – Environmental
Quality Assurance/Quality Control
Health and Safety/Chemical Hygiene

Higher Education

B.S., Marine Safety and Environmental Protection – Massachusetts Maritime Academy (2001)

Employment History

10/2023-Present	Pace Analytical – Quality Manager
2012-10/23	Alpha Analytical – Quality Systems Specialist
2010-2012	Alpha Analytical – Data Reviewer - Mansfield
2006-2010	AmeriSci Boston – Quality Assurance Officer
2004-2010	AmeriSci Boston – Health and Safety Officer
2002-2006	AmeriSci Boston – Metals Analyst

Professional Training/Committees

Occupational Safety and Health Administration – 40hr HAZWOPER

Department of Transportation – HAZMAT Training

DONALD C. ANNÉ
SENIOR CHEMIST

EDUCATION: M.S., Chemical Oceanography, Florida Institute of Technology, 1981
B.A., Earth Sciences, Millersville University of Pennsylvania, 1975

SPECIAL TRAINING:
Certified 40-Hour OSHA Health and Safety
Certified 8-Hour OSHA Supervisory Course
Ground Water Geochemistry (NWWA)
Ground Water Pollution and Hydrology (Princeton Associates)
Quality Assurance Programs for Environmental Monitoring Data (Stat-A-Matrix)

PROFESSIONAL AFFILIATIONS: American Chemical Society (AFS), 1979-Present

EXPERIENCE SUMMARY:

Mr. Anné has more than 39 years of environmental chemistry experience specializing in data validation, environmental sampling, analytical methodologies, petroleum fingerprinting, laboratory audits, field sampling audits, and preparing Quality Assurance Project Plans and Quality Assurance Manuals. Mr. Anné's experience includes analytical laboratory work with gas chromatography, atomic absorption, infrared spectrometry and wet chemistry methods.

PROJECT EXPERIENCE:

<u>Quality Assurance/Quality Control of Chemical Data- Data Validation</u>

Mr. Anné has more than 23 years experience as a data validator and quality assurance officer. Mr. Anné has validated data for most EPA Regions and under several independent state programs, including the NYSDEC. He has performed laboratory and field audits as well as written Quality Assurance Project Plans. Mr. Anné has written, reviewed, and initiated laboratory Quality Assurance Manuals for laboratories to maintain their regulatory compliance. Typical project experience includes:

- Senior Chemist responsible for data validation. Reviewed chemical data for numerous projects under the New Jersey ISRA regulations. Data validation typically is performed as a third-party validator under subcontract to consultants for private industry and utility companies.

- Supervising Environmental Scientist responsible for data validation. Reviewed chemical laboratory data for adherence to QA/QC protocols for several key projects, including National Priorities List sites and RCRA Corrective Actions located in EPA Regions I, II, III, IV, V, and IX. Validated analytical data, outlined problems and actions to be taken, and qualified all affected data. Consulted with project managers on data usability, and recommended corrective actions to support project goals. Responded to comments made by regulators regarding data quality.

- Supervising Environmental Scientist recognized by the New York State Department of Environmental Conservation (NYSDEC) to perform third party data validation. Attended NYSDEC workshop on data validation as part of the requirements set forth by NYSDEC. Performed data validation in support of NYSDEC ASP programs as well as data in support of the NYSDEC Part 360 Regulations for landfills. Validated data for an Albany area municipal landfill.

- Supervising Environmental Scientist responsible for developing and preparing Quality Assurance Project Plans (QAPPs) for several state and federal Superfund sites and federal RCRA corrective action sites. Negotiated with regulators for the acceptance of the QAPPs. The sites were located throughout the eastern United States.

- Environmental Chemist responsible for developing a laboratory QA/QC program which fulfilled requirements of the EPA and agencies from the States of Texas and Louisiana. Implemented and managed the program throughout DOE's SPR Environmental laboratories. Received verbal commendations from EPA and the Texas Water commission on the QA/QC Program.

Related Chemistry Experience:

Mr. Anné is experienced in sampling soil, water, air, and wastes in accordance with federal and state guidelines. He has performed field sampling audits and prepared sampling plans for numerous projects in accordance with applicable programmatic requirements. Mr. Anné is familiar with the geochemical aspects of fate and transport of contaminants.

Mr. Anné also has experience working in both fixed-base and mobile laboratories. His experience includes the use of gas chromatography, atomic absorption spectrometers, infrared spectrometers, and numerous wet chemistry and preparation equipment methods. He has served in the laboratory as an analyst, laboratory advisor, and QA officer. He has interfaced with regulators in the area of analytical chemistry and has experience in petroleum fingerprinting techniques and methods.

EMPLOYMENT: 2005- present, Alpha Geoscience
1998-2005, Alpha Environmental Consultants, Inc.
1990-1998, McLaren/Hart
1986-1990, Fred C. Hart Associates
1985-1986, Boeing Petroleum Services
1982-1985, Petroleum Operations and Support Services
1981-1982, Dravo Utility Constructors
1979-1981, Florida Institute of Technology
1975-1979, Berkley Products Company

Z:\ALPHA\RESUMES\DCA\DCA- ABBREV. DATA VAL.DOC

APPENDIX D

COMMUNITY AIR MONITORING PLAN

COMMUNITY AIR MONITORING PLAN

Prepared For: 38-18 33rd Street LLC and 32-20 38th Avenue LLC

Project Name: Former Refron Inc. Gas Reclamation Site

BCP Site No: C241285

Project Location: 32-10 38th Avenue, 38-18 33rd Street, and 32-20 38th Avenue, Queens, New York

Date: April 2026

Table of Contents

1.0 INTRODUCTION

This site-specific Community Air Monitoring Plan (CAMP) has been prepared on behalf of 38-18 33rd Street LLC and 32-20 38th Avenue LLC (the Applicant) for the implementation of a Remedial Action Work Plan (RAWP) by Vektor Consultants, LLC (Vektor), AMC Engineering, PLLC (AMC), and their subcontractors at the property located at 32-10 38th Avenue, 38-18 33rd Street and 32-20 38th Avenue in the Long Island City section of Queens County, New York (the Site). The Site is identified by the City of New York as Borough of Brooklyn, Tax Block 381, Lots 5, 12 and 16.

This CAMP was developed in accordance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan included within DER-10 Technical Guidance for Site Investigation and Remediation (May 2010). All instruments will be operated and calibrated as per the manufacturer's specifications.

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

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

Based on the information that public schools and a public playground are located east of the Site, beyond Franklin Avenue, a robust CAMP will be implemented when intrusive remedial activities are conducted along the eastern boundary area of the site.

A Special Requirements CAMP (SR-CAMP) will need to be implemented when remedial investigation activities are occurring within 20 feet of exposed populations or occupied eastern adjacent buildings.

2.0 COMMUNITY AIR MONITORING PLAN

A Phase II subsurface investigation and a remedial investigation were conducted by Vektor Consultants, Inc. (Vektor) in 2024 and 2025, respectively, and the findings of the assessments were provided in a Remedial Investigation Report dated June 2025, and updated April 2026. Based on the results of the previous assessments and the recent investigation, semi-volatile organic compounds (SVOCs), and metals in soils are the constituents of concern at the Site. Elevated concentrations of chlorinated VOCs (CVOCs) were detected in soil vapor samples across the Site. Therefore, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary.

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

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. Periodic monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

Meteorological monitoring including temperature, wind direction and speed will be conducted by the field personnel and the data will be logged in the field book on a daily basis. CAMP station(s) will be relocated based on the direction of the wind.

Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates will reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices will be considered to prevent exposures related to the work activities and to control dust and odors. Consideration will also be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions will be pre-determined, as necessary.

3.0 VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

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

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

SR-CAMP

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring will occur within the occupied structure(s). Depending upon the nature of contamination, chemical-specific colorimetric tubes of sufficient sensitivity may be necessary for comparing the exposure point concentrations with appropriate pre-determined response levels (response actions will be pre-determined). Background readings in the occupied spaces will be taken prior to commencement of the planned work. Any unusual background readings will be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m^3, work activities will be suspended until controls are implemented and are successful in reducing the total particulate concentration to150 mcg/m^3 or less at the monitoring point.
- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions will be pre-determined, as necessary.

Specific odor control methods to be used on a routine basis will included application of foam suppressants or tarps over the odorous materials. If nuisance odors are identified, work will be halted, and the source of the odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project. Implementation of all odor controls, including the halt of work, will be the responsibility of the Remedial Engineer.

4.0 PARTICULATE MONITORING, RESPONSE LEVELS, AND ACTIONS

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

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped, and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.
- All readings must be recorded and be available for the NYSDEC and NYSDOH personnel to review.

Dust suppression will be achieved by applying water as needed.

CAMP exceedances will immediately be reported to the NYSDEC and NYSDOH Project Managers at the time of exceedance via email, in addition to inclusion in the daily status reports. The NYSDEC Project Manager and NYSDOH Project Manager for the Site is:

Haala Al-Hadithy
Project Manager
NYSDEC Division of Remediation
haala.al-hadithy@dec.ny.gov

Josephine McCarthy
Project Manager
NYSDOH
josephine.mccarthy@health.ny.gov

CAMP
ACTION LIMIT REPORT

Project Location: Former Refron Gas Site

Date: ______________________________ Time: ________________________

Name: ______________________________

Contaminant: __________________________ PM-10: __________ VOC: _______________________

Wind Speed: __________________________ Wind Direction: _______________

Temperature: __________________________ Barometric Pressure: _________

DOWNWIND DATA

Monitor ID #: _______________________ Location: _________ Level Reported: _______________

Monitor ID#: _______________________ Location: _________ Level Reported: _______________

UPWIND DATA

Monitor ID #: _______________________ Location: _________ Level Reported: _______________

Monitor ID#: _______________________ Location: _________ Level Reported: _______________

BACKGROUND CORRECTED LEVELS

Monitor ID #: Location: _______________ Level Reported: Level Reported: ___________________

ACTIONS TAKEN

APPENDIX E

CITIZEN PARTICIPATION PLAN

NEW YORK STATE | Department of Environmental Conservation

Brownfield Cleanup Program

Citizen Participation Plan
for
Former Refron Inc. Gas Reclamation Site

April 2025

C241285
38-18 33rd Street and 32-20 38th Avenue
Long Island City, NY 11101

www.dec.ny.gov

Contents

* * * * *

Note: The information presented in this Citizen Participation Plan was current as of the date of its approval by the New York State Department of Environmental Conservation. Portions of this Citizen Participation Plan may be revised during the site's investigation and cleanup process.

Applicant: **32-20 38th Street LLC and 38-18 33rd Street LLC ("Applicant")**
Site Name: **Former Refron Inc. Gas Reclamation Site ("Site")**
Site Address: **38-18 33rd Street and 32-20 38th Avenue, Long Island City, NY**
Site County: **County of Queens**
Site Number: **C241285**

1. What is New York's Brownfield Cleanup Program?

New York's Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as "brownfields" so that they can be reused and developed. These uses include recreation, housing, and business.

A brownfield is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants who conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the BCP, go online at:
http://www.dec.ny.gov/chemical/8450.html

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision-makers form or adopt final positions.

Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include:

- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment

- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process

- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process

- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community

- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision making.

This Citizen Participation (CP) Plan provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The public's suggestions about this CP Plan and the CP program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The locations of the reports and information related to the site's investigation and cleanup program also are identified in Appendix A. These locations provide convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC web-site. If this occurs, NYSDEC will inform the public in fact sheets distributed about the site and by other means, as appropriate.

Site Contact List

Appendix B contains the site contact list. This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork), as well as availability of project documents and announcements about public comment periods.
The site contact list includes, at a minimum:

- Chief executive officer and planning board chairperson of each county, city, town and village in which the site is located;
- Residents, owners, and occupants of the site and properties adjacent to the site;
- The public water supplier which services the area in which the site is located;
- Any person who has requested to be placed on the site contact list;
- The administrator of any school or day care facility located on or near the site for purposes of posting and/or dissemination of information at the facility;
- Location(s) of reports and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

Note: The first site fact sheet (usually related to the draft Remedial Investigation Work Plan) is distributed both by paper mailing through the postal service and through DEC Delivers, its email listserv service. The fact sheet includes instructions for signing up with the appropriate county listserv to receive future notifications about the site. See http://www.dec.ny.gov/chemical/61092.html

Subsequent fact sheets about the site will be distributed exclusively through the listserv, except for households without internet access that have indicated the need to continue to receive site information in paper form. Please advise the NYSDEC site project manager identified in Appendix A if that is the case. Paper mailings may continue during the investigation and cleanup process for some sites, based on public interest and need.

CP Activities

The table at the end of this section identifies the CP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The flowchart in Appendix D shows how these CP activities integrate with the site investigation and cleanup process. The public is informed about these CP activities through fact sheets and notices distributed at significant points during the program. Elements of the investigation and cleanup process that match up with the CP activities are explained briefly in Section 5.

- **Notices and fact sheets** help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.

- **Public forums, comment periods and contact with project managers** provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about a site's investigation and cleanup.

The public is encouraged to contact project staff at any time during the site's investigation and cleanup process with questions, comments, or requests for information.

This CP Plan may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the site, as described in Section 5.

If the site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the site and the development/implementation of a remedy.

An eligible community group must certify that its membership represents the interests of the community affected by the site, and that its members' health, economic well-being or enjoyment of the environment may be affected by a release or threatened release of contamination at the site.

As of the date the declaration (page 2) was signed by the NYSDEC project manager, the significant threat determination for the site had not yet been made.

To verify the significant threat status of the site, the interested public may contact the NYSDEC project manager identified in Appendix A.

For more information about TAGs, go online at https://dec.ny.gov/regulatory/regulations/technical-assistance-grant-tag-guidance-handbook-der-14

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program follows on the next page:

Citizen Participation Activities	Timing of CP Activity(ies)
Application Process:	
• Prepare site contact list • Establish document repository(ies)	At time of preparation of application to participate in the BCP.
• Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period • Publish above ENB content in local newspaper • Mail above ENB content to site contact list • Conduct 30-day public comment period	When NYSDEC determines that BCP application is complete. The 30-day public comment period begins on date of publication of notice in ENB. End date of public comment period is as stated in ENB notice. Therefore, ENB notice, newspaper notice, and notice to the site contact list should be provided to the public at the same time.
After Execution of Brownfield Site Cleanup Agreement (BCA):	
• Prepare Citizen Participation (CP) Plan	Before start of Remedial Investigation **Note:** Applicant must submit CP Plan to NYSDEC for review and approval within 20 days of the effective date of the BCA.
Before NYSDEC Approves Remedial Investigation (RI) Work Plan:	
• Distribute fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period about draft RI Work Plan • Conduct 30-day public comment period	Before NYSDEC approves RI Work Plan. If RI Work Plan is submitted with application, public comment periods will be combined and public notice will include fact sheet. Thirty-day public comment period begins/ends as per dates identified in fact sheet.
After Applicant Completes Remedial Investigation:	
• Distribute fact sheet to site contact list that describes RI results	Before NYSDEC approves RI Report
Before NYSDEC Approves Remedial Work Plan (RWP):	
• Distribute fact sheet to site contact list about draft RWP and announcing 45-day public comment period • Public meeting by NYSDEC about proposed RWP (if requested by affected community or at discretion of NYSDEC project manager) • Conduct 45-day public comment period	Before NYSDEC approves RWP. Forty-five day public comment period begins/ends as per dates identified in fact sheet. Public meeting would be held within the 45-day public comment period.
Before Applicant Starts Cleanup Action:	
• Distribute fact sheet to site contact list that describes upcoming cleanup action	Before the start of cleanup action.
After Applicant Completes Cleanup Action:	
• Distribute fact sheet to site contact list that announces that cleanup action has been completed and that NYSDEC is reviewing the Final Engineering Report • Distribute fact sheet to site contact list announcing NYSDEC approval of Final Engineering Report and issuance of Certificate of Completion (COC)	At the time the cleanup action has been completed. **Note:** The two fact sheets are combined when possible if there is not a delay in issuing the COC.

3. Major Issues of Public Concern

This section of the CP Plan identifies major issues of public concern that relate to the site. Additional major issues of public concern may be identified during the course of the site's investigation and cleanup process.

There will be areas on the Site where soil excavation is necessary. Therefore, once the remediation commences, there may be concerns regarding odors, noise or truck traffic coming from the site. However, these impacts will be mitigated through implementation of a Health and Safety Plan (HASP) and Soil Management Plan (SMP) approved by NYSDEC, which will be designed to minimize these impacts. A Community Air Monitoring Plan will also be implemented to monitor dust and vapors to ensure the community is not impacted. Community Air Monitoring Plan (CAMP) implementation involves the placement of air monitoring stations upwind and downwind of where work is occurring to capture both dust and vapor emissions. If dust or emissions exceed a set threshold established by NYSDEC and the New York State Department of Health (NYSDOH), then work must cease and the cause of the issue must be corrected before work can proceed.

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

The Site is located in an Environmental Justice Area. There is a large Hispanic-American population nearby. Therefore, all future fact sheets will be translated into Spanish.

For additional information, visit: https://statisticalatlas.com/tract/New-York/Queens-County/003100/Race-and-Ethnicity.

4. Site Information

Appendix C contains a map identifying the location of the site.

Site Description

- **Location – 38-18 33rd Street and 32-20 38th Street, Long Island City, New York, County of Queens**
- **Setting – urban**
- **Site size – 0.683**
- **Adjacent properties – mixed residential, commercial, industrial and manufacturing**

History of Site Use, Investigation, and Cleanup

The 32-20 38th Avenue parcel was undeveloped until 1947. Thereafter, a fireproof structure was built in 1947, and a chemical laboratory began operations, which lasted until 1970. Between 1977 and 1986, the building was used for manufacturing, including by NY Chain Manufacturing Co and American LaFrance. From 1986 until 2021, the Site was used by Refron Inc. for reclamation of refrigerant gases, as well as testing and storage of refrigerants. This building was used for refrigerant gas reclamation until 2021.

The 38-18 33rd Street parcel was initially home to a few dwellings, a contractor’s yard, and a shed from 1888 until 1949, as well as some auto shops. By 1947, a fireproof structure was built, and a pipe cutter began using the building. From 1970 until 1980, the Site was occupied by a plumbing supply warehouse and a contractor’s staging area. From 1985 until 2021, the Site was used by Refron Inc. for reclamation and storage of refrigerant gases, with office space on the second floor. AirGas Refrigerants Inc and ASPEN Refrigerants also operated on the Site at certain points in this time frame. These parcels are currently vacant.

Contaminants related to the Site that have been found to date include the metals arsenic, nickel, zinc, lead, magnesium, chromium, mercury, manganese, and sodium in soil and chlorinated volatile organic compounds (VOCs) Tetrachloroethylene (PCE), trichloroethylene (TCE), and trans-1,2-dichloroethylene (which are chemicals previously used for degreasing), Freon (refrigerant) in groundwater, and CVOCs (\carbon tetrachloride, cis-1,2-dichloroethylene, tetrachloroethylene, and trichloroethylene in soil vapor. Therefore, all three environmental media – soil, groundwater and soil vapor – have been impacted.

Previous site environmental assessment investigations include Phase I Environmental Site Assessments (ESA), which identified the likelihood of vapor encroachment on the Site from surrounding dry-cleaners and auto repair facilities located nearby, the likely presence of refrigerant gases on the site, and the site’s history of housing a jeweler, a chemical laboratory, and reclamation and storage of refrigerant gases. The Phase I Report also indicated that hazardous waste was generated on-Site and that capped floor drains were present in the buildings. The 38-18 33rd Street parcel is also an E-Designation parcel by the City of New York. A spill of 25 gallons of diesel fuel occurred on this parcel when a tank ruptured and there is still an active above-ground storage tank containing fuel oil in the basement.

A subsequent Phase II subsurface environmental investigation reveal the contamination that has been summarized above.

5. Investigation and Cleanup Process

Application

The Applicant has applied for and been accepted into New York’s Brownfield Cleanup Program as a Volunteer. This means that the Applicant was not responsible for the disposal or discharge of the contaminants or whose ownership or operation of the site took place after the discharge or disposal of contaminants. The Volunteer must fully characterize the nature and extent of contamination onsite, and must conduct a "qualitative exposure assessment," a process that characterizes the actual or potential exposures of people, fish and wildlife to contaminants on the site and to contamination that has migrated from the site.

The Applicant in its Application proposes that the site will be used for residential purposes.

To achieve this goal, the Applicant will conduct investigation activities at the site with oversight provided by NYSDEC. The Brownfield Cleanup Agreement executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the site.

Investigation

The Applicant has completed a partial site investigation before it entered into the BCP. NYSDEC will determine if the data are useable.

The Applicant will conduct an investigation of the site officially called a "remedial investigation" (RI). This investigation will be performed with NYSDEC oversight. The Applicant has developed a remedial investigation workplan, which was subject to a 30-day public comment period with the Application.

The site investigation has several goals:

1) Define the nature and extent of contamination in soil, surface water, groundwater and any other parts of the environment that may be affected;
2) Identify the source(s) of the contamination;
3) Assess the impact of the contamination on public health and the environment; and
4) Provide information to support the development of a proposed remedy to address the contamination or the determination that cleanup is not necessary.

NYSDEC will use the information in the investigation report to determine if the site poses a significant threat to public health or the environment. If the site is a "significant threat," it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Interim Remedial Measures

An Interim Remedial Measure (IRM) is an action that can be undertaken at a site when a source of contamination or exposure pathway can be effectively addressed before the site investigation and analysis of alternatives are completed. If an IRM is likely to represent all or a significant part of the final remedy, NYSDEC will require a 30-day public comment period.

Remedy Selection

When the investigation of the site has been determined to be complete, the project likely would proceed in one of two directions:

1. The Applicant may recommend in its investigation report that no action is necessary at the site. In this case, NYSDEC would make the investigation report available for public comment for 45 days. NYSDEC then would complete its review, make any necessary revisions, and, if appropriate, approve the investigation report. NYSDEC would then issue a “Certificate of Completion” (described below) to the Applicant.

or

2. The Applicant may recommend in its investigation report that action needs to be taken to address site contamination. After NYSDEC approves the investigation report, the Applicant may then develop a cleanup plan, officially called a “Remedial Work Plan”. The Remedial Work Plan describes the Applicant’s proposed remedy for addressing contamination related to the site.

When the Applicant submits a draft Remedial Work Plan for approval, NYSDEC would announce the availability of the draft plan for public review during a 45-day public comment period.

Cleanup Action

NYSDEC will consider public comments, and revise the draft cleanup plan if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy. The selected remedy is formalized in the site Decision Document.

The Applicant may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH oversee the activities. When the Applicant completes cleanup activities, it will prepare a Final Engineering Report (FER) that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the site.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be achieved for the site, it will approve the FER. NYSDEC then will issue a Certificate of Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved, and relieves the Applicant from future liability for site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the site after it receives a COC.

Site Management

The purpose of site management is to ensure the safe reuse of the property if contamination will remain in place. Site management is the last phase of the site cleanup program. This phase begins when the COC is issued. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the site remains protective of public health and the environment. All significant activities are detailed in a Site Management Plan (SMP).

An *institutional control* is a non-physical restriction on use of the site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the site suitable for some, but not all uses.

An *engineering control* is a physical barrier or method to manage contamination. Examples include caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that pumps and treats groundwater. Site management continues until NYSDEC determines that it is no longer needed.

