TABLE 21

SUMMATION OF RISK TO CONSTRUCTION WORKERS (0-15')

Sum of Soil Exposure Risk

Former Shell-Branded Service Station No. 137847

620 Broadway

Somerville, Massachusetts

Exposure Pathways	Hazard Index	Excess Lifetime Cancer Risk
Incidental Ingestion	2.E-02	0.E+00
Dermal Exposure	3.E-02	0.E+00
Particulate Inhalation GI	4.E-04	0.E+00
Particulate Inhalation	8.E-03	2.E-07
Sum of Exposures	6.E-02	2.E-07
MCP Limits	1.E+00	1.E-05
Significant Risk	NO	NO

TABLE 22
RISK CALCULATIONS FOR CONSTRUCTION WORKERS (>15')
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

DERMAL

OHM Constituent of Concern	EPC Soil (mg/kg)	RAF	RAF	ADD	LADD	RFD	CSF	Hazard Index	ELCR
MA-VPH									
Aliphatics C5 to C8	4450.00	0.20	NC	1.1E-02		4.0E-01		2.8E-02	
Aliphatics C9 to C12	1310.00	0.20	NC	3.3E-03		1.0E+00		3.3E-03	
Aromatics C9 to C10	2030.00	0.20	NC	5.0E-03		3.0E-01		1.7E-02	
Benzene	17.20	0.03	0.03	6.4E-06	4.6E-08	1.0E-02	5.5E-02	6.4E-04	2.5E-09
Ethylbenzene	126.00	0.03	NC	4.7E-05		5.0E-02		9.4E-04	
Toluene	138.00	0.03	NC	5.1E-05		8.0E-02		6.4E-05	
Xylenes (Mixed Isomers)	391.80	0.03	NC	1.5E-04		4.0E-01		3.6E-04	
Methyl tert butyl ether	3.82	0.03	NC	1.4E-06		1.0E+00		1.4E-06	
Naphthalene	40.96	0.10	NC	5.1E-05		2.0E-01		2.5E-04	
DERMAL SUMMATIONS								[illegible]	1.5E-09

INCIDENTAL INGESTION

OHM Constituent of Concern	RAF	RAF	Incidental Ingestion ADD	LADD	RFD	CSF	Hazard Index	ELCR
Aliphatics C5 to C8	1.00	NC	5.5E-03		4.0E-01		1.4E-02	
Aliphatics C9 to C12	1.00	NC	1.6E-03		1.0E+00		1.6E-03	
Aromatics C9 to C10	1.00	NC	2.5E-03		3.0E-01		8.3E-03	
Benzene	1.00	1.00	2.1E-05	1.5E-07	1.0E-02	5.5E-02	2.1E-03	8.3E-09
Ethylbenzene	1.00	NC	1.6E-04		5.0E-02		3.1E-03	
Toluene	1.00	NC	1.7E-04		8.0E-01		2.1E-04	
Xylenes (Mixed Isomers)	1.00	NC	4.8E-04		4.0E-01		1.2E-03	
Methyl tert butyl ether	1.00	NC	4.7E-06		1.0E+00		4.7E-06	
Naphthalene	0.30	NC	1.5E-05		2.0E-01		7.6E-05	
INCIDENTAL INGESTION SUMMATIONS							[illegible]	[illegible]

PARTICLE INHALATION GI

OHM Constituent of Concern	RAF	RAF	Inhalation - GI ADD	LADD	RFD	CSF	Hazard Index	ELCR
Aliphatics C5 to C8	1	NC	1.4E-04		4.0E-01		3.6E-04	
Aliphatics C9 to C12	1	NC	4.2E-05		1.0E+00		4.2E-05	
Aromatics C9 to C10	1	NC	6.5E-05		3.0E-01		2.2E-04	
Benzene	1	1	5.5E-07	3.9E-09	1.0E-02	5.5E-02	5.5E-05	2.2E-10
Ethylbenzene	1	NC	4.0E-06		5.0E-02		8.0E-05	
Toluene	1	NC	4.4E-06		8.0E-01		5.5E-06	
Xylenes (Mixed Isomers)	1	NC	1.3E-05		4.0E-01		3.1E-05	
Methyl tert butyl ether	1	NC	1.2E-07		1.0E+00		1.2E-07	
Naphthalene	0.3	NC	3.9E-07		2.0E-01		2.0E-06	
PARTICLE INHALATION - GI SUMMATIONS							7.9E-04	2.2E-10

PARTICLE INHALATION - PA

OHM Constituent of Concern	RAF	RAF	Inhalation - PA ADD	LADD	RFD	CSF	Hazard Index	ELCR
Aliphatics C5 to C8	1.00		4.7E-05		5.7E-02	0.0E+00	8.3E-04	
Aliphatics C9 to C12	1.00		1.4E-05		1.7E-01	0.0E+00	8.1E-05	
Aromatics C9 to C10	1.00		2.2E-05		1.4E-01	0.0E+00	1.5E-04	
Benzene	1.00	1.00	1.8E-07	1.3E-09	2.9E-03	2.7E-02	6.4E-05	3.6E-11
Ethylbenzene	1.00		1.3E-06		2.6E+00	0.0E+00	5.2E-07	
Toluene	1.00		1.5E-06		1.4E+00	0.0E+00	1.0E-06	
Xylenes (Mixed Isomers)	1.00		4.2E-06		1.1E-01	0.0E+00	3.6E-05	
Methyl tert butyl ether	1.00		4.1E-08		8.6E-01	0.0E+00	4.7E-08	
Naphthalene	1.00		4.4E-07		8.6E-04	0.0E+00	5.1E-04	
PARTICLE INHALATION SUMMATIONS							1.7E-03	3.6E-11