Appendix A -
Project Contacts and Locations of Reports and Information

Project Contacts

For information about the site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Haala Al-Hadithy
Project Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation
One Hunters Point Plaza
47-40 21st Street
Long Island City, NY 11101
718-482-4096
haala.al-hadithy@dec.ny.gov

New York State Department of Health (NYSDOH):

Josephine McCarthy
Project Manager
New York State Department of Health
Bureau of Environmental Exposure Investigation
Empire State Plaza
Corning Tower Room 1787
Albany, NY 12237
beei@health.ny.gov

Locations of Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

NYSDEC DECinfo Locator (Maps and Information):
https://gisservices.dec.ny.gov/gis/dil/

NYSDEC DECinfo Locator (Documents):
https://extapps.dec.ny.gov/data/DecDocs/C241285/

PUBLIC LIBRARY: Queens Public Library at Long Island City 37-44 21 Street Long Island City, NY 11101 Attn: Abigail Goldberg Phone: (718) 752-3700	Hours of Operation: MON: ....10am – 6pm TUE: .....1am – 6pm WED: ....10am – 6pm THU: .....12pm – 8pm FRI: ......10am – 6pm SAT: .....10am – 5pm SUN: .....CLOSED

COMMUNITY BOARD:
Queens Community Board No. 1
45-02 Ditmars Boulevard
LL Suite 1025
Astoria, NY 11105
Attn: Florence Koulouris, District Manager
Chairperson: Evie Hantzopoulos
Antonella Di Saverio – Environmental and Sanitation Committee Chairperson
Phone: (718) 626-1021
Email: qn01@cb.nyc.gov

Hours of Operation:

MON .....9am – 5pm
TUE: .....9am – 5pm
WED: ....9am – 5pm
THU: .....9am – 5pm
FRI:.......9am – 5pm
SAT:......CLOSED
SUN: .....CLOSED

Appendix B - Site Contact List

LOCAL ELECTED OFFICIALS / GOVERNMENT OFFICIALS:

Hon. Eric Adams
NYC Mayor
City Hall
New York, NY 10007

Hon. Brad Lander
NYC Comptroller
1 Centre Street Room 517
New York, NY 10007

Hon. Jumaane D. Williams
Public Advocate
1 Centre Street 15th Floor North
New York, NY 10007

David Gold, Esq.
Commissioner, NYC Dept. of City Planning
120 Broadway, 31st Floor
New York, NY 10271

Rohit Aggarwala
Commissioner, NYC Dept. of Environmental Protection
59-17 Junction Blvd.
Flushing, NY 11373

Shaminder Chawla, Acting Director
NYC Office of Environmental Remediation
100 Gold Street - 2nd Floor
New York, NY 10038

Queens Borough President
Hon. Donovan Richards
120-55 Queens Blvd.
Kew Gardens, NY 11424

Hon Charles Schumer
U.S. Senator
780 Third Avenue, Suite 2301
New York, NY 10017

Hon. Kirsten Gillibrand
U.S. Senator
780 Third Avenue, Suite 2601
New York, NY 10017

Hon. Julie Won
NYC Councilmember
37-04 Queens Blvd., Suite 205
Long Island City, NY 11101

Hon. Zohran K. Mamdani
NYS Assemblymember
24-08 32nd Street, Suite 1002A
Astoria, NY 11102

Hon. Kirsten Gonzalez
NYS Senator
801 2nd Ave, Suite #303
New York, NY 10017

Hon. Nydia Velazquez
US House of Representatives
Sunnyside District Office
39-16 47th Avenue
Sunnyside, NY 11104

New York City Municipal Water Finance Authority
Philip Wasserman - Executive Director
255 Greenwich Street, 6th Floor
New York, NY 10007

New York City Water Board
NYC Department of Environmental Protection
Alfonso L. Carney, Jr., Chairperson
59-17 Junction Boulevard, 8th Floor
Flushing, NY 11373

Queens County Clerk
Hon. Audrey Pheffer
8811 Sutphin Blvd, #106
Jamaica, NY 11435

MEDIA:

Schneps Media
Media Outlet, Queens Office
45-17 Marathon Parkway
Little Neck, NY 11362

New York Daily News
PO Box 7180
New York, NY 10008

New York Post
1211 Avenue of the Americas
New York, NY 10036

Spectrum NY 1 News
75 Ninth Avenue
New York, NY 10011

Queens Chronicle
Atlas Parks 71-19 80th Street, Suite 8-201
Glendale, NY 11385

Queens Examiner
45-23 47th Street
Woodside, NY 11377

Hoy Nueva York
Impremedia
41 Flatbush Avenue, 1st Floor
Brooklyn, NY 11217

El Diario NY
Impremedia
41 Flatbush Avenue, 1st Floor
Brooklyn, NY 11217

Western Queens Gazette
42-16 34th Avenue
Long Island City, NY 11101

PUBLIC SCHOOLS / DAYCARE CENTERS

Our World Neighborhood Charter School - Middle School
President/Executive Director/Principal
38-27 30th Street
Long Island City, NY 11101
https://owncs.org/own-1-middle-school-long-island-city
(718) 274-2902

Grownning Up Green I Charter School - Elementary School
President/Executive Director/Principal
39-27 28th Street
Long Island City, NY 11101
https://www.gugcs.org/schools/gug-i-es/
(347) 642-4306 ext. 1

OWN 1 Elementary School
President/Executive Director/Principal
36-12 35th Avenue
Astoria, NY 11106
(718) 392-3405
https://owncs.org/own-1-elementary-school-astoria

I.S. 204 Oliver W. Holmes, School Leader
President/Executive Director/Principal
36-41 28th Street
Queens, NY 11106
https://insideschools.org/school/30Q204
(718) 937-1463

P.S. 166 Henry Gradstein,
President/Executive Director/Principal
33-09 35th Avenue
Queens, NY 11106
https://www.ps166q.com/apps/contact/
(718) 786-6703

Baccalaureate School for Global Education
President/Executive Director/Principal
34-12 36th Avenue
Queens, NY 11106
https://bsge.org/
(718) 361- 5275

The Riverview School 277Q @ 258
President/Executive Director/Principal
36-41 28th Street
Astoria, NY 11106
https://www.theriverviewschool.com/blank

ATLAS High School
President/Executive Director/Principal
28-01 41st Avenue
Queens, NY 11101
https://30q555.echalksites.com/
(718) 937-6005

Robert F. Wagner, Jr. Secondary School for Arts and Technology
President/Executive Director/Principal
47-07 30th Place
Queens, NY 11101
https://q560.echalksites.com/
(718) 472-5671

Q258 Energy Tech High School
President/Executive Director/Principal
36-41 28th Street
Queens, NY 11106
https://www.energytechschool.org/
(718) 472-0536

Frank Sinatra School of the Arts High School
President/Executive Director/Principal
35-12 35th Avenue
Astoria, NY 11106
https://franksinatraschoolofthearts.org/
(718) 361-9920

Q575 Academy of American Studies
President/Executive Director/Principal
40-11 28th Street
Queens, NY 11101
https://www.academyofamericanstudies.com/
(929) 487-1910

Playhouse NYC Daycare
President/Executive Director/Principal
29-22 Northern Blvd, 2nd Floor
Long Island City, NY 11101
https://www.playhousenyc.com/
(718) 392-2783

Babyland Daycare Astoria
President/Executive Director/Principal
35-10 35th Street
Astoria, NY 11106
https://babylanddaycare.com/
(718) 404-7210

Zachery's Familycare Center
President/Executive Director/Principal
35-25 34th Street
Astoria, NY 11106
(917) 403-8048

Children Blossom Daycare
President/Executive Director/Principal
35-25 34th Street
Astoria, NY 11106
(347) 642-3591

Diki Sunshine Childcare Center
President/Executive Director/Principal
37-11 30th Street
Long Island City, NY 11101
https://www.dikidaycarecenter.com/diki-sunshine-childcare-center
(718) 278-1570

Bright Horizons at Long Island City
President/Executive Director/Principal
42-09 28th Street
Long Island City, NY 11101
https://child-care-preschool.brighthorizons.com/ny/longislandcity/licity
(848) 230-3594

Maria's Daycare
President/Executive Director/Principal
36-33 32nd Street
Long Island City, NY 11106

Magali's Daycare NYS
President/Executive Director/Principal
35-11 30th Street
Astoria, NY 11106
(718) 255-1446

Long Island City Family Daycare
President/Executive Director/Principal
40-34 28th Street
Long Island City, NY 11101
https://licfd.com/contact-us
(347) 669-4009

A Child's Daycation
President/Executive Director/Principal
35-25 34th Street
Astoria, NY 11106
https://achildsdaycation.com/
(347) 527-2078

Long Island City Early Childhood Center - SCO Family of Services
President/Executive Director/Principal
38-11 27th Street
Long Island City, NY 11101
https://sco.org/programs/long-island-city-early-childhood-center/
(718) 487-7070

Crescent Seedlings
President/Executive Director/Principal
3735 Crescent St #1
Long Island City, NY 11101
https://crescentseedlings.com/contact-us-1
(917) 855-6445

COMMERCIAL - ADJACENT PROPERTY OWNERS / OPERATORS

Adjacent Property Owner of 32-04 38th Avenue
Jae Four Real Estate Investment LLC
3734 29th Street
Long Island City, NY 11101

Adjacent Property Owner of 38-28 32nd Street
38-28 32nd Street LLC
38-28 32nd Street
Long Island City, NY 11101

Adjacent Property Owner of 38-34 33rd Street, 3709-17 Northern Blvd, 32-19 Northern Blvd, and 33-01 Northern Blvd
NYC Transit
2 Broadway, Frnt 4
New York, NY 10004

Adjacent Property Owner of 33-01 38th Avenue
38th Avenue Partners, LLC
8 West 40th Street, Floor 6
New York, NY 10018

Adjacent Property Owner of 37-40 31st Street
PFAS Realty Corp
37-40 31st Street
Long Island City, NY 11101

Adjacent Property Owner of 31-18 38th Avenue
31-18 Realty LLC
31-18 38th Avenue
Long Island City, NY 11101

Adjacent Property Owner of 38-30 32nd Street
38-30 32nd Street LLC
38-30 32nd Street
Long Island City, NY 11101

Adjacent Property Owner of 33rd Street
38th Ave. Realty Holdings, LLC
3302 38th Avenue
Long Island City, NY 11101

Adjacent Property Owner of 32-19 38th Avenue
3219 38th St Real Estate Corp
32-19 38th Avenue
Long Island City, NY 11101

Adjacent Property Owner of 38-12 32nd Street
38-12 Realty LLC
38-12 32nd Street
Long Island City, NY 11101

Adjacent Property Owner of 38-24 32nd Street
32nd Street Realty Associates LLC
1836 Gilford Avenue
New Hyde Park, NY 11040

Adjacent Property Owner of 32-03 39th Avenue and 39th Avenue
39th Ave Holdings 1 LLC & 39th Ave Holdings 2 LLC
505 Flushing Avenue, Suite 1F
Brooklyn, NY 11205

Adjacent Property Owner of 33-02 38th Avenue
38-09 33rd St., LLC
33-02 38th Avenue
Long Island City, NY 11101

Adjacent Property Owner of 32-11 38th Avenue
32-11 38 Ave LLC
1500 Solona Blvd, Bldg 1
Roanoke, TX 76262

RESIDENTIAL - ADJACENT PROPERTY OWNERS / OPERATORS

Adjacent Property Owner of 38-18 32nd Street
Henao, Nury Maria
38-18 32nd Street
Long Island City, NY 11101

Adjacent Property Owner of 32-17 38th Avenue
Pan, Yu Ping
25143 Hand Road
Little Neck, NY 11362

Adjacent Property Owner of 32-07 38th Avenue
Sukhai, Nandy C
1 Home Campus Road
Des Moines, IA 50328

Adjacent Property Owner of 32-03 38th Avenue
Maria M. Palencia
32-03 38th Avenue
Long Island City, NY 11101

Adjacent Property Owner of 32-10 38th Avenue and 32-08 38th Avenue
Ramlochan, Vashie
8713 89th Street
Woodhaven, NY 11101

Adjacent Property Owner of 33-04 38th Avenue
Labiba Estate
50-02 65th Street
Flushing, NY 11377

Adjacent Property Owner of 32-15 38th Avenue
Avila, Victor M.
32-15 38th Avenue
Long Island City, NY 11101

Adjacent Property Owner of 32-01 38th Avenue
Filiotis Andriana
1806 Astoria Park S.
Long Island City, NY 11102

Adjacent Property Owner of 38-14 32nd Street
Mohammed A. Rahman
38-14 32nd Street
Long Island City, NY 11101

Adjacent Property Owner of 33-08 38th Avenue
Saeed, Jewel
7921 Metropolitan Avenue
Middle Village, NY 11379

Adjacent Property Owner of 32-09 38th Avenue
Eladio Baez
32-09 38th Avenue
Long Island City, NY 11101

COMMUNITY , CIVIC, RELIGIOUS AND OTHER ENVIRONMENTAL ORGANIZATIONS:

Consolidated Edison Corporate Affairs
Richard David - Director Queens Regional & Community Affairs
59-17 Junction Blvd.
Flushing, NY 11373

114th NYPD Precinct Council
President Ann Bruno
34-16 Astoria Blvd.
Queens, NY, 11103

FDNY
Ladder 116
37-20 29 Street
Long Island City, NY 11101

Masjid El-Ber
3605 30th Street
Astoria, NY 11106

Bosnian-Herzegovinian Islamic Center New York
37-46 Crescent Street
Long Island City, NY 11101

Al-Amin Jame Masjid & Islamic Center
35-19 36th Avenue
Long Island City, NY 11106

Long Island City BID
27-01 Queens Plaza North, Level B
Long Island City, NY 11101
https://www.longislandcityqueens.com/licbid/
Laura Rothrock: lrothrock@licpartnership.org
(718) 786-5300 x 210

Evangel Christian Center
39-20 27th Street
Long Island City, NY 11101

St. Patrick Roman Catholic Church
39-38 29th Street
Long Island City, NY 11101

Fount Church
3608 33rd Street
Long Island City, NY 11106

Expansion Church NYC
2907 40th Road
Long Island City, NY 11101

Brazilian Missionary Church
39-22 30th Street
Long Island City, NY 11101

Hope Astoria Church
36-14 35th Street
Astoria, NY 11106

St. George's Coptic Orthodox Church
38-25 31st Street
Astoria, NY 11101

Catedral de Adoração
40-26 28th Street
Long Island City, NY 11101

Emmanuel Charismatic Church
3109 35th Avenue
Astoria, NY 11106

Fullness World Christian Center
3809 33rd Street
Long Island City, NY 11101

Centro Mundial de Avivamiento NY
3535 Steinway Street
Astoria, NY 11101

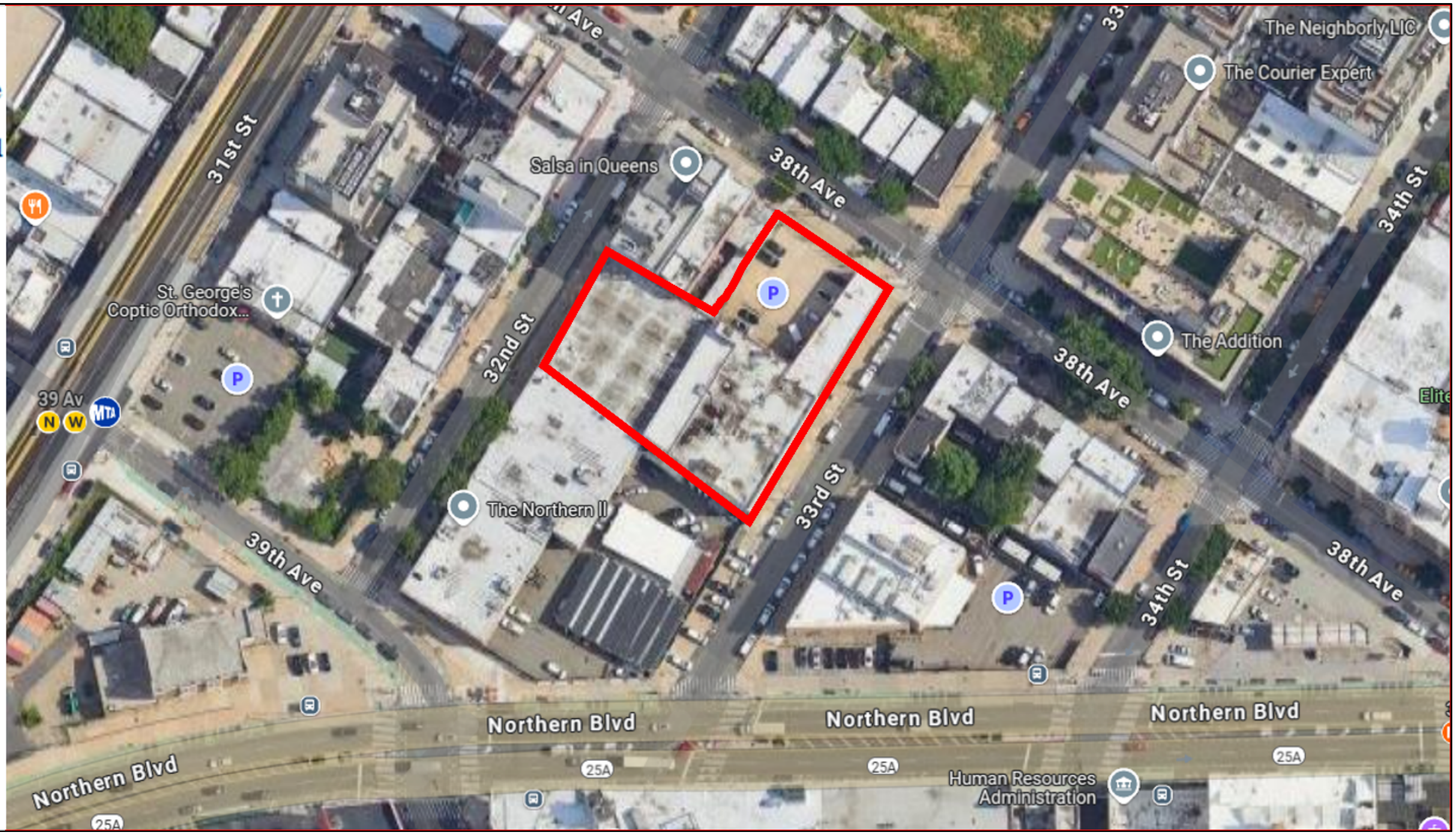
Iglesia Pentecostal El Renuevo, Inc.
3408 36th Avenue
Long Island City, NY 11106

Assembéia de Deus Filadélfia
37-29 28th Street
Long Island City, NY 11101

Appendix C - Site Location Map

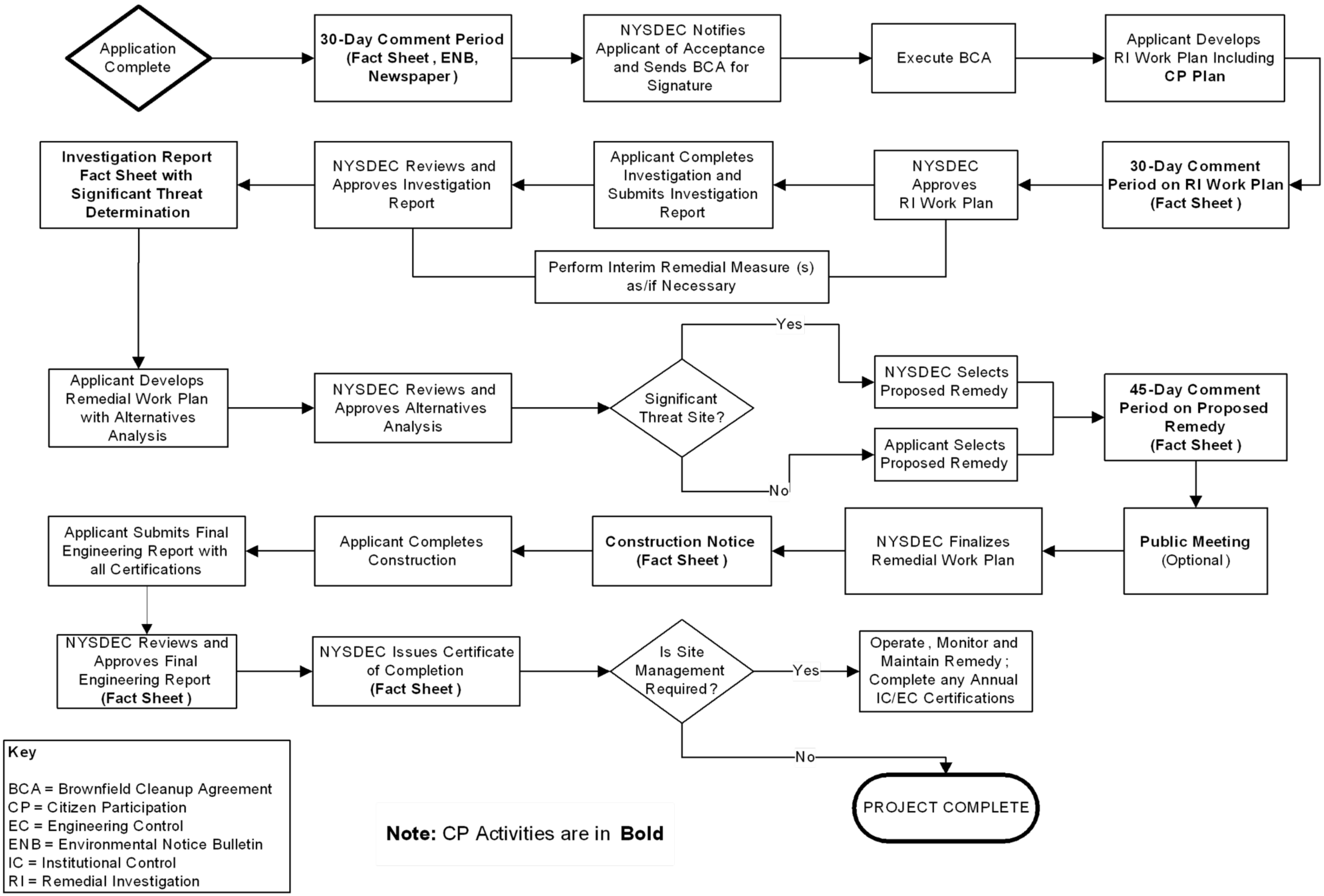
Street Map
Former Refron Inc. Gas Reclamation Site

38-18 33rd Street and 32-20 38th Avenue



Legend:
Site Property Boundary

Appendix D – Brownfield Cleanup Program Process



APPENDIX F

GREEN AND SUSTAINABLE REMEDATION

Appendix F
GSR Summary
Alternative 1

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
NYSDEC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Cleanup

Environmental Footprint Summary

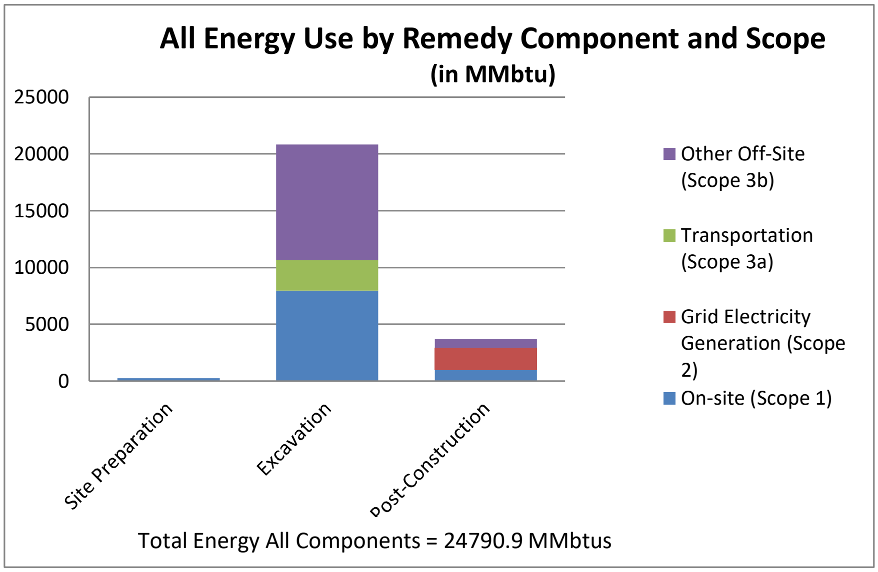
Core Element	Metric		Unit of Measure	Footprint			
				Site Preparation	Excavation	Post-Construction	Total
Materials & Waste	M&W-1	Refined materials used on-site	Tons	3.7	800.0	0.0	803.7
	M&W-2	% of refined materials from recycled or reused material	%	0.0%	0.0%		0.0%
	M&W-3	Unrefined materials used on-site	Tons	0.000	24.150	0.000	24.2
	M&W-4	% of unrefined materials from recycled or reused material	%		0.0%		0.0%
	M&W-5	On-site hazardous waste disposed of off-site	Tons	0.0	0.0	0.0	0.0
	M&W-6	On-site non-hazardous waste disposed of off-site	Tons	0.0	50,000.0	7.0	50,007.0
	M&W-7	Recycled or reused waste	Tons	0.0	0.0	0.0	0.0
	M&W-8	% of total potential waste recycled or reused	%		0.0%	0.0%	0.0%
Water (used on-site)	W-1	Public water use	MG	0.0	0.1	0.0	0.1
	W-2	Groundwater use	MG	0.0	0.0	0.0	0.0
	W-3	Surface water use	MG	0.0	0.0	0.0	0.0
	W-4	Reclaimed water use	MG	0.0	0.0	0.0	0.0
	W-5	Storm water use	MG	0.0	0.0	0.0	0.0
	W-6	User-defined water resource #1	MG	0.0	0.0	0.0	0.0
	W-7	User-defined water resource #2	MG	0.0	0.0	0.0	0.0
	W-8	Wastewater generated	MG	0.0	0.0	0.0	0.0
Energy	E-1	Total energy used (on-site and off-site)	MMBtu	267.8	20,841.9	3,681.1	24,790.9
	E-2	Energy voluntarily derived from renewable resources					
	E-2A	On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	0.0	0.0	0.0	0.0
	E-2B	Voluntary purchase of renewable electricity	MWh	0.0	0.0	0.0	0.0
	E-3	Voluntary purchase of RECs	MWh	0.0	0.0	0.0	0.0
	E-4	On-site grid electricity use	MWh	0.000	0.000	282.310	282.3
Air	A-1	On-site NOx, SOx, and PM emissions	Pounds	292.3	10,265.9	0.0	10,558.3
	A-2	On-site HAP emissions	Pounds	0.0	0.3	0.0	0.3
	A-3	Total NOx, SOx, and PM emissions	Pounds	325.6	45,932.9	4,022.5	50,281.0
	A-3A	Total NOx emissions	Pounds	297.0	20,422.8	414.4	21,134.1
	A-3B	Total SOx emissions	Pounds	19.8	4,939.6	3,576.7	8,536.2
	A-3C	Total PM emissions	Pounds	8.9	20,570.5	31.3	20,610.7
	A-4	Total HAP emissions	Pounds	2.0	177.9	9.0	188.9
	A-5	Total greenhouse gas emissions	Tons CO2e*	21.9	1,700.4	239.8	1,962.1
Land & Ecosystems		Qualitative Description					

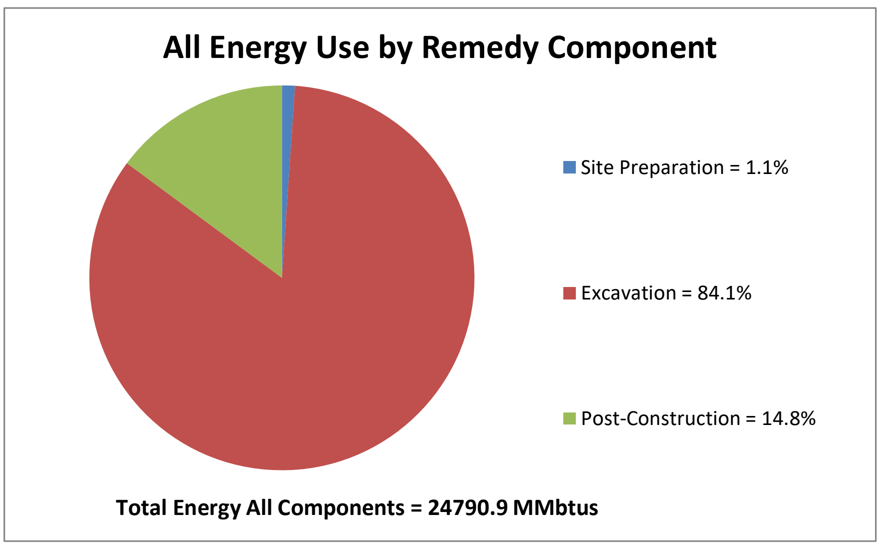
** Total greenhouse gases emissions (in CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.*
"MMBtu" = millions of Btus
"MG" = millions of gallons
"CO2e" = carbon dioxide equivalents of global warming potential
"MWh" = megawatt hours (i.e., thousands of kilowatt-hours or millions of Watt-hours)
"Tons" = short tons (2,000 pounds)

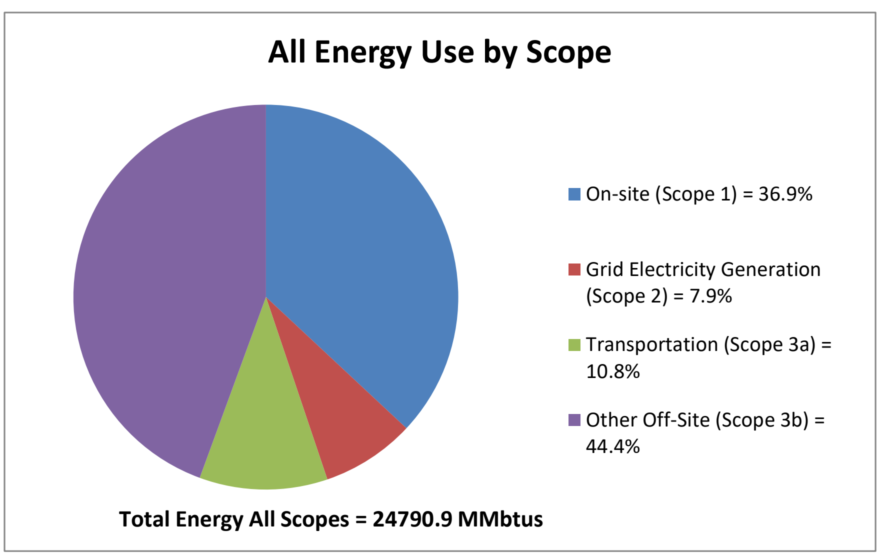
The above metrics are consistent with EPA's Methodology for Understanding and Reducing a Project's Environmental Footprint (EPA 542-R-12-002), February 2012

Notes:

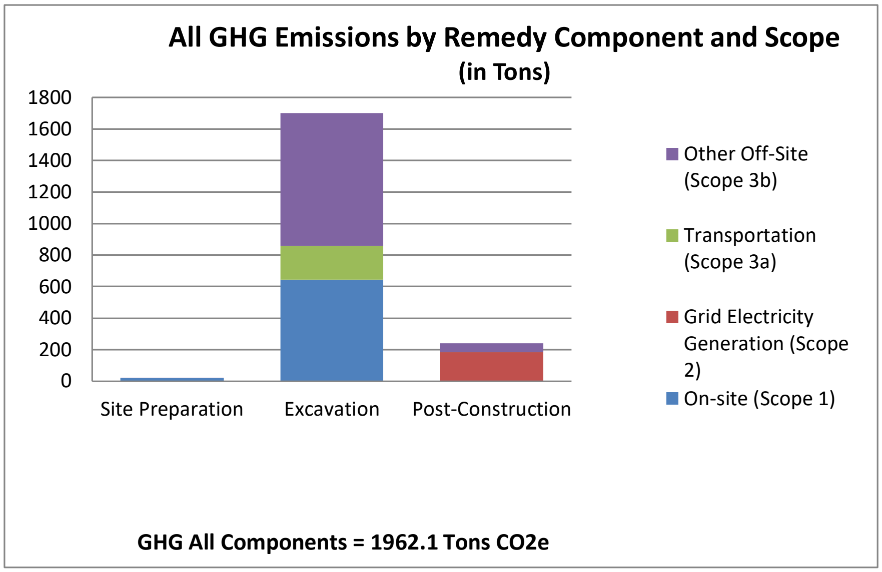
Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
DEC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Clea

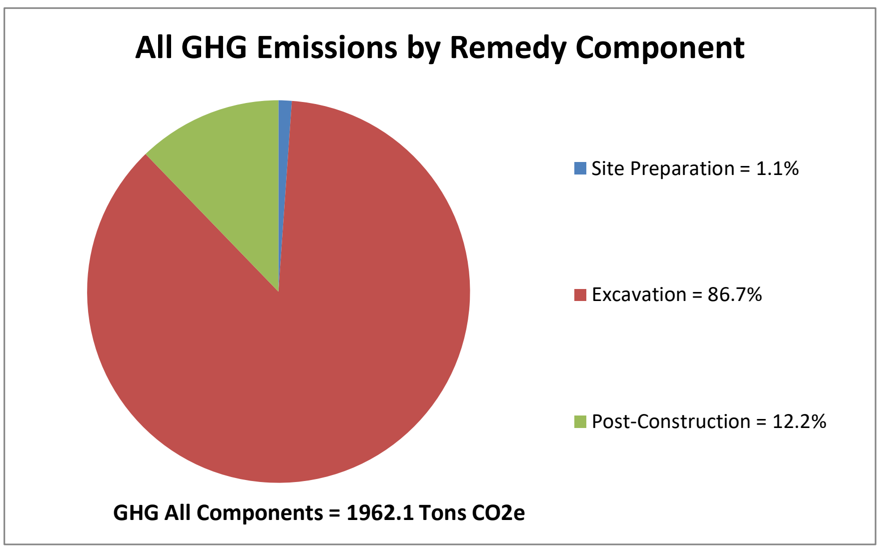


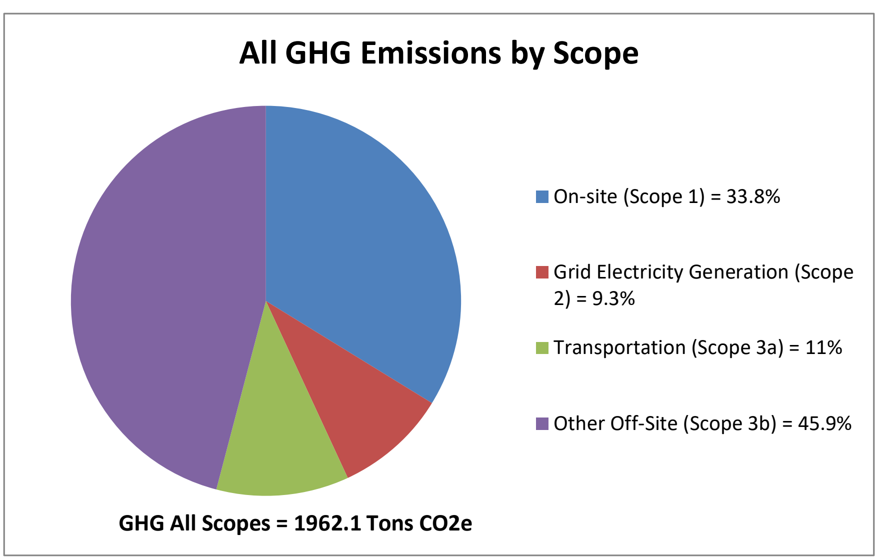




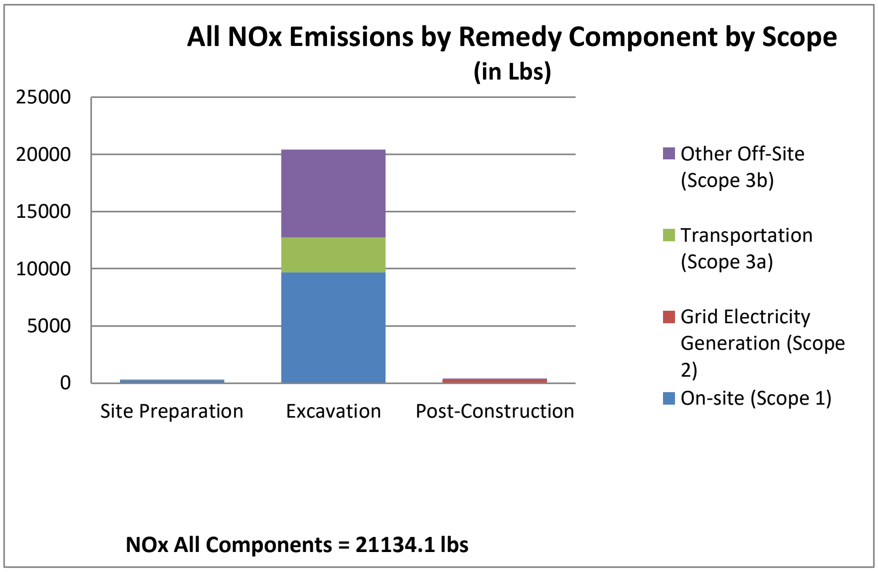
Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
DEC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Cle

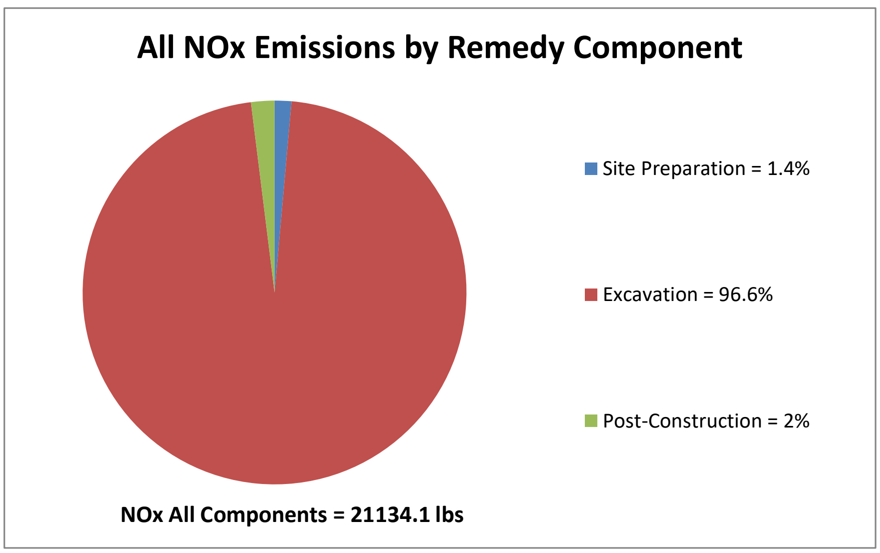


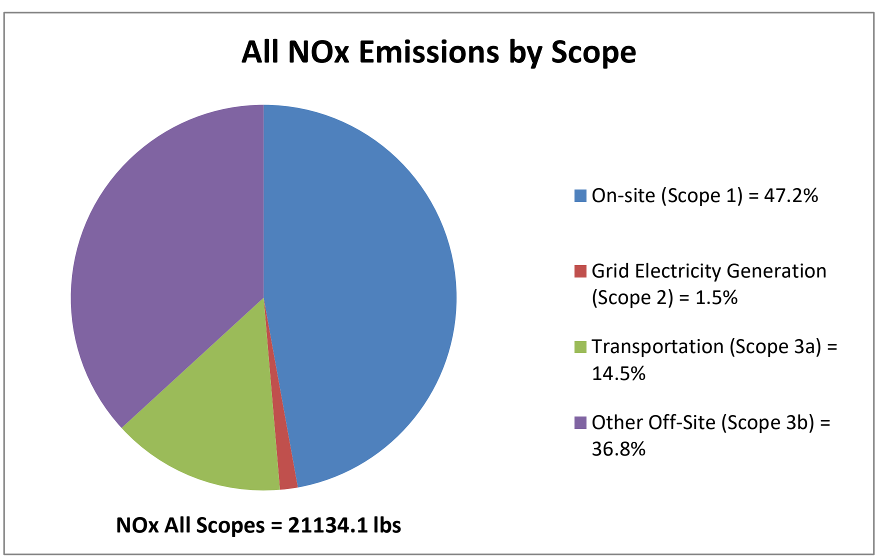




Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
DEC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Clea

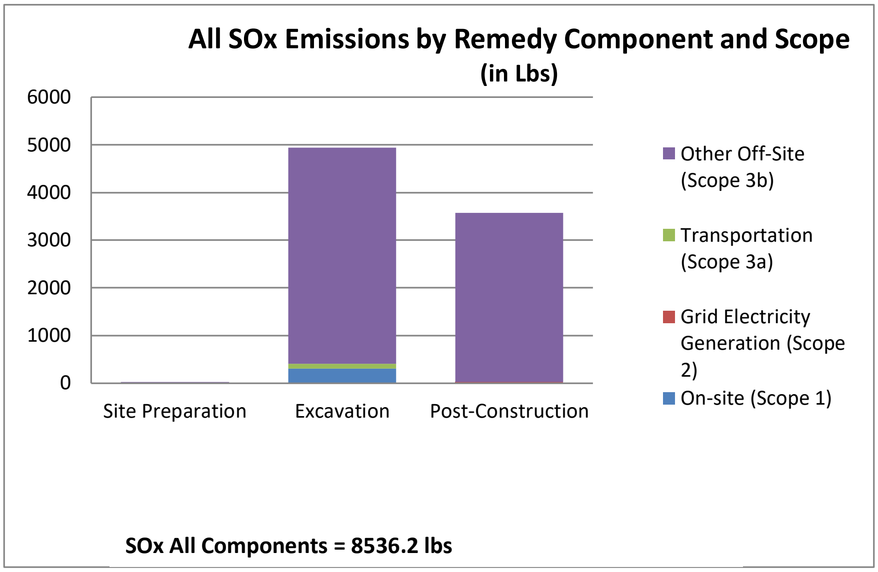


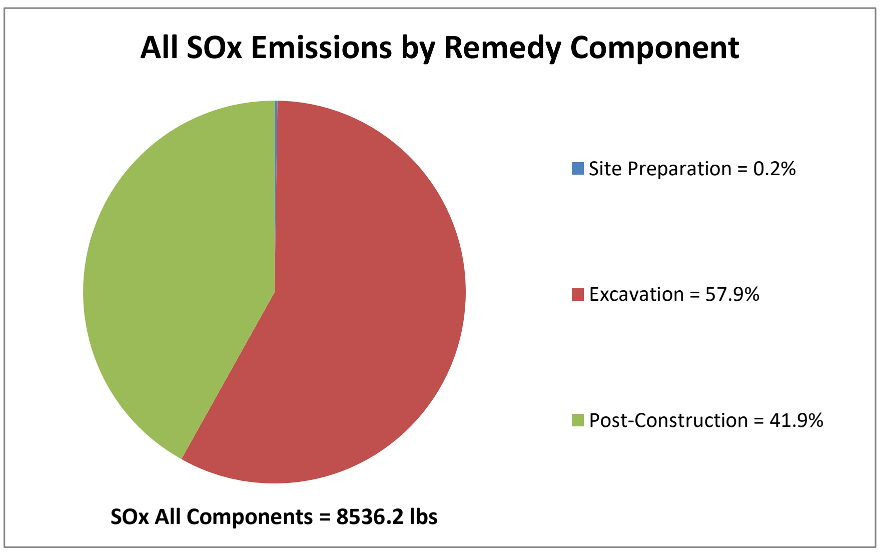


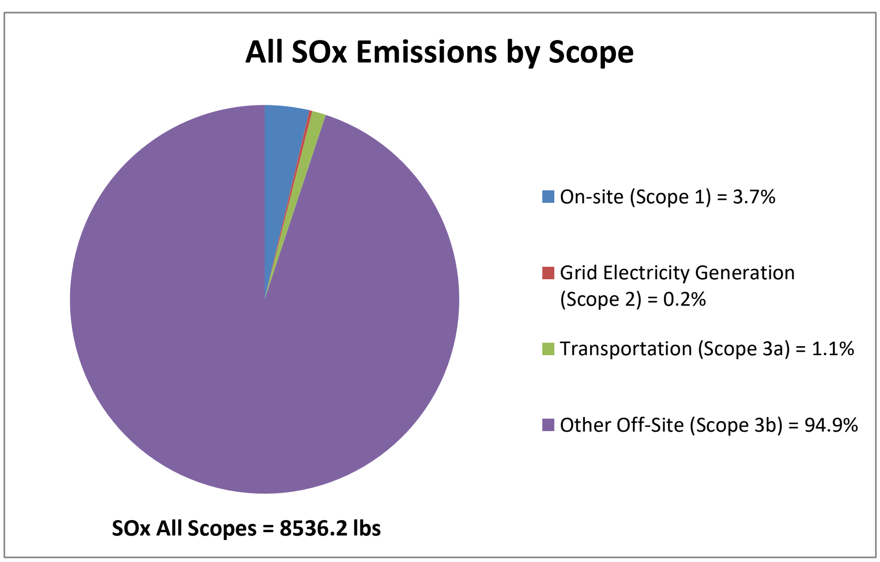


Appendix F
GSR Summary
Alternative 1

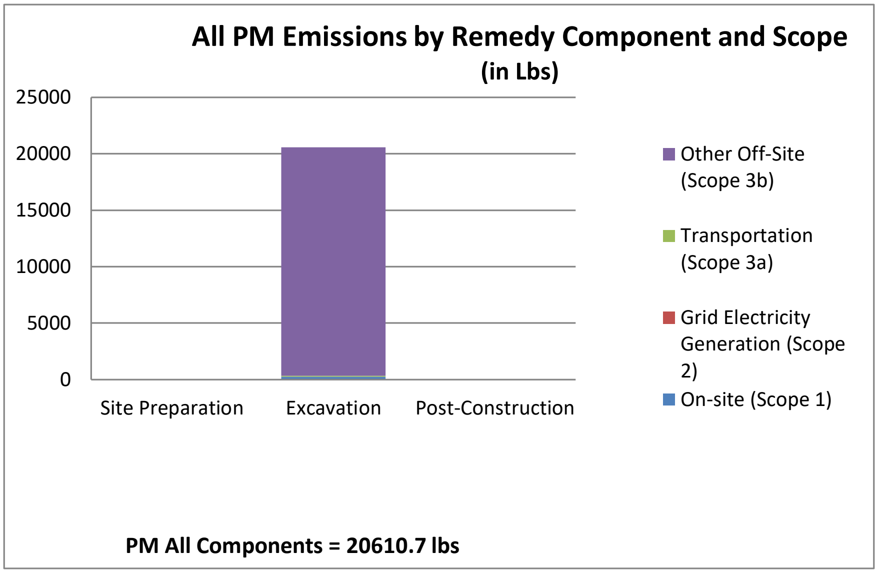
Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
)EC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Cle

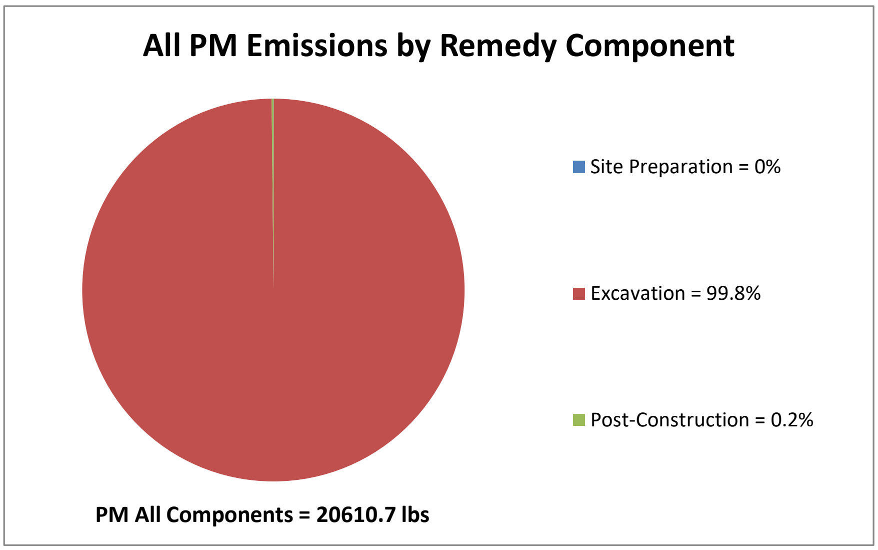


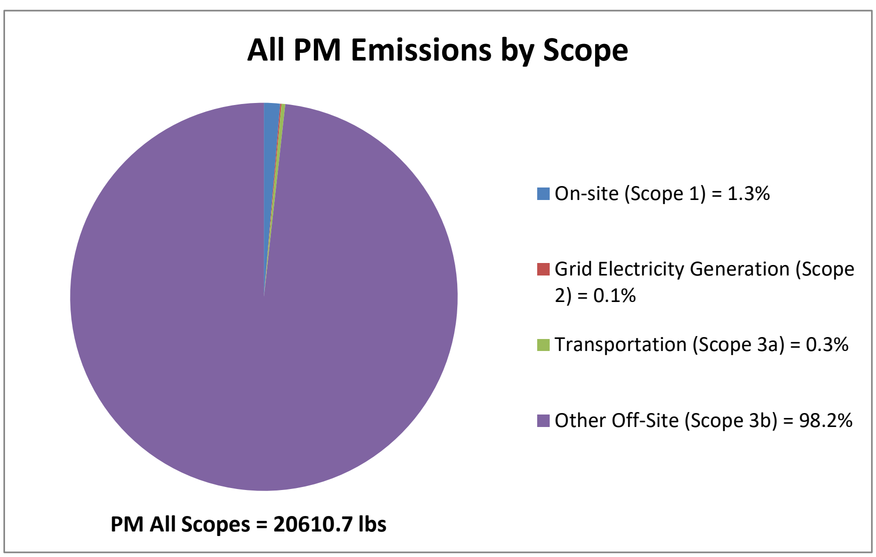




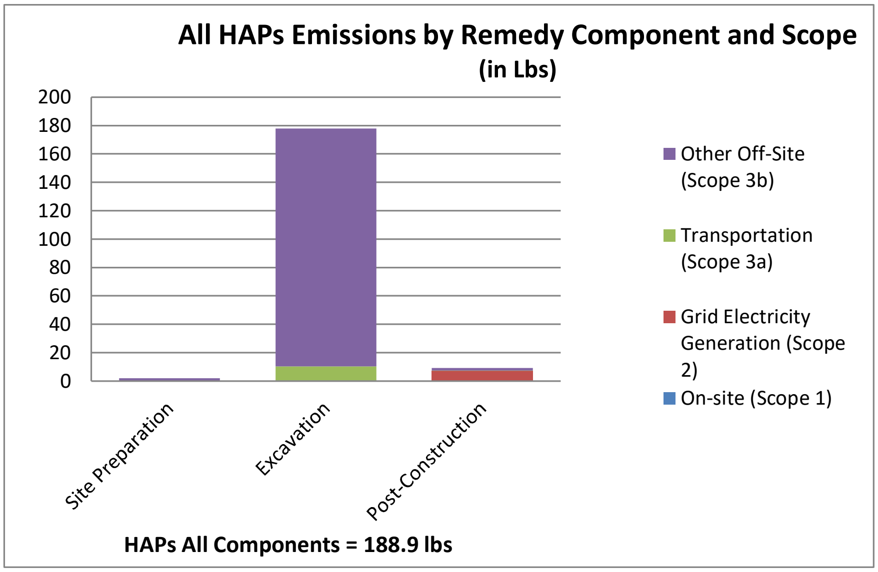
Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
DEC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Clea

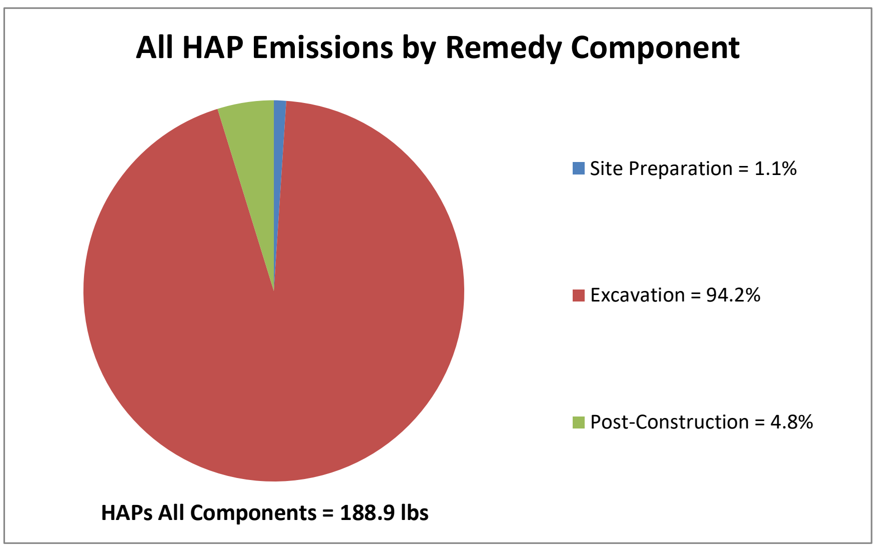


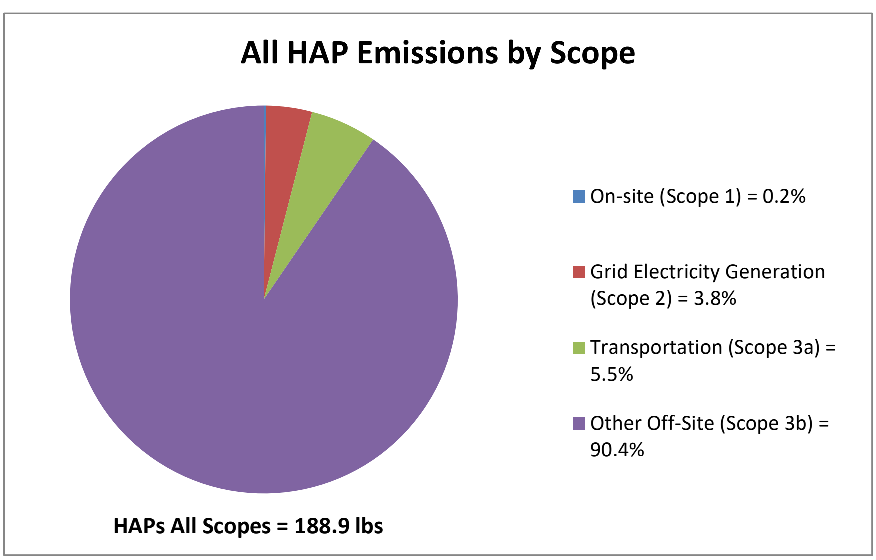




Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
)EC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Cle







Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
NYSDEC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Cleanup

Site Preparation - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**227**	**36,788**	**278**	**9**	**6**	**292**	**0**
Grid Electricity Generation (Scope 2)	**0.000**	**0**	**0**	**0**	**0**	**0**	**0**
Transportation (Scope 3a)	**11**	**1,800**	**10**	**0**	**0**	**11**	**0**
Other Off-Site (Scope 3b)	**29**	**5,205**	**9**	**11**	**3**	**23**	**2**
Remedy Totals	**268**	**43,793**	**297**	**20**	**9**	**326**	**2**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_(71525)-Track 1.xlsx

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
NYSDEC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Cleanup

Excavation - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**7,965**	**1,288,080**	**9,687**	**307**	**272**	**10,266**	**0**
Grid Electricity Generation (Scope 2)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Transportation (Scope 3a)	**2,654**	**429,172**	**3,060**	**96**	**65**	**3,221**	**10**
Other Off-Site (Scope 3b)	**10,223**	**1,683,628**	**7,676**	**4,536**	**20,234**	**32,446**	**167**
Remedy Totals	**20,842**	**3,400,880**	**20,423**	**4,940**	**20,571**	**45,933**	**178**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_(71525)-Track 1.xlsx

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
NYSDEC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Cleanup

Post-Construction - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**964**	**0**	**0**	**0**	**0**	**0**	**0**
Grid Electricity Generation (Scope 2)	**1,956**	**366,213**	**316**	**21**	**23**	**360**	**7**
Transportation (Scope 3a)	**5**	**775**	**2**	**0**	**0**	**2**	**0**
Other Off-Site (Scope 3b)	**757**	**112,579**	**96**	**3,556**	**8**	**3,660**	**2**
Remedy Totals	**3,681**	**479,567**	**414**	**3,577**	**31**	**4,022**	**9**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_(71525)-Track 1.xlsx

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
NYSDEC BCP C241285 Former Refron Inc. Gas Reclamation Site - RAWP - Alternative 1 - Conditional Track 1 Cleanup

All - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**9,156**	**1,324,868**	**9,965**	**316**	**277**	**10,558**	**0**
Grid Electricity Generation (Scope 2)	**1,956.128**	**366,213**	**316**	**21**	**23**	**360**	**7**
Transportation (Scope 3a)	**2,670**	**431,748**	**3,072**	**97**	**65**	**3,234**	**10**
Other Off-Site (Scope 3b)	**11,009**	**1,764,791**	**7,750**	**8,100**	**20,243**	**36,093**	**170**
Remedy Totals	**24,791**	**3,887,619**	**21,103**	**8,534**	**20,608**	**50,245**	**188**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_(71525)-Track 1.xlsx

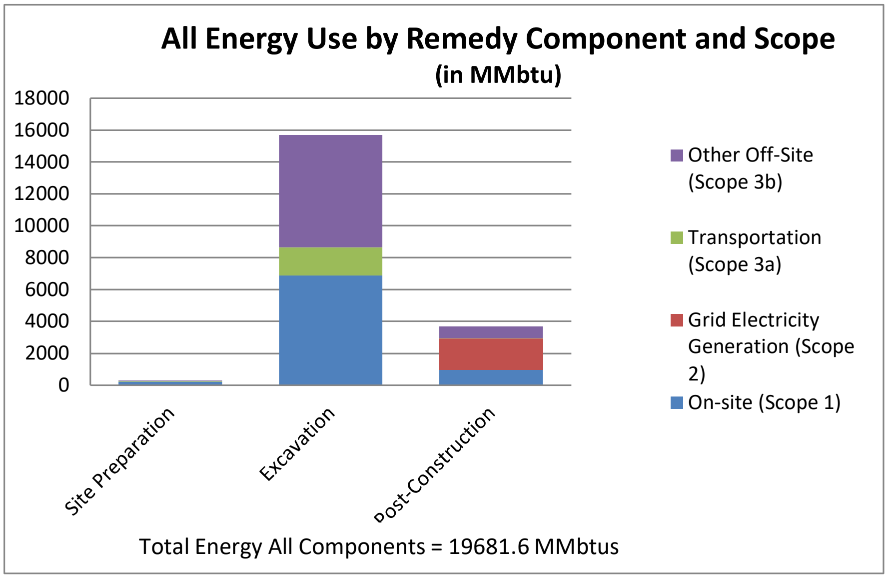
Environmental Footprint Summary

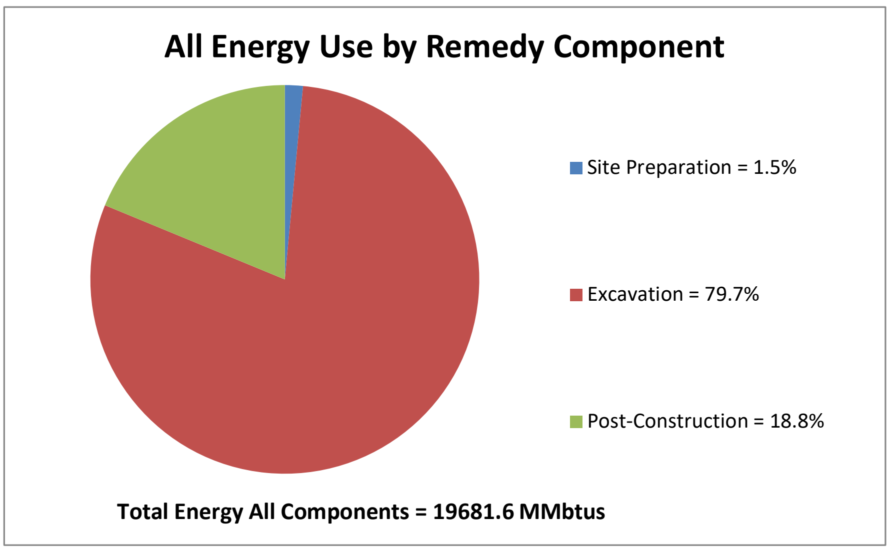
Core Element	Metric		Unit of Measure	Footprint			
				Site Preparation	**Excavation**	**Post-Construction**	**Total**
Materials & Waste	M&W-1	Refined materials used on-site	Tons	3.7	2,625.0	0.0	2,628.7
	M&W-2	% of refined materials from recycled or reused material	%	0.0%	0.0%		0.0%
	M&W-3	Unrefined materials used on-site	Tons	0.000	24.150	0.000	24.2
	M&W-4	% of unrefined materials from recycled or reused material	%		0.0%		0.0%
	M&W-5	On-site hazardous waste disposed of off-site	Tons	0.0	0.0	0.0	0.0
	M&W-6	On-site non-hazardous waste disposed of off-site	Tons	0.0	31,000.0	7.0	31,007.0
	M&W-7	Recycled or reused waste	Tons	0.0	0.0	0.0	0.0
	M&W-8	% of total potential waste recycled or reused	%		0.0%	0.0%	0.0%
Water (used on-site)	W-1	Public water use	MG	0.0	0.1	0.0	0.1
	W-2	Groundwater use	MG	0.0	0.0	0.0	0.0
	W-3	Surface water use	MG	0.0	0.0	0.0	0.0
	W-4	Reclaimed water use	MG	0.0	0.0	0.0	0.0
	W-5	Storm water use	MG	0.0	0.0	0.0	0.0
	W-6	User-defined water resource #1	MG	0.0	0.0	0.0	0.0
	W-7	User-defined water resource #2	MG	0.0	0.0	0.0	0.0
	W-8	Wastewater generated	MG	0.0	0.0	0.0	0.0
Energy	E-1	Total energy used (on-site and off-site)	MMBtu	293.7	15,693.0	3,694.9	19,681.6
	E-2	Energy voluntarily derived from renewable resources					
	E-2A	On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	0.0	0.0	0.0	0.0
	E-2B	Voluntary purchase of renewable electricity	MWh	0.0	0.0	0.0	0.0
	E-3	Voluntary purchase of RECs	MWh	0.0	0.0	0.0	0.0
	E-4	On-site grid electricity use	MWh	0.000	0.000	282.310	282.3
Air	A-1	On-site NOx, SOx, and PM emissions	Pounds	292.3	8,871.3	0.0	9,163.6
	A-2	On-site HAP emissions	Pounds	0.0	0.3	0.0	0.3
	A-3	Total NOx, SOx, and PM emissions	Pounds	338.7	31,630.5	4,015.9	35,985.1
	A-3A	Total NOx emissions	Pounds	307.5	15,355.1	415.2	16,077.7
	A-3B	Total SOx emissions	Pounds	20.9	3,367.4	3,570.0	6,958.2
	A-3C	Total PM emissions	Pounds	10.3	12,908.1	30.7	12,949.1
	A-4	Total HAP emissions	Pounds	2.6	137.0	9.0	148.7
	A-5	Total greenhouse gas emissions	Tons CO2e*	24.0	1,287.4	240.8	1,552.2
Land & Ecosystems	Qualitative Description						

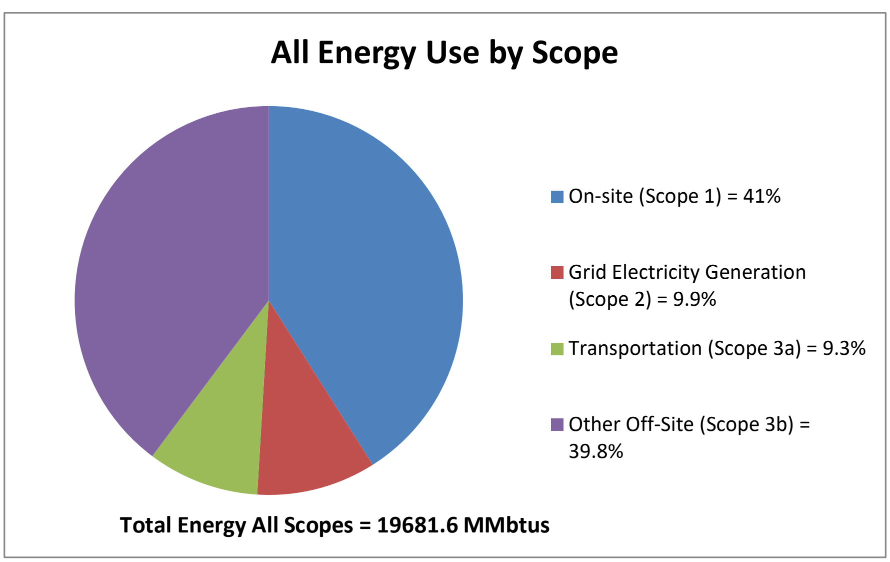
** Total greenhouse gases emissions (in CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.*
"MMBtu" = millions of Btus
"MG" = millions of gallons
"CO2e" = carbon dioxide equivalents of global warming potential
"MWh" = megawatt hours (i.e., thousands of kilowatt-hours or millions of Watt-hours)
"Tons" = short tons (2,000 pounds)

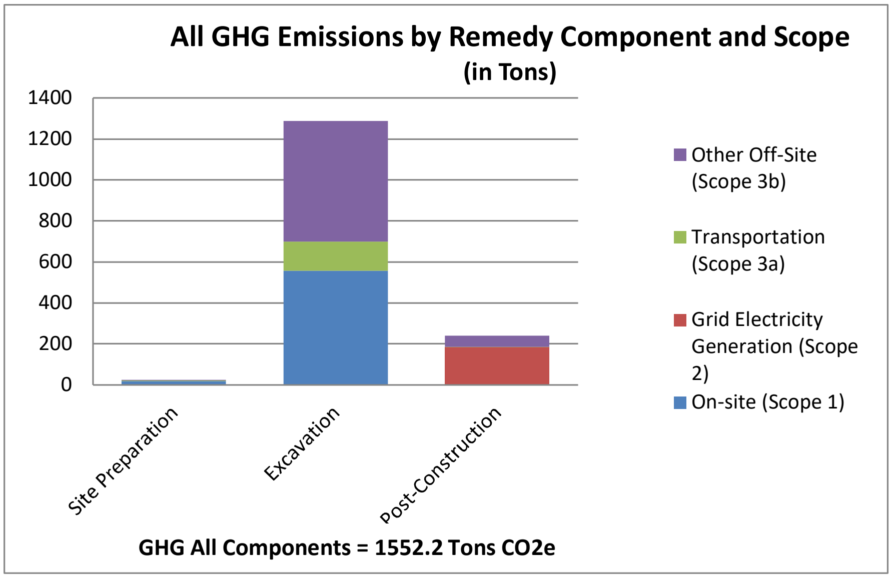
for Understanding and Reducing a Project's Environmental Footprint (EPA 542-R-12-002), February

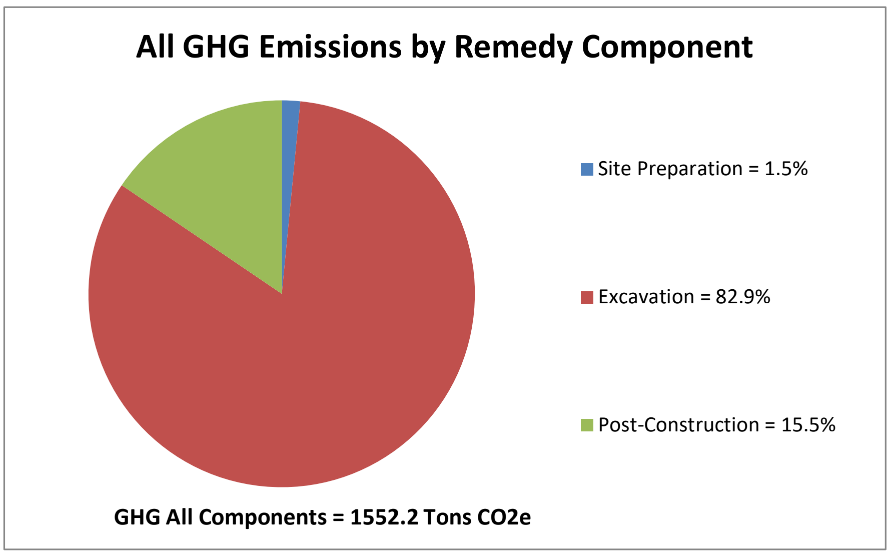
Notes:

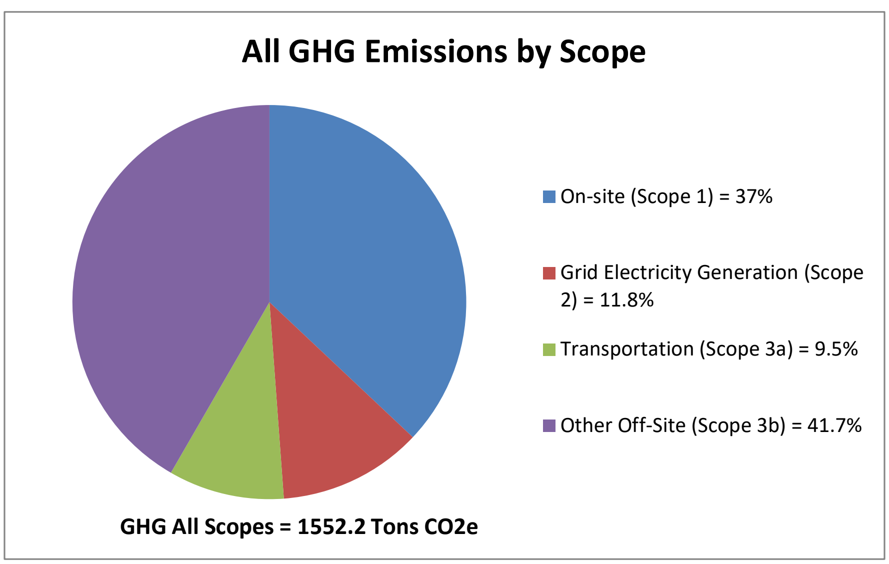

All Energy Use by Remedy Component and Scope
(in MMbtu)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Site Preparation
Excavation
Post-Construction
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
Total Energy All Components = 19681.6 MMbtus

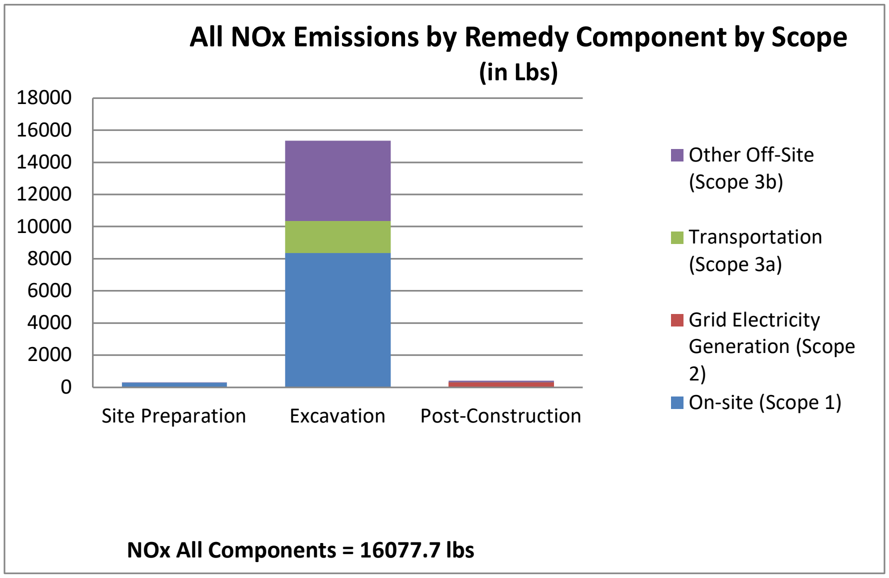

All Energy Use by Remedy Component
Site Preparation = 1.5%
Excavation = 79.7%
Post-Construction = 18.8%
Total Energy All Components = 19681.6 MMbtus

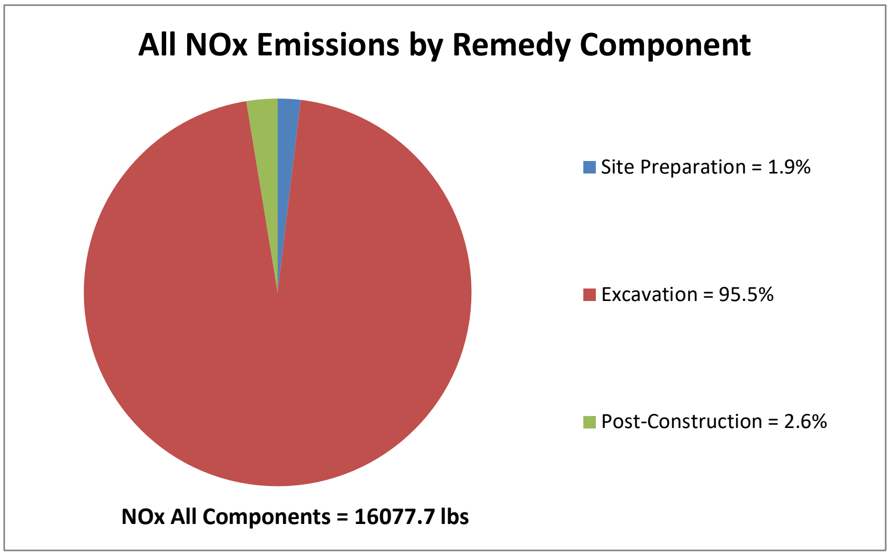

All Energy Use by Scope
On-site (Scope 1) = 41%
Grid Electricity Generation (Scope 2) = 9.9%
Transportation (Scope 3a) = 9.3%
Other Off-Site (Scope 3b) = 39.8%
Total Energy All Scopes = 19681.6 MMbtus

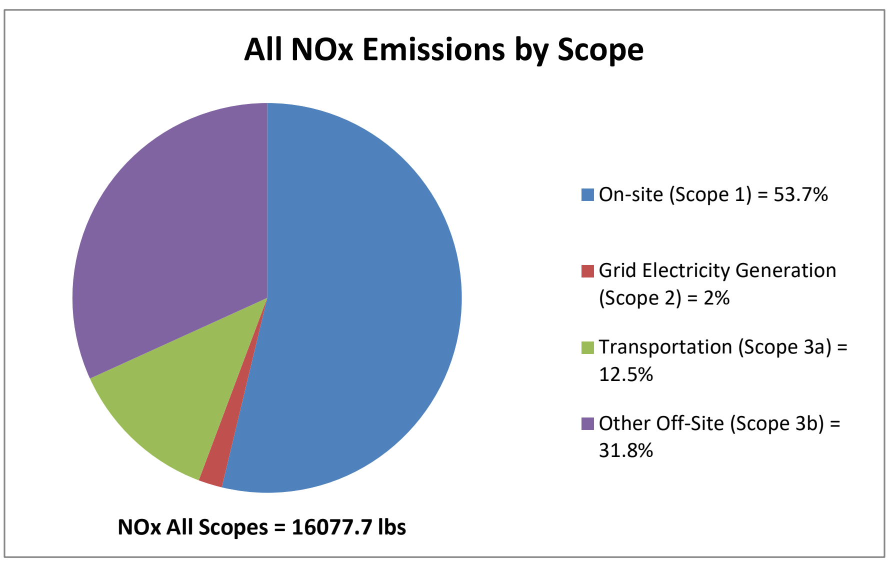

All GHG Emissions by Remedy Component and Scope
(in Tons)
1400
1200
1000
800
600
400
200
0
Site Preparation
Excavation
Post-Construction
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
GHG All Components = 1552.2 Tons CO2e

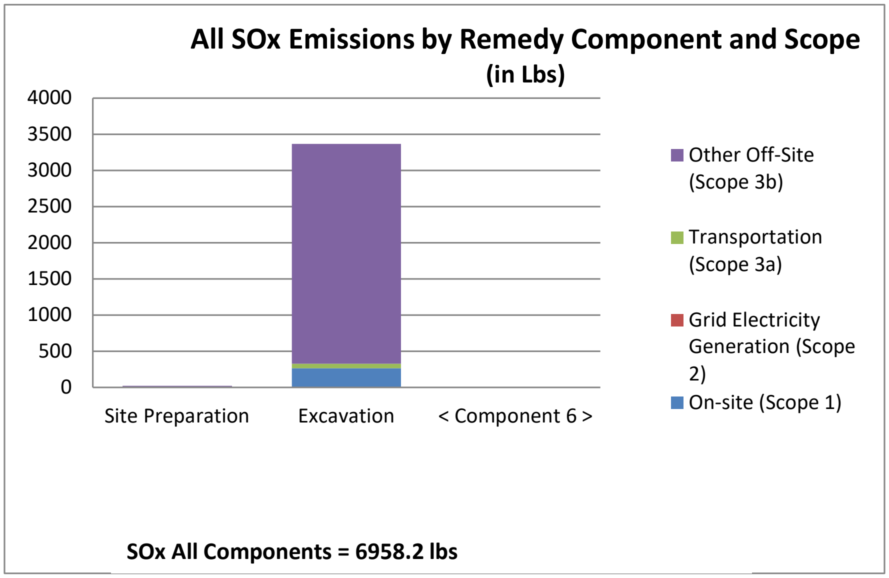

All GHG Emissions by Remedy Component
Site Preparation = 1.5%
Excavation = 82.9%
Post-Construction = 15.5%
GHG All Components = 1552.2 Tons CO2e

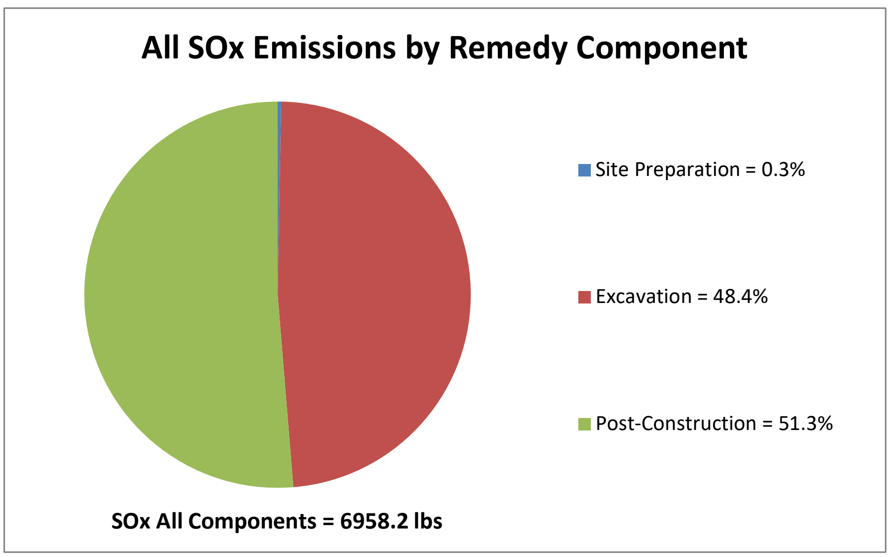

All GHG Emissions by Scope
On-site (Scope 1) = 37%
Grid Electricity Generation (Scope 2) = 11.8%
Transportation (Scope 3a) = 9.5%
Other Off-Site (Scope 3b) = 41.7%
GHG All Scopes = 1552.2 Tons CO2e

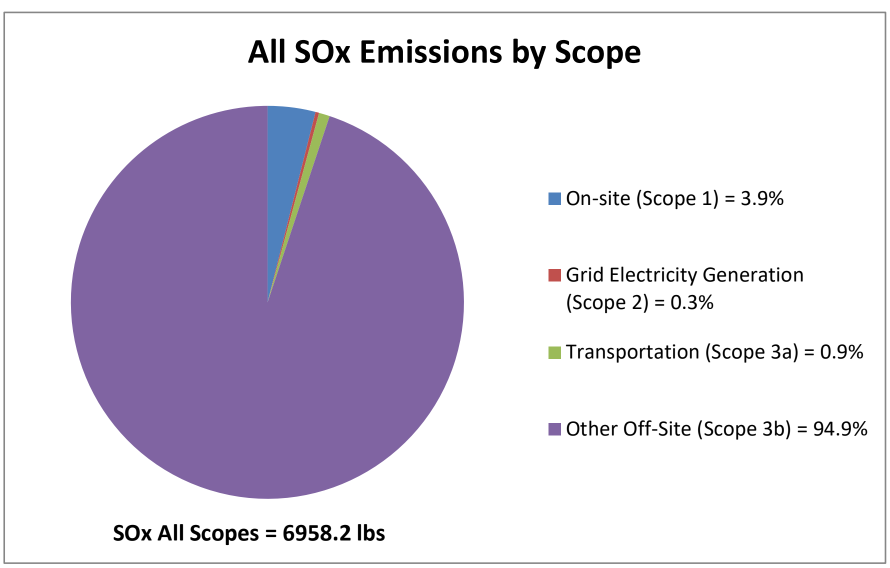

All NOx Emissions by Remedy Component by Scope
(in Lbs)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Site Preparation
Excavation
Post-Construction
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
NOx All Components = 16077.7 lbs

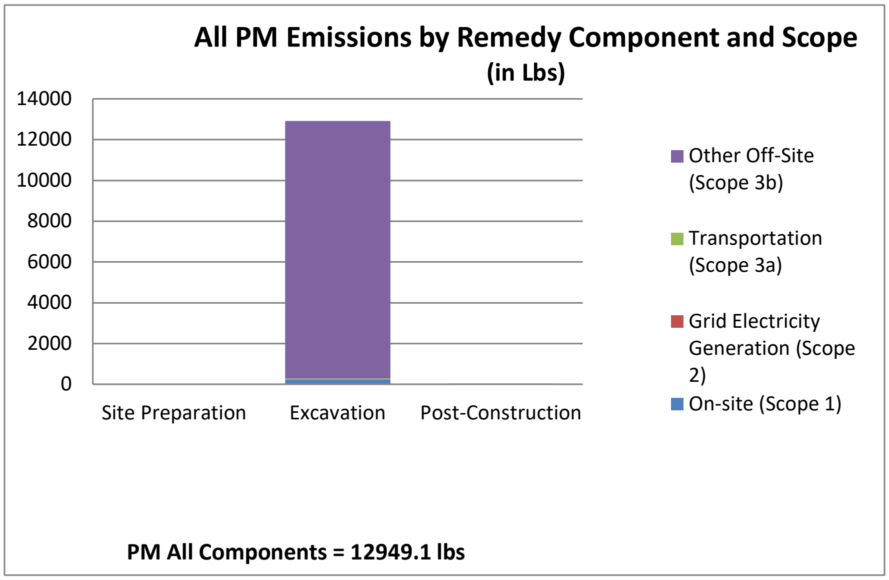

All NOx Emissions by Remedy Component
Site Preparation = 1.9%
Excavation = 95.5%
Post-Construction = 2.6%
NOx All Components = 16077.7 lbs

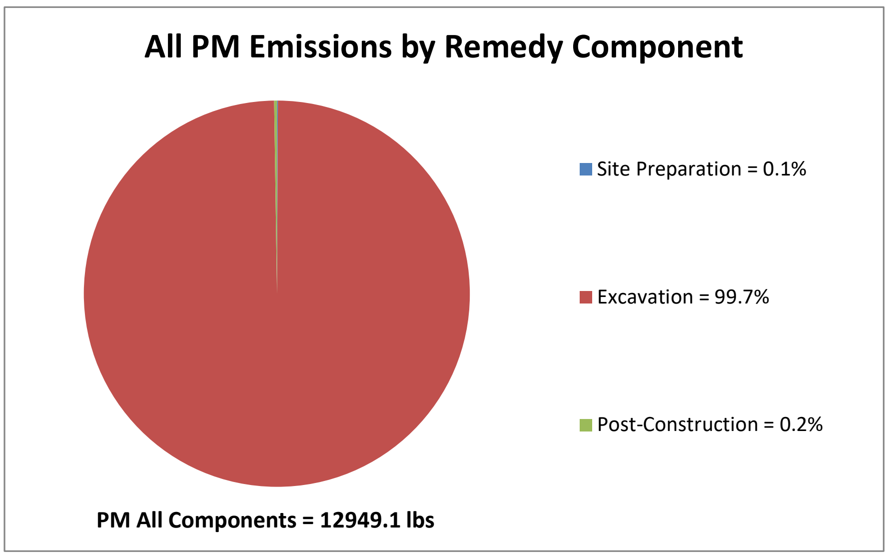

All NOx Emissions by Scope
On-site (Scope 1) = 53.7%
Grid Electricity Generation (Scope 2) = 2%
Transportation (Scope 3a) = 12.5%
Other Off-Site (Scope 3b) = 31.8%
NOx All Scopes = 16077.7 lbs

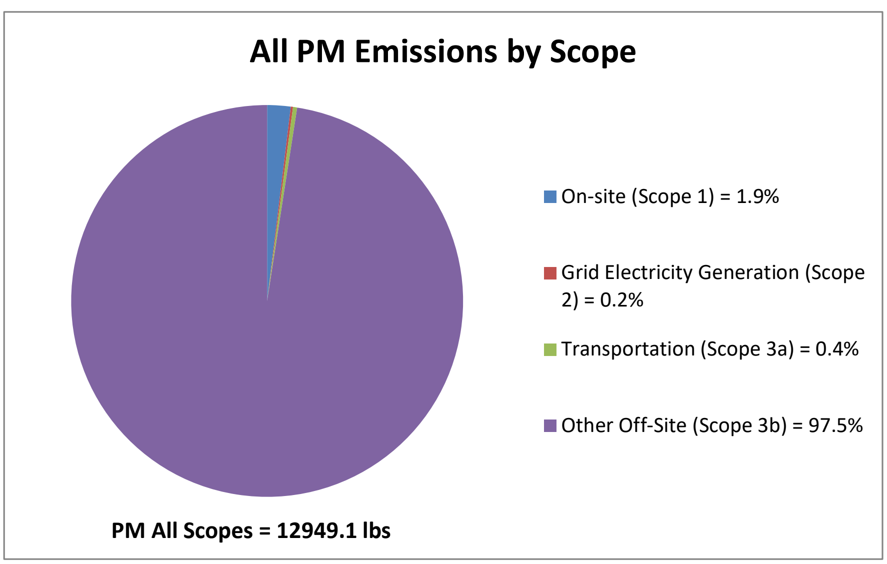

All SOx Emissions by Remedy Component and Scope
(in Lbs)
4000
3500
3000
2500
2000
1500
1000
500
0
Site Preparation
Excavation
< Component 6 >
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
SOx All Components = 6958.2 lbs

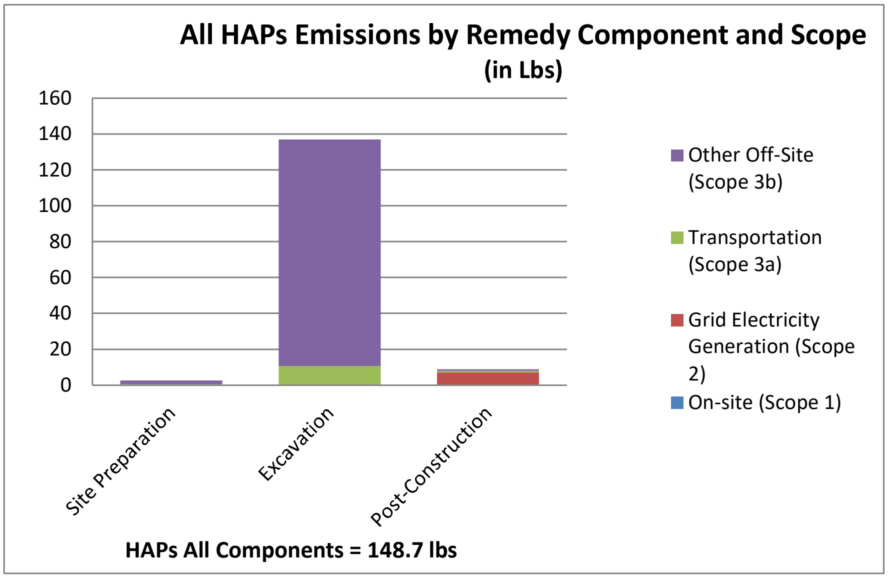

All SOx Emissions by Remedy Component
Site Preparation = 0.3%
Excavation = 48.4%
Post-Construction = 51.3%
SOx All Components = 6958.2 lbs

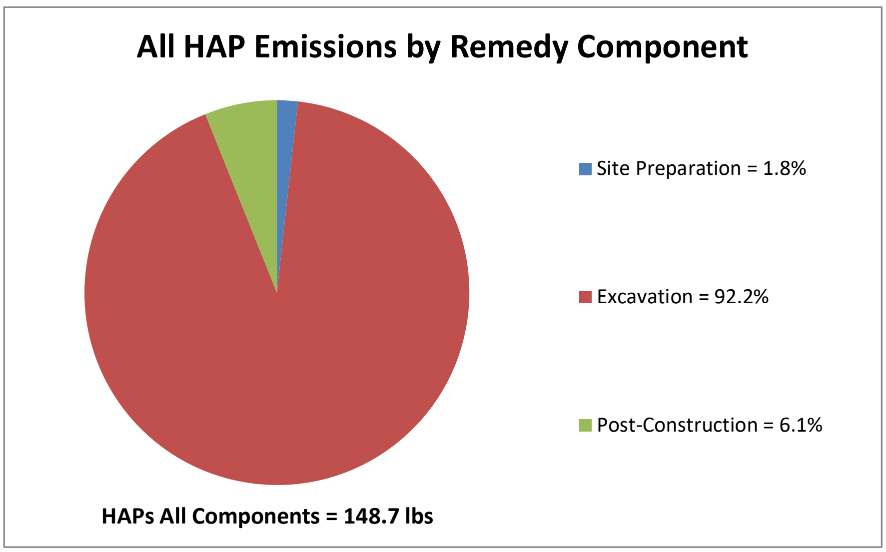

All SOx Emissions by Scope
On-site (Scope 1) = 3.9%
Grid Electricity Generation (Scope 2) = 0.3%
Transportation (Scope 3a) = 0.9%
Other Off-Site (Scope 3b) = 94.9%
SOx All Scopes = 6958.2 lbs

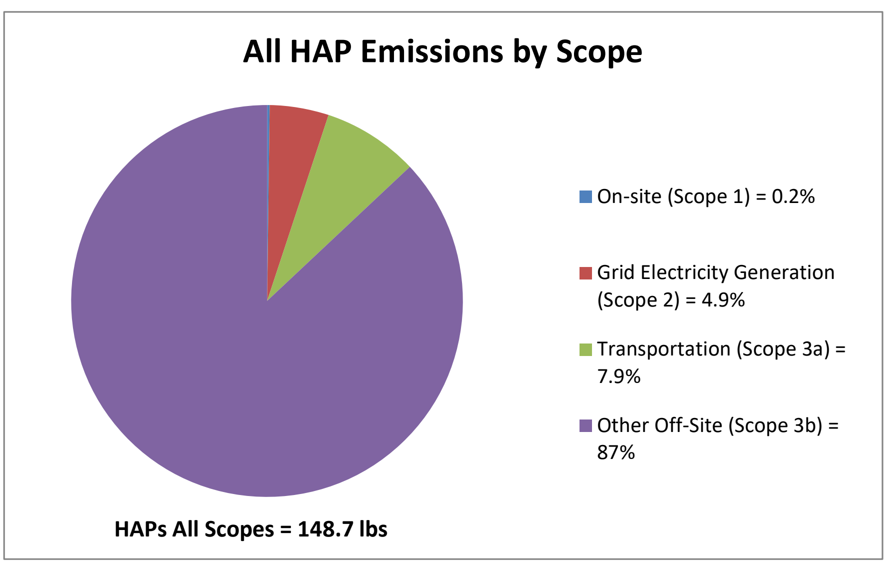

All PM Emissions by Remedy Component and Scope
(in Lbs)
14000
12000
10000
8000
6000
4000
2000
0
Site Preparation
Excavation
Post-Construction
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
PM All Components = 12949.1 lbs


All PM Emissions by Remedy Component
Site Preparation = 0.1%
Excavation = 99.7%
Post-Construction = 0.2%
PM All Components = 12949.1 lbs


All PM Emissions by Scope
On-site (Scope 1) = 1.9%
Grid Electricity Generation (Scope 2) = 0.2%
Transportation (Scope 3a) = 0.4%
Other Off-Site (Scope 3b) = 97.5%
PM All Scopes = 12949.1 lbs


All HAPs Emissions by Remedy Component and Scope
(in Lbs)
160
140
120
100
80
60
40
20
0
Site Preparation
Excavation
Post-Construction
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
HAPs All Components = 148.7 lbs


All HAP Emissions by Remedy Component
Site Preparation = 1.8%
Excavation = 92.2%
Post-Construction = 6.1%
HAPs All Components = 148.7 lbs


All HAP Emissions by Scope
On-site (Scope 1) = 0.2%
Grid Electricity Generation (Scope 2) = 4.9%
Transportation (Scope 3a) = 7.9%
Other Off-Site (Scope 3b) = 87%
HAPs All Scopes = 148.7 lbs

Site Preparation - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**227**	**36,788**	**278**	**9**	**6**	**292**	**0**
Grid Electricity Generation (Scope 2)	**0.000**	**0**	**0**	**0**	**0**	**0**	**0**
Transportation (Scope 3a)	**34**	**5,531**	**20**	**0**	**2**	**22**	**1**
Other Off-Site (Scope 3b)	**32**	**5,705**	**10**	**12**	**3**	**25**	**2**
Remedy Totals	**294**	**48,024**	**307**	**21**	**10**	**339**	**3**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_(71525)-Track 2.xlsx

Excavation - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**6,881**	**1,112,580**	**8,361**	**265**	**245**	**8,871**	**0**
Grid Electricity Generation (Scope 2)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Transportation (Scope 3a)	**1,778**	**287,352**	**1,984**	**62**	**43**	**2,090**	**10**
Other Off-Site (Scope 3b)	**7,034**	**1,174,801**	**5,010**	**3,040**	**12,620**	**20,669**	**126**
Remedy Totals	**15,693**	**2,574,733**	**15,355**	**3,367**	**12,908**	**31,631**	**137**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_(71525)-Track 2.xlsx

Post-Construction - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**964**	**0**	**0**	**0**	**0**	**0**	**0**
Grid Electricity Generation (Scope 2)	**1,956**	**366,213**	**316**	**21**	**23**	**360**	**7**
Transportation (Scope 3a)	**18**	**2,818**	**6**	**0**	**0**	**6**	**1**
Other Off-Site (Scope 3b)	**758**	**112,580**	**93**	**3,549**	**8**	**3,650**	**1**
Remedy Totals	**3,695**	**481,610**	**415**	**3,570**	**31**	**4,016**	**9**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file: SEFA_calculations_(71525)-Track 2.xlsx

All - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**8,072**	**1,149,368**	**8,639**	**274**	**251**	**9,164**	**0**
Grid Electricity Generation (Scope 2)	**1,956.128**	**366,213**	**316**	**21**	**23**	**360**	**7**
Transportation (Scope 3a)	**1,830**	**295,701**	**2,009**	**63**	**45**	**2,117**	**12**
Other Off-Site (Scope 3b)	**7,824**	**1,256,464**	**5,081**	**6,599**	**12,628**	**24,308**	**129**
Remedy Totals	**19,682**	**3,067,745**	**16,046**	**6,956**	**12,947**	**35,949**	**148**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_(71525)-Track 2.xlsx

APPENDIX G

RESUMES

AMC Engineering PLLC
18-36 42nd Street
Astoria, NY 11105
Phone: (516) 417-8588

ARIEL CZEMERINSKI, P.E.
Email: Ariel@AMC-Engineering.com

SUMMARY:

New York State Professional Engineer. Chemical and Environmental Engineer, with 29 years of experience in the chemical and environmental areas. Areas of expertise include inspections and sign off on Large Scale Vapor Barrier Installations at Various NYC schools, Design and inspections of Sub Slab Depressurization Systems, wastewater treatment systems, Large scale dewatering system design for construction, process control and automation, process optimization, productivity improvement, quality systems, environmental compliance, Phase I Environmental Site Assessments, Phase II Environmental Investigations, Phase III: Remedial Activities, process and plant safety, and management of a production facility. Special Inspector with New York City Department of Buildings. Registered PE in NY.

Professional Experience:

AMC: 18 Years
Prior: 6 years

Education

Master of Science in Chemical Engineering, Columbia University, New York, NY, Feb. 1990.
Bachelor of Science in Chemical Engineering, University Of Buenos Aires, Buenos Aires, Argentina, May 1987

Areas of Expertise

- Vapor Intrusion - Barrier and Sub Slab Venting System Design
- Environmental Assessment Statements under CEQR, ULURP
- Remedial Program Design and Management
- Environmental Compliance, Clean Water Act, Clean Air Act, Hazardous Materials
- Dewatering & Treatment System Design
- SWPPP design and implementation. Preparation and Submittal of NOIs.
- NYCDEP Sewer Discharge Permitting
- Transfer Station Permitting and Compliance
- Wastewater Treatment Systems and Permitting, SPDES, LI Well permit, Water Withdrawal Permit.
- Air Permits and Registration
- Zoning Regulations and Permitting
- Safety and Environmental Training
- Waste Management Plans
- Professional Certifications
- OSHA 40-hr HAZWOPER
- OSHA 10-hr Construction Safety and Health

Project Experience

Project: Bergen Basin Sewer - CS-JA-BBS -Queens, NY
Project Description: NYC infrastructure (sewer, water) upgrade, drainage channel installation. Dewatering Design. Permits with NYCDEP and NYSDEC. Soil contaminated with petroleum requiring excavation, soil management and disposal under a Materials Handling Plan, Construction Health and Safety Plan. SWPPP design and implementation.
Client: JR Cruz - NYCDDC
Regulatory Authority: NYSDEC, NYCDEP
Role: Mr. Czemerinski served as the Environmental Consultant for the project.

Project: SER002326- Storm and Sanitary Sewers in Wardwell Avenue, Staten Island, New York
Project Description: NYC infrastructure (sewer, water) upgrade.
Dewatering Design. Permits with NYCDEP and NYSDEC. SWPPP design and implementation.
Client: E.E. Cruz - NYCDDC
Regulatory Authority: NYSDEC, NYCDEP
Role: Mr. Czemerinski served as the Environmental Consultant for the project.

Project: HED568-Installation of New 20" Subaqueous water main extension, and new 12" sub-aqueous high pressure gas main from the Bronx to Randall's Island, New York
Project Description: NYC infrastructure (gas, water) upgrade.
Soil contaminated with petroleum requiring excavation, soil management and disposal under a Materials Handling Plan, Construction Health and Safety Plan. Dewatering Design. Permits with NYCDEP and NYSDEC.
Client: E.E. Cruz - NYCDDC
Regulatory Authority: NYSDEC, NYCDEP
Role: Mr. Czemerinski served as the Environmental Consultant for the project.

Project: Domsey Fiber Corp. - 431 Kent Avenue, Brooklyn NY
Project Description: NYS Brownfield cleanup project / NYC E-Designation. Soil contaminated with chlorinated solvents, petroleum and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: Express Builders
Regulatory Authority: NYSDEC, NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project: SE-807 –Construction of Storm and Sanitary Sewers and Water Main in 20th Ave between 126th St and US Bulkhead Line Area, College Point, Queens, NY
Project Description: NYC Residential infrastructure (sewer, water) upgrade, outfall reconstruction, Soil characterization, soil management and disposal under a Materials Handling Plan, Construction Health and Safety Plan and Community Air Monitoring Plan. SWPPP design and implementation, Public Participation Plan, Marine HASP, Dewatering Design and permit application.

Client: EIC Associates
Regulatory Authority: NYCDDC
Role: Mr. Czemerinski served as the Environmental Consultant for the project.

Project: Springfield Gardens Residential Area BMP - Springfield Gardens, Queens, NY
Project Description: NYC Residential infrastructure (sewer, gas, water) upgrade, drainage channel installation and pond restoration. Soil contaminated with, petroleum and heavy metals requiring excavation, soil management and disposal under a Materials Handling Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: EIC Associates - NYCEDC
Regulatory Authority: NYSDEC, NYCParks
Role: Mr. Czemerinski served as the Environmental Consultant for the project.

Project: Former Domino Sugar Site - Kent Avenue, Brooklyn NY
Project Description: NYC E-Designation. Soil contaminated with semi-volatile organic compounds and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: Two Trees Management
Regulatory Authority: NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project: Former Uniforms For Industry Site - Jamaica Avenue, Queens NY
Project Description: NYS Brownfield cleanup project / NYC E-Designation. Soil contaminated with chlorinated solvents, petroleum, mop oil and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: The Arker Companies
Regulatory Authority: NYSDEC, NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project

Project: Former Sunbelt Equipment Site – 25 Kent Avenue, Brooklyn, NY
Project Description: NYS Brownfield cleanup project. Soil contaminated with petroleum, and heavy metals and coal tar, requiring deep excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan, Dewatering Design and implementation, SWPPP design and implementation
Client: 19 Kent Acquisition LLC
Regulatory Authority: NYSDEC
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project Experience

Project: Former Charles Pfizer & Co. Site - 407 Marcy Avenue, Brooklyn, NY
Project Description: NYS Brownfield cleanup project / NYC E-Designation. Soil contaminated with chlorinated solvents, petroleum, and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: The Rabsky Group
Regulatory Authority: NYSDEC, NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project: Former East Coast Industrial Uniforms Site - 39 Skillman Street, Brooklyn, NY
Project Description: NYS Brownfield cleanup project / NYC E-Designation. Soil contaminated with chlorinated solvents, petroleum, and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: Riverside Builders
Regulatory Authority: NYSDEC, NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project: Former BP Amoco Service Station Site - 1800 Southern Boulevard, Bronx, NY
Project Description: NYS Brownfield cleanup project / NYC E-Designation. Soil contaminated with petroleum, and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: SoBro, Joy Construction
Regulatory Authority: NYSDEC, NYCOER
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Project: Former Dico G Auto & Truck Repair Site - 3035 White Plains Road, Bronx, NY
Project Description: NYS Brownfield cleanup project. Soil contaminated with petroleum, and heavy metals requiring excavation, soil management and disposal under a Remedial Action Work Plan, Soil / Materials Management Plan, Construction Health and Safety Plan and Community Air Monitoring Plan
Client: The Arker Companies
Regulatory Authority: NYSDEC
Role: Mr. Czemerinski served as the Remedial Engineer for the project.

Ezgi Karayel

Principal

Contact

347.871.0750
ezgi@vektorconsultants.com

Ezgi Karayel is an environmental engineer with extensive experience in brownfield redevelopment. She is the founder and Principal of Vektor Consultants and serves as Operations Officer of the firm. Ms. Karayel guides firm's clients through their due diligence processes. She manages all aspects of the firm strongly focusing on brownfield redevelopment and E-Designation projects across New York Metropolitan area. She has worked with major real estate developers and shareholders by developing strategic approaches to the environmental challenges of complex real estate transactions and brownfield redevelopment. Her experience also includes a broad range of environmental services including regulatory compliance, due diligence assessments, acquisition support, design and implementation of engineering controls and remediation systems, excavation support and soil disposal plans, and facility decommissioning.

She is the chair of the Partnership's Scholarship Program and works closely with committee members to support the education and training of students who are pursuing environmental careers.

Education

B.S. Environmental Engineering
University at Buffalo

Professional Registration

OSHA 10-hour Construction and 40-hour General Industry
OSHA 40-hour HAZWOPER and 8-hour HAZWOPER Refresher
Certified Environmental Manager and Certified Environmental Inspector

Affiliations

New York City Brownfield Partnership, President

Brownfield Coalition of the Northeast, Advisory Board Member

Select Projects

Linden Boulevard, Queens, New York – Site Investigation and Remediation of a 7-acre former landfill with a Restrictive Declaration. The scope of work for the project included preparation of a Remedial Investigation Work Plan for review and approval by the NYCOER, NYSDEC and NYCDOH, implementation of Remedial Investigation, preparation of Remedial Investigation Report, Remedial Action Work Plan, preparation and implementation of a waste characterization plan for soils for proper disposal, supervision of site remediation activities, coordination with remediation engineer to design a methane mitigation system as well as vapor barrier system and managing field staff during remediation.

Ezgi Karayel, Principal

Former Tunnel Diner, Jersey City, New Jersey – Remedial Investigation (RI) of a 1⁄2-acre property in accordance with the New Jersey Technical Requirements for Site Remediation. Ms. Karayel worked closely with the Licensed Site Remediation Professional (LSRP) of the project. Followed by the approval of the RAWP prepared by her, Ms. Karayel directed remediation activities at the site and managed field staff on a daily basis. Upon completion of remediation, she has prepared Remedial Action Outcome for review and certification of the LSRP.

249 North 7th Street, Brooklyn, New York – As a Project Director for a Remedial Investigation of a former auto repair shop with an active spill, Ms. Karayel was responsible for remediation of the property under the direct supervision of NYCOER and NYSDEC. Her responsibilities consisted of preparing the required reports and supervision of remediation including excavation, and installation of engineering controls. By successful coordination with NYCOER, she has managed to enroll the project in City's Clean Soil Bank program and saving the client over $160,000 for soil disposal.

9029 Flatlands Avenue, Brooklyn, New York – E-Designation for HazMat. She conducted a Phase I ESA prior to development, followed by remedial investigation and preparation of Remedial Investigation Report and Remedial Action Work Plan for the remediation. Remediation for the project included design and implementation of an active sub-slab depressurization system. For the engineering controls design and implementation, Ms. Karayel worked closely with the Professional Engineer for the project and performed all required pilot tests, initial start-up and inspections.

37-23 33rd Street, Queens, New York – Removal of "P" Designation. Ms. Karayel managed to prevent the property from becoming a Class II site by performing a thorough due-diligence and disproving the prior consultant's findings and recommendations. Furthermore, her due-diligence study and evaluation saved the client over $1,000,000 clean-up costs, regulatory and legal fees.

261 Grand Concourse, Bronx, New York – Brownfield Redevelopment
1-9 Wythe Avenue, Brooklyn, New York – Brownfield Redevelopment
42 Reeve Place, Brooklyn, New York – Spill Closure
21-01 21st Street, Queens, New York – Former Gasoline Station Decommissioning and Storage Tank Removal
260-262 Van Brunt Street, Brooklyn, New York – Brownfield Cleanup
299 East 161st Street, Bronx, New York – Voluntary Cleanup Program
122 East 32nd Street, New York, New York – Community Center, Remediation under Voluntary Cleanup Program
346 Metropolitan Avenue, Brooklyn, New York – Voluntary Cleanup Program
574 Broome Street, New York, New York – Voluntary Cleanup Program
173-175 McGuinness Boulevard, Brooklyn, New York – Voluntary Cleanup Program
4790 Broadway, New York, New York – Voluntary Cleanup Program

David B. Klein

Project Manager

Contact

347.871.0750
dklein@vektorconsultants.com

David B. Klein is a project manager with Vektor Consultants. David authored Remedial Action Work Plans, Remedial Investigation Reports, Remedial Action Reports, Final Engineering Reports, Noise Sampling Reports, Soil Vapor/Air Sampling Work Plans, Construction Health and Safety Plans, Interim Remedial Measures Summary Reports, Brownfield Cleanup Program Applications, Volunteer Cleanup Program Applications, Disposal Facility Applications, Underground Storage Tank Closure Reports, Phase I and Phase II Environmental Site Assessment Reports. David manages construction activities, drilling teams, excavations, tank removals, and waste disposals at multiple sites concurrently.

Education

B.S. Environmental Science &
Minor in Geology
University at Albany

Professional Registration

OSHA 10-hour Construction
OSHA 40-hour HAZWOPER and 8-hour HAZWOPER Refresher
10-Hour Site Safety Training
SWPPP Certification

Affiliations

New York City Brownfield Partnership

Select Projects

Far Rockaway Project Phases I, II, III, IV, and V, Queens, New York
Responsible for oversight and preparation of the Remedial Action Work Plan, Remedial Action Report, Final Engineering Report, Interim Remedial Measures Summary Report, NYSDEC Letter reports, and daily reports. Managed construction, drilling, excavation, waste disposal oversight of multiple phases concurrently.

Cropsey Avenue LLC, Brooklyn, New York
Authored Indoor Air Sampling Work Plan, Construction Health and Safety Plan, Interim Remedial Measures Summary Report and managed pilot tests for sub-slab depressurization system design and provided oversight during the installation of the engineering controls.

1815 West Farms Road, Bronx, New York – Voluntary Cleanup Program
315 Grand Concourse, Bronx, New York – Brownfield Redevelopment
261 Grand Concourse, Bronx, New York – Brownfield Redevelopment
960 Franklin Avenue, Brooklyn, New York – Brownfield Redevelopment

Izzy Hettleman

Environmental Scientist

Contact

410.428.2370
ihettleman@vektorconsultants.com

Izzy Hettleman is an Environmental Scientist with Vektor Consultants. Izzy authored Remedial Action Work Plans, Remedial Investigation Reports, Remedial Action Reports, Final Engineering Reports, Noise Sampling Reports, Soil Vapor/Air Sampling Work Plans, Brownfield Cleanup Program Applications, Underground Storage Tank Closure Reports, Phase I and Phase II Environmental Site Assessment Reports. His experience and education with sampling processes, environmental analysis, and environmental conservation provides knowledge and insight for navigating projects through different regulatory programs.

Education

B.A. Environmental Analysis
Focus in Natural Science
Washington University in St. Louis

Professional Registration

OSHA 30-hour Construction
OSHA 40-hour HAZWOPER and 8-hour HAZWOPER Refresher
10-Hour Site Safety Training

Select Projects

Consumers Park Brewery Site, Brooklyn, New York

Responsible for oversight and execution of the remedial action including excavation, installation of engineering controls, waste characterization, and reporting. Authored sampling plans, underground storage tank closure reports, and soil disposal and import requests.

CSB Forbell Stockpile – Clean Soil Bank

Responsible for day-to-day oversight of operations at the NYC OER lead CSB Forbell Clean Soil Bank, including management of all imports and exports, record-keeping, and soil testing.

Other Projects:
2892 Nostrand Avenue, Brooklyn, New York
Remedial Action Report, Installation Report
918 Atlantic Avenue, Brooklyn, New York
Remedial Action Plan (Noise and Air Quality), Remedial Investigation
54-11 Queens Boulevard, Queens, New York
Remedial Action Work Plan, Phase II Investigation

Ben Neumann

Assistant Project Manager

Contact

347.871.0750
bneumann@vektorconsultants.com

Ben Neumann is an Assistant Project Manager with Vektor Consultants. He is responsible for conducting and overseeing field investigations and site assessments. In addition, Ben authors Phase I and Phase II Environmental Site Assessments, Remedial Investigation Workplans, Remedial Investigation Reports, Remedial Action Workplans, Remedial Action Reports, and Installation Reports. His responsibilities include providing environmental oversight at construction project sites in the New York City Metropolitan area, performing site visits, conducting subsurface investigations and waste characterization sampling. Ben's experience and education in environmental remediation and project management provides valuable knowledge and insight for navigating projects through different regulatory programs.

Education

B.S. Environmental Science
Environmental Engineering & Technology Focus
Union College, Schenectady, NY

Professional Registration

Project Management Professional (PMP)

OSHA 30-hour Construction

OSHA 40-hour HAZWOPER

10-Hour Site Safety Training (SST)

Affiliations

The New York City Brownfield Partnership

Select Projects & Prior Experience

1533-1541 60th Street – Voluntary Cleanup Program
1547-1555 60th Street – Voluntary Cleanup Program
601 Union Street – Brownfield Cleanup Program

Prior to joining Vektor, Ben assisted Licensed Site Remediation Professionals (LSRPs) and carried out project management duties on over 100 projects within the New Jersey Department of Environmental Protection's (NJDEP) Site Remediation Program (SRP). Ben performed and oversaw Site Investigation, Remedial Investigation, and Remedial Action activities to achieve site remediation goals and obtain project closure via the issuance of Response Action Outcome (RAO) and No Further Action (NFA) Letters.

DONALD C. ANNÉ
SENIOR CHEMIST

EDUCATION:	M.S., Chemical Oceanography, Florida Institute of Technology, 1981 B.A., Earth Sciences, Millersville University of Pennsylvania, 1975
SPECIAL TRAINING:	Certified 40-Hour OSHA Health and Safety Certified 8-Hour OSHA Supervisory Course Ground Water Geochemistry (NWWA) Ground Water Pollution and Hydrology (Princeton Associates) Quality Assurance Programs for Environmental Monitoring Data (Stat-A-Matrix)
PROFESSIONAL AFFILIATIONS:	American Chemical Society (AFS), 1979-Present

EXPERIENCE SUMMARY:

Mr. Anné has more than 39 years of environmental chemistry experience specializing in data validation, environmental sampling, analytical methodologies, petroleum fingerprinting, laboratory audits, field sampling audits, and preparing Quality Assurance Project Plans and Quality Assurance Manuals. Mr. Anné's experience includes analytical laboratory work with gas chromatography, atomic absorption, infrared spectrometry and wet chemistry methods.

PROJECT EXPERIENCE:

Quality Assurance/Quality Control of Chemical Data- Data Validation

Mr. Anné has more than 23 years experience as a data validator and quality assurance officer. Mr. Anné has validated data for most EPA Regions and under several independent state programs, including the NYSDEC. He has performed laboratory and field audits as well as written Quality Assurance Project Plans. Mr. Anné has written, reviewed, and initiated laboratory Quality Assurance Manuals for laboratories to maintain their regulatory compliance. Typical project experience includes:

- Senior Chemist responsible for data validation. Reviewed chemical data for numerous projects under the New Jersey ISRA regulations. Data validation typically is performed as a third-party validator under subcontract to consultants for private industry and utility companies.

- Supervising Environmental Scientist responsible for data validation. Reviewed chemical laboratory data for adherence to QA/QC protocols for several key projects, including National Priorities List sites and RCRA Corrective Actions located in EPA Regions I, II, III, IV, V, and IX. Validated analytical data, outlined problems and actions to be taken, and qualified all affected data. Consulted with project managers on data usability, and recommended corrective actions to support project goals. Responded to comments made by regulators regarding data quality.

- Supervising Environmental Scientist recognized by the New York State Department of Environmental Conservation (NYSDEC) to perform third party data validation. Attended NYSDEC workshop on data validation as part of the requirements set forth by NYSDEC. Performed data validation in support of NYSDEC ASP programs as well as data in support of the NYSDEC Part 360 Regulations for landfills. Validated data for an Albany area municipal landfill.

- Supervising Environmental Scientist responsible for developing and preparing Quality Assurance Project Plans (QAPPs) for several state and federal Superfund sites and federal RCRA corrective action sites. Negotiated with regulators for the acceptance of the QAPPs. The sites were located throughout the eastern United States.

- Environmental Chemist responsible for developing a laboratory QA/QC program which fulfilled requirements of the EPA and agencies from the States of Texas and Louisiana. Implemented and managed the program throughout DOE's SPR Environmental laboratories. Received verbal commendations from EPA and the Texas Water commission on the QA/QC Program.

Related Chemistry Experience:

Mr. Anné is experienced in sampling soil, water, air, and wastes in accordance with federal and state guidelines. He has performed field sampling audits and prepared sampling plans for numerous projects in accordance with applicable programmatic requirements. Mr. Anné is familiar with the geochemical aspects of fate and transport of contaminants.

Mr. Anné also has experience working in both fixed-base and mobile laboratories. His experience includes the use of gas chromatography, atomic absorption spectrometers, infrared spectrometers, and numerous wet chemistry and preparation equipment methods. He has served in the laboratory as an analyst, laboratory advisor, and QA officer. He has interfaced with regulators in the area of analytical chemistry and has experience in petroleum fingerprinting techniques and methods.

EMPLOYMENT:

2005- present, Alpha Geoscience
1998-2005, Alpha Environmental Consultants, Inc.
1990-1998, McLaren/Hart
1986-1990, Fred C. Hart Associates
1985-1986, Boeing Petroleum Services
1982-1985, Petroleum Operations and Support Services
1981-1982, Dravo Utility Constructors
1979-1981, Florida Institute of Technology
1975-1979, Berkley Products Company

Z:\ALPHA\RESUMES\DCA\DCA- ABBREV. DATA VAL.DOC

APPENDIX H

IMPORT REQUEST FORM

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Request to Import/Reuse Fill or Soil

This form is based on the information required by DER-10, Section 5.4(e) and 6NYCRR Part 360.13. Use of this form is not a substitute for reading the applicable regulations and Technical Guidance document.

SECTION 1 – SITE BACKGROUND

The allowable site use is: Choose an item

Have Ecological Resources been identified? Choose an item

Is this soil originating from the site? Choose an item

How many cubic yards of soil will be imported/reused? Choose an item

If greater than 1000 cubic yards will be imported, enter volume to be imported:

SECTION 2 – MATERIAL OTHER THAN SOIL

Is the material to be imported gravel, rock or stone? Choose an item

Does it contain less than 10%, by weight, material that passes a size 100 sieve? Choose an item

Is this virgin material from a permitted mine or quarry? Choose an item

Is this material recycled concrete or brick from a DEC registered processing facility? Choose an item

SECTION 3 - SAMPLING

Provide a brief description of the number and type of samples collected in the space below:

Example Text: 5 discrete samples were collected and analyzed for VOCs. 2 composite samples were collected and analyzed for SVOCs, Inorganics & PCBs/Pesticides.

If the material meets requirements of DER-10 section 5.4(e)5 (other material), no chemical testing needed.

SECTION 3 CONT'D - SAMPLING

Provide a brief written summary of the sampling results or attach evaluation tables (compare to DER-10, Appendix 5):

Example Text: Arsenic was detected up to 17 ppm in 1 (of 5) samples; the allowable level is 16 ppm.

If Ecological Resources have been identified use the "If Ecological Resources are Present" column in Appendix 5.

SECTION 4 – SOURCE OF FILL

Name of person providing fill and relationship to the source:

Location where fill was obtained:

Identification of any state or local approvals as a fill source:

If no approvals are available, provide a brief history of the use of the property that is the fill source:

Provide a list of supporting documentation included with this request:

The information provided on this form is accurate and complete.

______________________________ ______________
Signature Date

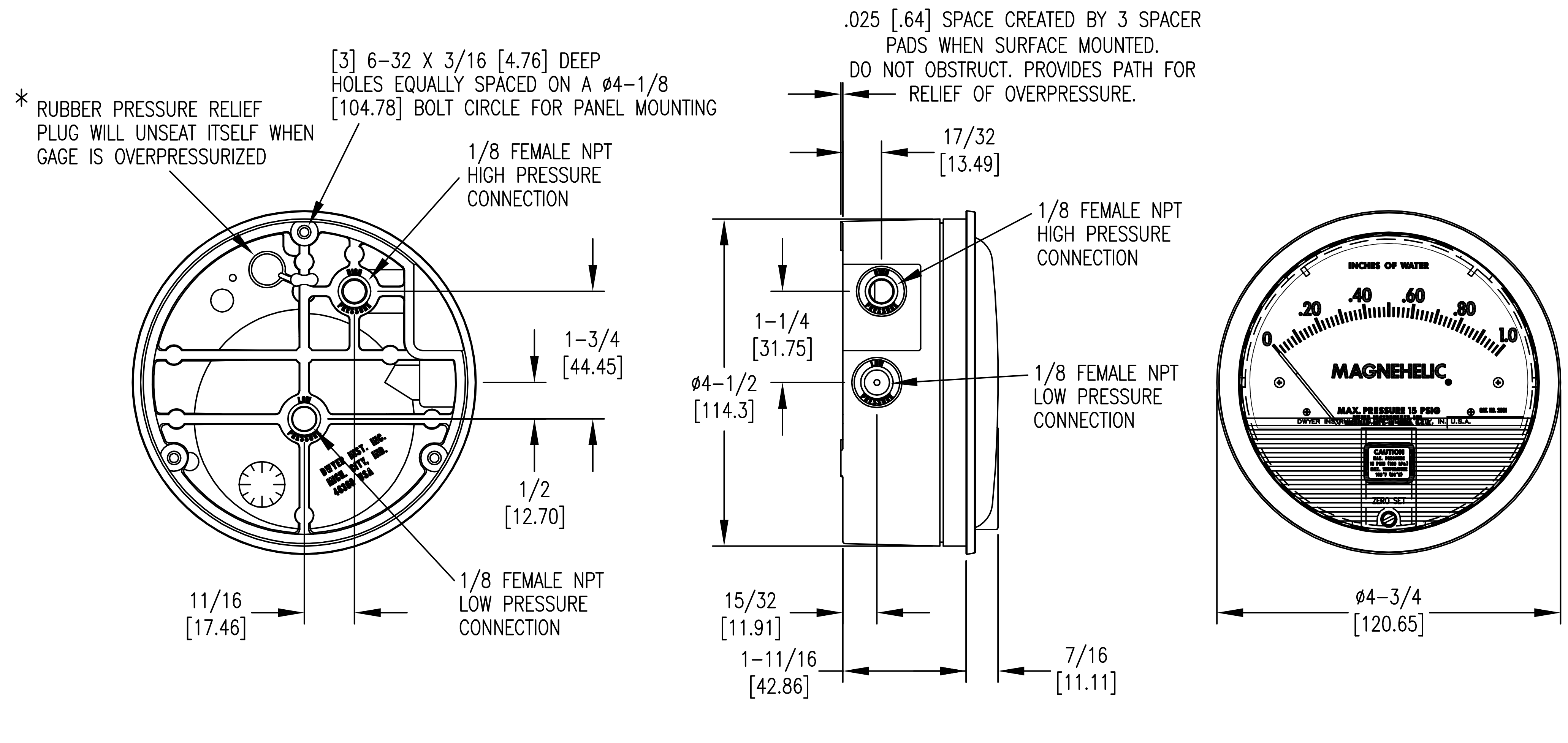
____
Print Name

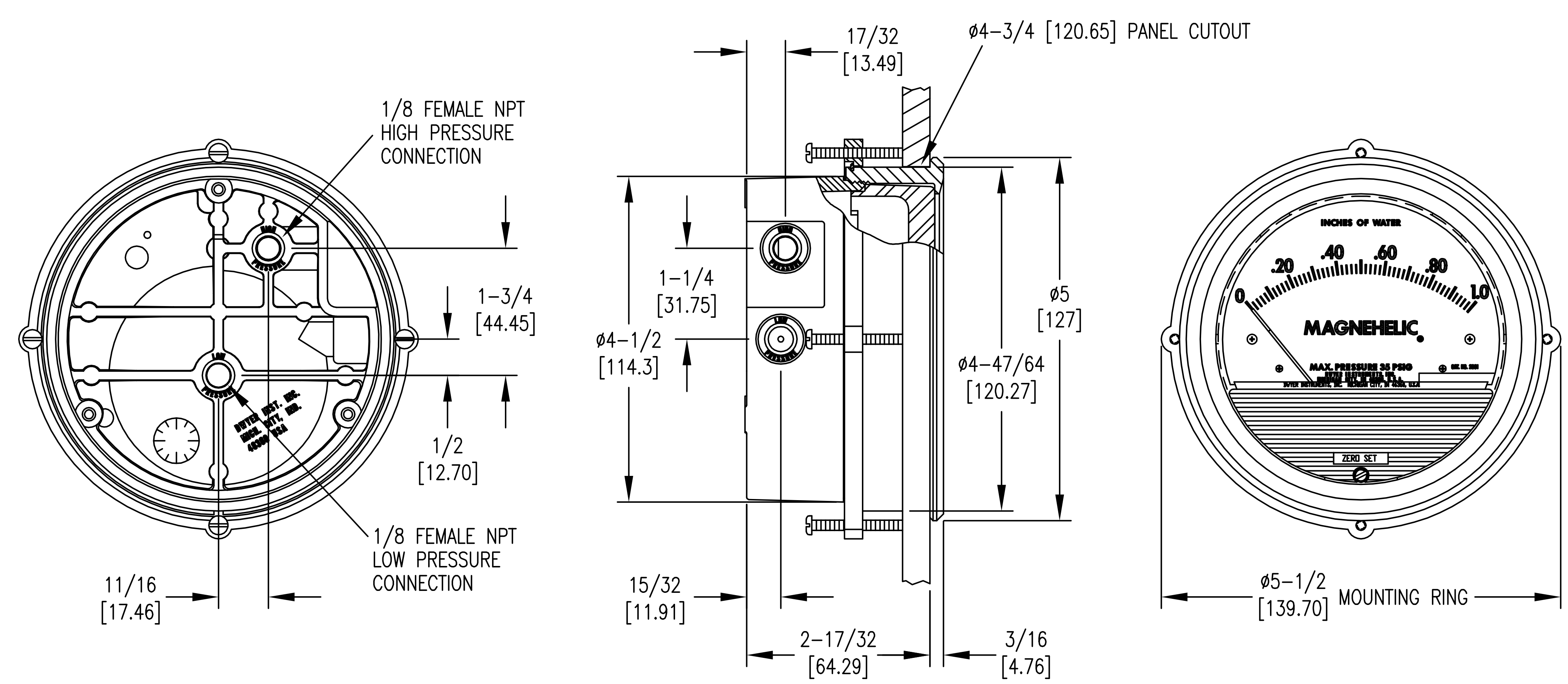
____
Firm

APPENDIX I

SUBSLAB DEPRESSURIZATION SYSTEM SPECIFICATIONS

12-700060-05





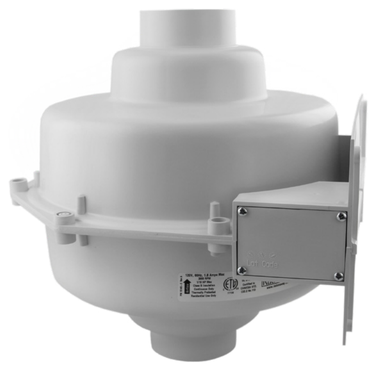
CD = CRITICAL DIMENSION
STANDARD TOLERANCES UNLESS NOTED:
ALL DECIMAL DIMENSIONS ± .005
ALL ANGLES ± 1°

SCALE 1:2

NO.	CHANGES	BY/DATE	DATE / DWN BY / CHKD / APPD	NAME	MATERIAL / FINISH
			DATE	2000 MAGNEHELIC ARTWORK (FOR REFERENCE ONLY)	MATERIAL
			DWN BY		FINISH
			CHKD		DWYER INSTRUMENTS, INC. MICHIGAN CITY, INDIANA 46360 U.S.A.
			APPD	ACAD2002	

3 FR. NO. 12-700060-05

The world's leading radon fan manufacturer



RP, GP, XP Pro Series Installation Instructions

DO NOT CONNECT POWER SUPPLY UNTIL FAN IS COMPLETELY INSTALLED. MAKE SURE ELECTRICAL SERVICE TO FAN IS LOCKED IN "OFF" POSITION. DISCONNECT POWER BEFORE SERVICING FAN.

1. **WARNING!** For General Ventilating Use Only. Do Not Use to Exhaust Hazardous, Corrosive or Explosive Materials, Gases or Vapors. See Vapor Intrusion Application Note #AN001 for important information on VI Applications. RadonAway.com/vapor-intrusion

2. **NOTE:** Fan is suitable for use with solid state speed controls; however, use of speed controls is not generally recommended.

2. **WARNING!** Check voltage at the fan to insure it corresponds with nameplate.

3. **WARNING!** Normal operation of this device may affect the combustion airflow needed for safe operation of fuel burning equipment. Check for possible backdraft conditions on all combustion devices after installation.

4. **NOTICE!** There are no user serviceable parts located inside the fan unit.
   Do NOT attempt to open. Return unit to the factory. (See Warranty, p. 8, for details.)

5. **WARNING!** Do not leave fan unit installed on system piping without electrical power for more than 48 hours. Fan failure could result from this non-operational storage.

6. **WARNING!** TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING:

   a) Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer. (See p. 8.)

   b) Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.

   c) Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire rated construction.

   d) Sufficient air is needed for proper combustion and exhausting of gases through the flue (chimney) of fuel burning equipment to prevent backdrafting. Follow the heating equipment manufacturers' guidelines and safety standards such as those published by any National Fire Protection Association, and the American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), and the local code authorities.

   e) When cutting or drilling into a wall or ceiling, do not damage electrical wiring and other hidden utilities.

   f) Ducted fans must always be vented to outdoors.

   g) If this unit is to be installed over a tub or shower, it must be marked as appropriate for the application and be connected to a GFCI (Ground Fault Circuit Interrupter) protected branch circuit.

RP Series	GP Series	XP Series
RP140 | P/N 28460	GP201 | P/N 28465	XP151 | P/N 28469
RP145 | P/N 28461	GP301 | P/N 28466	XP201 | P/N 28470
RP260 | P/N 28462	GP401 | P/N 28467	
RP265 | P/N 28463	GP501 | P/N 28468	
RP380 | P/N 28464		

1.0 SYSTEM DESIGN CONSIDERATIONS

1.1 INTRODUCTION
The RP, GP and XP Series Radon Fans are intended for use by trained, professional, certified/licensed radon mitigators. The purpose of these instructions is to provide additional guidance for the most effective use of RP, GP and XP Series Fans. These instructions should be considered supplemental to EPA/radon industry standard practices, state and local building codes and regulations. In the event of a conflict, those codes, practices and regulations take precedence over these instructions.

1.2 FAN SEALING
The RP, GP and XP Series Fans are factory sealed; no additional caulk or other materials are required to inhibit air leakage.

1.3 ENVIRONMENTALS
The RP, GP and XP Series Fans are designed to perform year-round in all but the harshest climates without additional concern for temperature or weather. For installations in an area of severe cold weather, please contact RadonAway for assistance. When not in operation, the fan should be stored in an area where the temperature is never less than 32 degrees F or more than 100 degrees F.

1.4 ACOUSTICS
The RP, GP and XP Series Fans, when installed properly, operate with little or no noticeable noise to the building occupants. The velocity of the outgoing air should be considered in the overall system design. In some cases the "rushing" sound of the outlet air may be disturbing. In these instances, the use of a RadonAway Exhaust Muffler is recommended.

(To ensure quiet operation of inline and remote fans, each fan shall be installed using sound attenuation techniques appropriate for the installation. For bathroom and general ventilation applications, at least 8 feet of insulated flexible duct shall be installed between the exhaust or supply grille(s) and the fan(s). RP, GP and XP Series Fans are not suitable for kitchen range hood remote ventilation applications.)

1.5 GROUND WATER
In the event that a temporary high water table results in water at or above slab level, water may be drawn into the riser pipes, thus blocking air flow to the RP, GP and XP Series Fan. The lack of cooling air may result in the fan cycling on and off as the internal temperature rises above the thermal cutoff. Should this condition arise, it is recommended that the fan be turned off until the water recedes, allowing for return to normal operation.

1.6 SLAB COVERAGE
The RP, GP and XP Series Fans can provide coverage up to 2000+ sq. ft. per slab penetration. This will primarily depend on the sub-slab material in any particular installation. In general, the tighter the material, the smaller the area covered per penetration. Appropriate selection of the RP, GP and XP Series Fan best suited for the sub-slab material can improve the slab coverage. The RP, GP and XP Series have a wide range of models to choose from to cover a wide range of sub-slab materials. The RP140 and 145 are best suited for general purpose use. The RP 260 can be used where additional airflow is required, and the RP265 and RP 380 are best suited for large slab, high airflow applications. Additional suction points can be added as required. It is recommended that a small pit (5 to 10 gallons in size) be created below the slab at each suction hole.

1.7 CONDENSATION & DRAINAGE

Condensation is formed in the piping of a mitigation system when the air in the piping is chilled below its dew point. This can occur at points where the system piping goes through unheated space such as an attic, garage or outside. The system design must provide a means for water to drain back to a slab hole to remove the condensation. The RP, GP and XP Series Fan MUST be mounted vertically plumb and level, with the outlet pointing up for proper drainage through the fan. Avoid mounting the fan in any orientation that will allow water to accumulate inside the fan housing. The RP, GP and XP Series Fans are NOT suitable for underground burial.

For RP, GP and XP Series Fan piping, the following table provides the minimum recommended pipe diameter and pitch under several system conditions.

Pipe Diameter	Minimum Rise per Ft of Run*		
	@25 CFM	@50 CFM	@100 CFM
4”	1/8”	1/4”	3/8”
3”	1/4”	3/8”	1 1/2”

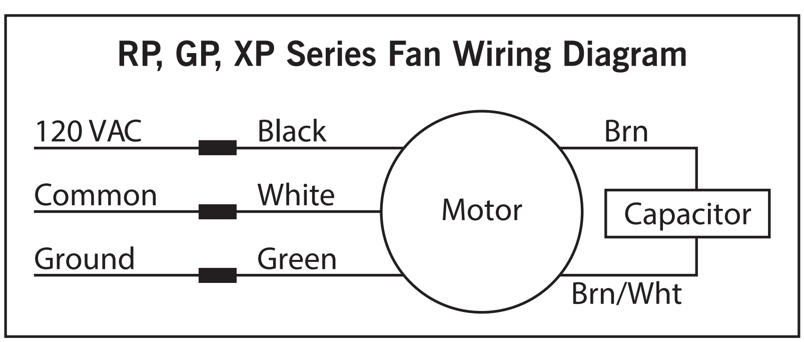
See p. 7 for detailed specifications.

1.8 SYSTEM MONITOR & LABEL

A System Monitor, such as a manometer (P/N 50017) or audible alarm (P/N 28001-2, 28001-4 or 28421), is required to notify the occupants of a fan system malfunction. A System Label (provided with Manometer P/N 50017) with instructions for contacting the installing contractor for service and identifying the necessity for regular radon tests to be conducted by the building occupants must be conspicuously placed in a location where the occupants frequent and can see the label.

1.9 ELECTRICAL WIRING

The RP, GP and XP Series Fans operate on standard 120V, 60Hz AC. All wiring must be performed in accordance with National Fire Protection (NFPA) National Electrical Code, Standard #70, current edition, for all commercial and industrial work, and state and local building codes. All wiring must be performed by a qualified and licensed electrician. Outdoor installations require the use of a UL Listed watertight conduit. Ensure that all exterior electrical boxes are outdoor rated and properly sealed to prevent water penetration into the box. A means, such as a weep hole, is recommended to drain the box.

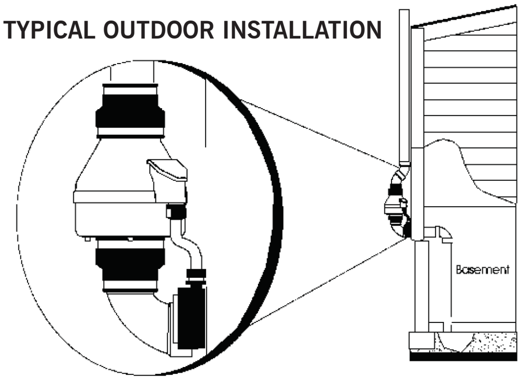


1.10 SPEED CONTROLS

The RP, GP and XP Series Fans are rated for use with electronic speed controls; however, speed controls are generally not recommended. If used, the recommended speed control is Pass & Seymour Solid State Speed Control (Cat. No. 94601-1).

2.0 INSTALLATION

TYPICAL OUTDOOR INSTALLATION

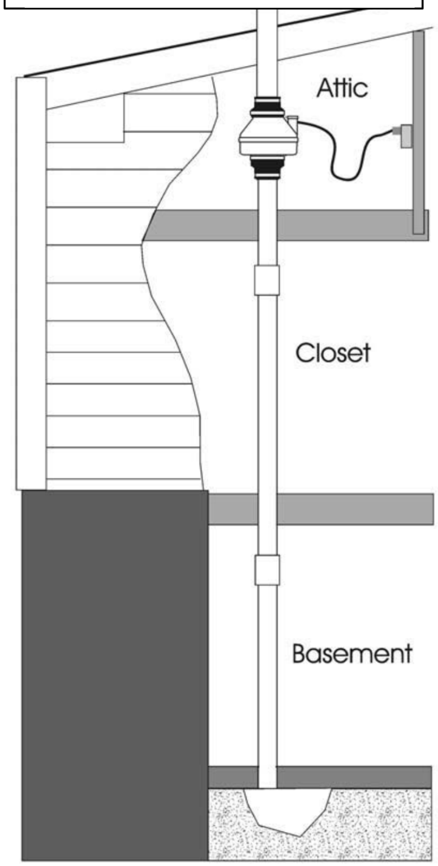


The RP, GP and XP Series Fans can be mounted indoors or outdoors. (It is suggested that EPA and radon mitigation standards recommendations be followed in choosing the fan location.) The GP fans have an integrated mounting bracket; RP and XP Series Fans may be mounted directly on the system piping or fastened to a supporting structure by means of an optional mounting bracket.
The ducting from the fan to the outside of the building has a strong effect on noise and fan energy use. Use the shortest, straightest duct routing possible for best performance, and avoid installing the fan with smaller ducts than recommended. Insulation around the ducts can reduce energy loss and inhibit mold growth. Fans installed with existing ducts may not achieve their rated airflow.

2.1 MOUNTING

Mount the RP, GP and XP Series Fan vertically with outlet up. Insure the unit is plumb and level. When mounting directly on the system piping assure that the fan does not contact any building surface to avoid vibration noise.

TYPICAL INDOOR INSTALLATION



2.2 MOUNTING BRACKET (optional)

The RP and XP Series Fans may be optionally secured with the RadonAway P/N 25007 mounting bracket. Foam or rubber grommets may also be used between the bracket and mounting surface for vibration isolation.

2.3 SYSTEM PIPING

Complete piping run, using flexible couplings as a means of disconnect for servicing the unit and for vibration isolation. As the fan is typically outside of the building thermal boundary and is venting to the outside, installation of insulation around the fan is not required.

2.4 ELECTRICAL CONNECTION

Connect wiring with wire nuts provided, observing proper connections (See Section 1.9). Note that the fan is not intended for connection to rigid metal conduit.

2.5 VENT MUFFLER (optional)

Install the muffler assembly in the selected location in the outlet ducting. Solvent weld all connections. The muffler is normally installed at the end of the vent pipe.

2.6 OPERATION CHECKS & ANNUAL SYSTEM MAINTENANCE

______ **Verify** all connections are tight and **leak-free**.

______ **Ensure** the RP, GP and XP Series Fan and all ducting are **secure and vibration-free**.

______ **Verify system vacuum pressure** with manometer. **Insure** vacuum pressure is within normal operating range and **less than** the maximum recommended operating pressure.
(Based on sea-level operation, at higher altitudes reduce by about 4% per 1000 feet)
(Further reduce Maximum Operating Pressure by 10% for High Temperature environments.)
See Product Specifications. If this is exceeded, increase the number of suction points.

______ **Verify Radon levels** by testing to EPA Protocol and applicable testing standards.

THE FOLLOWING CHARTS SHOW THE PERFORMANCE OF THE RP, GP and XP SERIES FANS

RP Series Product Specifications

Typical CFM Vs. Static Pressure "WC									
Model	0"	.25"	.5"	.75"	1.0"	1.25"	1.5"	1.75"	2.0"
RP140	135	103	70	14	-	-	-	-	
RP145	166	146	126	104	82	61	41	21	3
RP260	251	209	157	117	70	26	-	-	-
RP265	375	330	282	238	204	170	140	108	70
RP380	531	490	415	340	268	200	139	84	41

Model	Power Consumption 120VAC, 60Hz, 1.5 Amp Maximum	Maximum Recommended Operation Pressure* (Sea Level Operation)**
RP140	15 - 21 watts	0.7" WC
RP145	41 - 72 watts	1.7" WC
RP260	47-65 watts	1.3" WC
RP265	95 - 139 watts	2.3" WC
RP380	96 - 138 watts	2.0" WC

**Reduce by 10% for High Temperature Operation **Reduce by 4% per 1000 ft. of altitude.*

Model	Size	Weight	Inlet/Outlet	L.2
RP140	8.5"H x 9.7" Dia.	5.5 lbs	4.5"OD (4.0" PVC Sched 40 size compatible)	25
RP145	8.5"H x 9.7" Dia.	5.5 lbs	4,5" OD	15
RP260	8.6"H x 11.75" Dia.	5.5 lbs	6.0" OD	48
RP265	8.6"H x 11.75" Dia.	6.5 lbs	6.0" OD	30
RP380	10.53"H x 13.41" Dia.	11.5 lbs	8.0" OD	57

L.2 = Estimated Equivalent Length of Rigid Metal Ducting resulting in .2" WC pressure loss for Duct Size listed. Longer Equivalent Lengths can be accommodated at Flows Lower than that at .2" WC pressure loss (see CFM Vs Static Pressure "WC Table).

XP Series Product Specifications

Typical CFM Vs. Static Pressure "WC						
	0"	.5"	1.0"	1.5"	1.75"	2.0"
XP151	150	115	69	-	-	-
XP201	112	95	70	40	-	-

Model	Power Consumption 120VAC, 60Hz, 1.5 Amp Maximum	Maximum Recommended Operation Pressure* (Sea Level Operation)**
XP151	45 - 60 watts	1.3" WC
XP201	45 - 66 watts	1.7" WC

**Reduce by 10% for High Temperature Operation **Reduce by 4% per 1000 ft. of altitude.*

Model	Size	Weight	Inlet/Outlet
XP151	9.5"H x 8.5" Dia.	6 lbs	4.5"OD (4.0" PVC Sched 40 size compatible)
XP201	9.5"H x 8.5" Dia.	6 lbs	4.5" OD

GP Series Product Specifications

	Typical CFM Vs. Static Pressure "WC						
	1.0"	1.5"	2.0"	2.5"	3.0"	3.5"	4.0"
GP201	54	42	11	-	-	-	-
GP301	64	54	41	4	-	-	-
GP401	-	61	52	44	22	-	-
GP501	-	-	66	58	50	27	4

Model	Power Consumption 120VAC, 60Hz, 1.5 Amp Maximum	Maximum Recommended Operation Pressure* (Sea Level Operation)**
GP201	31-65 watts	1.8" WC
GP301	56-100 watts	2.3" WC
GP401	62-128 watts	3.0" WC
GP501	68 - 146 watts	3.8" WC

**Reduce by 10% for High Temperature Operation **Reduce by 4% per 1000 ft. of altitude.*

Model	Size	Weight	Inlet/Outlet
GP201	13"H x 12.5" Dia.	12 lbs	3.5"OD (3.0" PVC Sched 40 size compatible)
GP301	13"H x 12.5" Dia.	12 lbs	3.5" OD
GP401	13"H x 12.5" Dia.	12 lbs	3.5" OD
GP501	13"H x 12.5" Dia.	12 lbs	3.5" OD

RP, XP and GP Series Additional Specifications

Model	Recommended Duct	PVC Pipe Mounting	Thermal Cutout	Insulation Class
RP140	3" or 4" Schedule 20/40 PVC	Mount on the duct pipe or with optional mounting bracket. For Ventilation: 4", 6" or 8" Rigid or Flexible Ducting.	130ºC/266ºF	Class B Insulation
RP145			130ºC/266ºF	Class F Insulation
RP260			150ºC/302ºF	
RP265			150ºC/302ºF	
RP380	6" Schedule 20/40 PVC Pipe		150ºC/302ºF	
XP151	3" or 4" Schedule 20/40 PVC	Fan may be mounted on the duct pipe or with integral flanges.	120ºC/248ºF	Class B Insulation
XP201				
GP201	3" or 4" Schedule 20/40 PVC	Fan may be mounted on the duct pipe or with integral flanges.	120ºC/248ºF	Class B Insulation
GP301				
GP401				
GP501				

Continuous Duty
3000 RPM
Thermally Protected
RP, GP Residential and Commercial
XP Residential Only
Rated for Indoor or Outdoor Use

LISTED
Electric Fan

C US
Intertek
77728

Conforms to
UL STD. 507
Certified to
CAN/CSA STD.
C22.2 No.113

IMPORTANT INSTRUCTIONS TO INSTALLER

Inspect the RadonAway® RP, GP and XP Series Fan for shipping damage within 15 days of receipt. **Notify RadonAway of any damages immediately.** RadonAway is not responsible for damages incurred during shipping. However, for your benefit, RadonAway does insure shipments.

There are no user serviceable parts inside the fan. **Do not attempt to open the housing.** Return unit to factory. (See Warranty below).

Install the RP, GP and XP Series Fan in accordance with all EPA, ANSI/AARST standard practices, and state and local building codes and regulations.

Provide a copy of this instruction or comparable radon system and testing information to the building occupants after completing system installation.

Warranty

RadonAway® warrants that the RP, GP (excluding GP500) and XP Series Fan (the "Fan") will be free from defects in materials and workmanship for a period of 12 months from the date of purchase or 18 months from the date of manufacture, whichever is sooner (the "Warranty Term").

RadonAway® will replace any fan which fails due to defects in materials or workmanship during the Warranty Term. This Warranty is contingent on installation of the Fan in accordance with the instructions provided. This Warranty does not apply where any repairs or alterations have been made or attempted by others, or if the unit has been abused or misused. Warranty does not cover damage in shipment unless the damage is due to the negligence of RadonAway®.

The Fan must be returned (at Owner's cost) to the RadonAway® factory. Any Fan returned to the factory will be discarded unless the Owner provides specific instructions along with the Fan when it is returned regardless of whether or not the Fan is actually replaced under this warranty. Proof of purchase must be supplied upon request for service under this Warranty.

5-YEAR EXTENDED WARRANTY WITH PROFESSIONAL INSTALLATION.

RadonAway® will extend the Warranty Term of the fan to 60 months (5 years) from date of purchase or 66 months from date of manufacture, whichever is sooner, provided that the fan is installed by a professional radon mitigation contractor. Proof of purchase and/or proof of professional installation may be required for service under this warranty. No extended warranty is offered outside the Continental United States and Canada beyond the standard 12 months from the date of purchase or18 months from the date of manufacture, whichever is sooner.

RadonAway® is not responsible for installation, removal or delivery costs associated with this Warranty.

LIMITATION OF WARRANTY

EXCEPT AS STATED ABOVE, THE RP, GP (excluding GP500) and XP SERIES FANS ARE PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULARPURPOSE.

IN NO EVENT SHALL RADONAWAY BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR RELATING TO, THE FAN OR THE PERFORMANCE THEREOF. RADONAWAY'S AGGREGATE LIABILITY HEREUNDER SHALL NOT IN ANY EVENT EXCEED THE AMOUNT OF THE PURCHASE PRICE OF SAID PRODUCT. THE SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY SHALL BE THE REPAIR OR REPLACEMENT OF THE PRODUCT, TO THE EXTENT THE SAME DOES NOT MEET WITH RADONAWAY'S WARRANTY AS PROVIDED ABOVE.

For service under this Warranty, contact RadonAway for a Return Material Authorization (RMA) number and shipping information. No returns can be accepted without an RMA. If factory return is required, the customer assumes all shipping costs, including insurance, to and from factory.

RadonAway® 3 Saber Way
Ward Hill, MA 01835 USA TEL (978) 521-3703
FAX (978) 521-3964
Email to: Returns@RadonAway.com

Record the following information for your records:

Serial Number: ______________________________ Purchase Date: ________________

VaporPin®

Product Catalog 2018

ABOUT VAPOR PIN®

The Vapor Pin® a unique, patented, re-usable sampling device, has a variety of applications, including but not limited to: sub-slab soil-gas sampling, de-pressurization studies/ testing, stray gas evaluations, source area characterization, pilot testing and mitigation progress monitoring. The Vapor Pin® specifically, manufactured and marketed by Vapor Pin Enterprises, was designed to eliminate many of the problems associated with traditional sub-slab soil-gas sampling methods.

The patented design of the Vapor Pin® provides environmental professionals a means of collecting high-quality, low-cost soil-gas samples and pressure readings within minutes. Plus, the Vapor Pin® is made in the USA.

*Protected under US Patent # 8,220,347 B2, US 9,291,531 B2 and other US and International Patents pending.

THE VAPOR PIN® ADVANTAGE

- Reduces damage to the slab
- Improves diagnostic testing
- Improves spatial resolution
- Connects easily to sampling equipment
- Is easily installed, sampled, and retrieved for reuse
- Eliminates the need for grout, increasing productivity
- Reduces sampling time, allowing collection of more samples for less cost, and improves the understanding of site conditions
- Unique patented design reduces the potential for leaks and improves sample quality

VAPOR PIN® KITS

Vapor Pin® Kits are the all-in-one solution to your gas sampling needs.

The Standard Kits come in 3 varieties* and Include:

- 10 VAPOR PINS®
- 20 VAPOR PIN® Sleeves
- 20 VAPOR PIN® Caps
- 10 Plastic Flush Mount Covers
- 1 Installation/Extraction Tool
- 1 Bottle Brush
- 1 Water Dam for leak testing
- Vapor Pin® SOPs
- Hard-sided carrying Case

STANDARD KITS

* Brass, Stainless Steel, or FLX-VP Stainless Steel

CONTRACTOR KITS

* Brass, Stainless Steel, FLX-VP, or FLX-VP with Quick Connect

The Contractor Kits come in 4 varieties* and Include:

- 10 VAPOR PINS®
- 20 VAPOR PIN® Sleeves
- 20 VAPOR PIN® Caps
- 10 Stainless Steel Secure Covers
- 1 Spanner Screwdriver
- 1 Stainless Steel Drilling Guide
- 1 Installation/Extraction Tool
- 1 Bottle Brush
- 1 Water Dam for leak testing
- Vapor Pin® SOPs
- Hard-sided carrying Case

Single Point Installation

Not all Projects call for multiple installation points, sometimes you only need one. In this case the essentials will get the job done.

At a minimum you will need:

- 1 VAPOR PIN®
- 1 installation/ Extraction tool
- 1 Bag of sleeves
- 1 Bag of white protective caps

Additionally, if you want a finished look, or if you are in an area with some foot traffic, you may want the optional plastic or stainless steel secure covers. The Stainless Steel Drilling Guide and Stainless Steel Secure Covers are recommended for flush mount installations in high traffic areas.

Individual Products

When you need an "a la carte" product we've got you covered. Order individual parts and pieces for your projects as you see fit. Placing an order is easy. The website works like Amazon, place items in your cart and checkout online at https://www.vaporpin.com/. If you have any questions, please contact us at 614-504-6915.

FLX-VPSS

The FLX-VPSS provides additional connectivity for the collection of soil-gas samples and subslab pressure readings. In addition to the barbed fitting that comes with the FLX-VPSS, the FLX-VPSS allows you to connect to sampling equipment though the use of Swagelok® fittings or Quick Connects. With the FLX-VPSS you can directly connect to TO-17 tubes connected to a Swagelok® fitting or to Bottle-VacsTM equipped with Quick Connects. Available in stainless steel only.

Stainless Steel Vapor Pin®

The barb at the top of the Vapor Pin® connects to ¼-inch OD sample tubing (typically Nylon or Teflon®) with softer tubing, preferably Tygon®. Because stainless steel is more durable than brass and more corrosion resistant, we recommend stainless steel for long-term installations and in corrosive environments.

Brass Vapor Pin®

Brass Vapor Pins® are less durable than stainless steel, but they can be reused repeatedly with proper care. We recommend brass Vapor Pins® for short-term installations, especially those installed in the stick-up configuration.

Mini Pin

The Mini Pin is ideal for use in buildings with thin slabs (as thin as 2 inches). Additionally, the Mini Pin is installed in the flush-mount position after drilling only a 5/8-inch hole. Mini Pins are supplied with Secure Covers, which act as a seal. While Mini Pins are designed for permanent installation and cannot be removed and reused, they are constructed of anodized aluminum, making them very economical.

FLX-VPBarb

The FLX-VPSS comes with a removable ¼-inch barb fitting, but the barb can be replaced, should it become lost or damaged. Available in stainless steel only.

MQT-SVPS Quick Connect

The optional Quick Connect attaches to the top of the FLX-VPPS, and connects directly to some sample containers, including Entech's glass Bottle-Vacs™. Quick Connect fittings provide the fastest way to connect to sample containers or field instruments, and they minimize the loss of soil gas to indoor air. Available in stainless steel only. Contact your analytical lab to make sure they provide compatible connections between the pin and the container.

Swagelok® and Ferrules

The optional Swagelok® fitting replaces the barb on top of the FLX-VPSS, should you desire to connect ¼-inch OD nylon or Teflon® tubing directly to the Vapor Pin®. The Swagelok® fitting also connects directly to most TO-17 sorbent tubes. Dedicated Swagelok® ferrules (not shown) are used to make connections, and are discarded whenever sample tubing is replaced. These are the same ferrules used for connecting ¼-inch OD sample tubing to most Summa-type canisters. Available in stainless steel only.

Vapor Pin® Filters

Vapor Pin® Filters screw into the bottom of Vapor Pins® to prevent particulates from entering the sample train. Due to the process used to manufacture them, Vapor Pin® Filters are available in brass only.

Vapor Pin® Barb Extension

With the Vapor Pin® Barb Extension screwed into to the bottom of the Vapor Pin®, sample tubing can be attached to extend deeper beneath the slab. The Barb Extension is the same diameter as the barb on top of the Vapor Pin®, and it accepts the same tubing. A Vapor Pin® Filter or Vapor Pin® Sieve can be attached to the bottom of the nylon tubing with Tygon® to prevent clogging the opening with soil.

Vapor Pin® 1.5″ Extension

The Vapor Pin® 1.5″ Extension is an alternative to the Barb Extension, and is screwed into the bottom of the Vapor Pin® to minimize contact between soil gas and the slab. Vapor Pin® Extensions can be connected end-to-end for collecting soil gas at various depths in increments of 1.5 inch. They can also be used with the Sealing Extension, described below.

Sealing Extension

Like the Vapor Pin® Barb Extension or the Vapor Pin® 1.5-inch Extension, the Sealing Extension is placed beneath the Vapor Pin®. The Sealing Extension is used to isolate the slab from the soil-gas environment to ensure that collected soil-gas samples are not affected by VOCs that may have saturated the slab. Depending on slab thickness, one or more Vapor Pin® 1.5″ Extensions can be placed between the Vapor Pin® and the Sealing Extension to extend the assembly to the bottom of the slab. Available in stainless steel only.

Vapor Pin® Sieve

The Vapor Pin® Sieve can be attached to the bottom of a Vapor Pin®, a Barb Extension with tubing, or a Vapor Pin® 1.5″ Extension to prevent soil from clogging the sample train.

Stainless Steel Drilling Guide

When installing Vapor Pins® in the flush-mount configuration, the Stainless Steel Drilling Guide is placed in the 1.5-inch hole prior to drilling the 5/8-inch hole, to ensure that the holes are co- centered, and perpendicular to the slab. The guide also functions as a depth gauge while drilling the 1.5-inch hole. When the flange on the Drilling Guide just touches the slab, the hole is at the proper depth.

Stainless Steel Secured Cover

The Stainless Steel Secured Cover screws onto the Vapor Pin® installed in the flush-mount configuration, to reduce trip hazards and to discourage tampering. The Secured Cover can be used with brass or stainless steel Vapor Pins®, and with the FLX-VPSS. The Secure Cover is available in stainless steel only.

Flush Mount Covers

The basic Flush Mount Cover is made of black plastic, and is a low-cost alternative to the Stainless Steel Secured Cover used in flush-mount installations.

Vapor Pin® Sleeves

The Vapor Pin® Sleeve is what distinguishes the Vapor Pin® from other sampling points. The Vapor Pin® Sleeve instantly forms a tight seal between the concrete slab and the Vapor Pin®, without the use of grout, cement, or adhesives. Like most plastic parts, including sample tubing, Vapor Pin® Sleeves are replaced each time the Vapor Pin® is installed.

Vapor Pin® Caps

Vapor Pin® Caps are placed on top of any type of Vapor Pins® equipped with barb fittings, and prevent soil gas from escaping between sample events. Caps should be replaced each time the Vapor Pin® is installed.

Spanner for Secured Cover

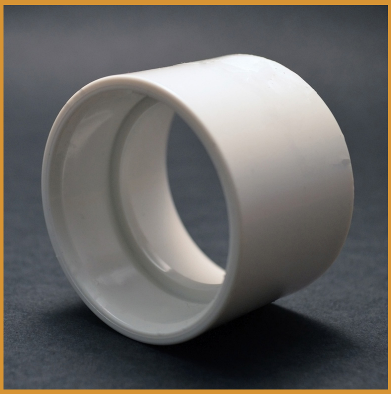
The spanner is used to secure and remove the Stainless Steel Secured Cover from Vapor Pins® installed in the flush-mount configuration.

Installation/Extraction Tool

The Installation/Extraction Tool is placed on the barb of the Vapor Pin® or FLX-VPSS during installation to prevent damage to the barb while hammering it into the slab. At project completion, the Vapor Pin® is extracted by screwing the Installation/Extraction Tool onto the Vapor Pin® and twisting, in the way one extracts a wine cork.

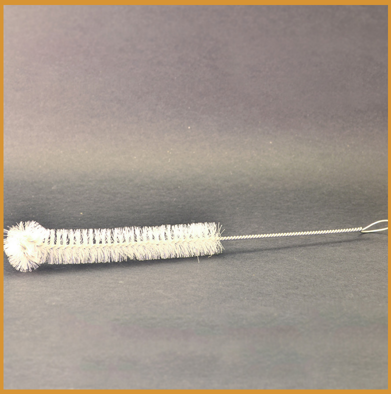
Elastrator Tool

The elastrator simplifies placing the Vapor Pin® Sleeve onto the Vapor Pin®. While wearing work gloves, screw the Vapor Pin® into a Stainless Steel Secured Cover, and place it upside down on a desk or work bench. Place the elastrator into the end of a sleeve, squeeze the elastrator handles, and with the other hand, push the sleeve onto the Vapor Pin®.



Water Dam

The Water Dam is used to leak test the seal between the Vapor Pin® and the concrete slab. The Water Dam is placed around the Vapor Pin® and in contact with the slab using a ring of clean modeling clay or Play-Doh®. Make your sample train connections, then pour distilled water into the Water Dam before purging, and if water isn't lost into the slab, the seal is tight.



Bottle Brush

The Bottle Brush is used to remove dust from the 5-8-inch hole prior to hammering in the Vapor Pin®.

O-Rings

The O-Rings form the seal between the FLX-VPSS and the interchangeable Barb Fitting, Swagelok® fitting, Quick Connect fitting or MiniPin cover. These fittings are sold with O-rings, but the rings can be replaced if desired.

Tygon® Tubing

Tygon® Tubing connects the Vapor Pin® ¼-inch barb to ¼-inch OD Nylon or Teflon® tubing. Tygon® is the best available tubing for making connections, but like all soft tubing, it is less chemically inert than Nylon or Teflon®, and it should not be used for longer tubing runs. Tygon® tubing should be replaced between samples.

Nylaflow® Tubing

Nylon tubing (¼-inch OD) has low chemical reactivity, and it should make up as much of the sample train as possible. Nylaflow® LM tubing is comparable to Teflon® at a lower cost. Nylaflow® tubing should be replaced between samples.

Hard Sided Case

The Vapor Pin® Contractor Kit is sold with a Hard Sided Case, but you can replace it should your case become lost or damaged.

Countersink Drill Bit

The Stainless Steel Secure Cover projects approximately 1/16" above grade and poses minimal trip hazard. The Countersink Drill Bit allows you to place the entire cover below grade, and drills both the 1.5-inch diameter hole, and a shallow 2-inch diameter hole. Besides making installations even neater, the Countersink Drill Bit makes it obvious when the 1.5-inch hole reaches total depth, without periodically having to stop and check.

Snap a shot of our QR code
and start shopping Now!

Distributors

HOSKIN SCIENTIFIC

www.hoskin.ca

Ribble Enviro Ltd
www.ribble-enviro.co.uk
...everything gas detection

http://www.ribble-enviro.co.uk/

C & H

http://www.candh.co.kr

HydroTerra
Environmental Monitoring Specialists

https://www.hydroterra.com.au

ENVIROLOGEK TECHNOLOGIES

www.Envirologek.com

VaporPin

Contact us at:

www.Vaporpin.com
www.Vaporpin.com.br

7750 Corporate Blvd.
Plain City, Ohio. 3064

(614) 504-6915
FAX (614) 526-2041

Laurie_Chilcote@vaporpin.com

Follow us at:

https://www.vaporpin.com/vapor-pin-newsletter/
https://www.facebook.com/vaporpin/
https://www.linkedin.com/in/vaporpin/

APPENDIX J

REMEDIAL ACTION SCHEDULE

Remedial Schedule
Former Refron Inc. Gas Reclamation Site (C241285)

Milestone	***Date***
Submission of Draft RAWP to NYSDEC and NYSDOH	July 2025
Public Comment Period for RAWP	January-March 2026
Significant Threat Determination	March-April 2026
Submission of Final RIR & RAWP to NYSDEC and NYSDOH	April 2026
Approval of RAWP and Issuance of Decision Document	April 2026
Pre-Construction Meeting	April 2026
Mobilization	May 2026
Remedial Excavation / Soil Removal	May 2026 – October 2026
EC Installation	May 2026 – October 2026
Post-Excavation Endpoint Sampling	May 2026 – October 2026
Environmental Easement Package	By June 1, 2027
Submission of Draft Site Management Plan	By August 1, 2027
Submission of Final Site Management Plan	By October 1, 2027
Submission of Final Engineering Report	By November 15, 2027

Remedial Schedule Gantt Chart

Former Refron Inc. Gas Reclamation Site (C241285)

Legend Duration Milestone

Milestone	Source Date	Start Date	Finish Date	Type
Submission of Draft RAWP to NYSDEC and NYSDOH	July 2025	Jul 1, 2025	Jul 31, 2025	Task
Public Comment Period for RAWP	January-March 2026	Jan 1, 2026	Mar 31, 2026	Task
Significant Threat Determination	March-April 2026	Mar 1, 2026	Apr 30, 2026	Task
Submission of Final RIR & RAWP to NYSDEC and NYSDOH	April 2026	Apr 1, 2026	Apr 30, 2026	Task
Approval of RAWP and Issuance of Decision Document	April 2026	Apr 1, 2026	Apr 30, 2026	Task
Pre-Construction Meeting	April 2026	Apr 1, 2026	Apr 30, 2026	Task
Mobilization	May 2026	May 1, 2026	May 31, 2026	Task
Remedial Excavation / Soil Removal	May 2026 – October 2026	May 1, 2026	Oct 31, 2026	Task
EC Installation	May 2026 – October 2026	May 1, 2026	Oct 31, 2026	Task
Post-Excavation Endpoint Sampling	May 2026 – October 2026	May 1, 2026	Oct 31, 2026	Task
Environmental Easement Package	By June 1, 2027	Jun 1, 2027	Jun 1, 2027	Milestone
Submission of Draft Site Management Plan	By August 1, 2027	Aug 1, 2027	Aug 1, 2027	Milestone
Submission of Final Site Management Plan	By October 1, 2027	Oct 1, 2027	Oct 1, 2027	Milestone
Submission of Final Engineering Report	By November 15, 2027	Nov 15, 2027	Nov 15, 2027	Milestone