SK SUMMARY - SOIL-CONSTRUCTION WORKER

	Scientific	Decimal
Hazard Index	[illegible]	0.08173
ELCR	1E-08	0.00000

TABLE 22 (Continued)
RISK CALCULATIONS FOR CONSTRUCTION WORKERS (>15')
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Construction Worker - Soil: Table CW-2
Equations to Calculate Cancer Risk for Construction Worker

Cancer Risk from Ingestion

$$ELCR_{ing} = LADD_{ing} * CSF_{oral}$$

$$LADD_{ing} = \frac{EPC * IR * RAF_{c,ing} * EF * ED_{ing} * EP * C1}{BW * AP_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR_{derm} = LADD_{derm} * CSF_{oral}$$

$$LADD_{derm} = \frac{EPC * SA * AF * RAF_{c,derm} * EF * ED_{derm} * EP * C1}{BW * AP_{lifetime}}$$

Cancer Risk from Particulate Inhalation - Gastrointestinal Absorption

$$ELCR_{inh,GI} = LADD_{inh,GI} * CSF_{oral}$$

$$LADD_{inh,GI} = \frac{EPC * RCAF_{GI} * PM_{10} * VR_{work} * RAF_{c,ing} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{lifetime}}$$

Cancer Risk from Particulate Inhalation - Pulmonary Absorption

$$ELCR_{inh} = LADD_{inh} * CSF_{inhalation}$$

$$LADD = \frac{EPC * RCAF_{inh} * PM_{10} * VR_{work} * RAF_{c,inh} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{lifetime}}$$

Vlookup Version V0414

Parameter		Value	Units
[illegible]	[illegible]	[illegible]	[illegible]

Construction Worker - Soil: Table CW-3
Equations to Calculate Noncancer Risk for Construction Worker

Noncancer Risk from Ingestion

$$HQ_{ing} = \frac{ADD_{ing}}{RfD_{[illegible]}}$$

$$ADD_{ing} = \frac{EPC * IR * RAF_{nc,ing} * EF * ED_{ing} * EP * C1}{BW * AP_{noncancer}}$$

Noncancer Risk from Dermal Absorption

$$HQ_{derm} = \frac{ADD_{derm}}{RfD_{[illegible]}}$$

$$ADD_{derm} = \frac{EPC * SA * AF * RAF_{nc,derm} * EF * ED_{derm} * EP * C1}{BW * AP_{noncancer}}$$

Noncancer Risk from Particulate Inhalation - Gastrointestinal Absorption

$$HQ_{inh,GI} = \frac{ADD_{inh,GI}}{RfD_{[illegible]}}$$

$$ADD_{inh,GI} = \frac{EPC * RCAF_{GI} * PM_{10} * VR_{work} * RAF_{nc,ing} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{noncancer}}$$

Noncancer Risk from Particulate Inhalation - Pulmonary Absorption

$$HQ_{inh} = \frac{ADD_{inh}}{RfD_{[illegible]}}$$

$$ADD_{inh} = \frac{EPC * RCAF_{inh} * PM_{10} * VR_{work} * RAF_{nc,inh} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{noncancer}}$$

Vlookup Version V0414

Parameter	Value	Units
[illegible]	[illegible]	[illegible]

Construction Worker - Soil: Table CW-4
Definitions and Exposure Factors

Vlookup Version V0414

Parameter	Value	Units	Notes
ELCR - Excess Lifetime Cancer Risk	chemical specific	dimensionless	Pathway specific (ing=ingestion, derm=dermal, inh=inhalation)
HI - Hazard Index	chemical specific	dimensionless	Pathway specific (ing=ingestion, derm=dermal, inh=inhalation)
CSF - Cancer Slope Factor	chemical specific	(mg/kg-day)$^{-1}$	see Table CW-5.
RfD - Reference Dose	chemical specific	mg/kg-day	see Table CW-5.
LADD - Lifetime Average Daily Dose	chemical specific	mg/kg-day	Pathway specific. See Table CW-2.
ADD - Average Daily Dose	chemical specific	mg/kg-day	Pathway specific. See Table CW-3.
EPC - Exposure Point Concentration	chemical specific	µg/L	see Table CW-1.
IR - Soil Ingestion Rate	100	mg/day	MADEP, 2002. Technical Update: Calculation of an Enhanced Soil Ingestion Rate. (http://www.mass.gov/dep/ors/orspubs.htm)
RAF_c - Relative Absorption Factor for Cancer Effects	chemical specific	dimensionless	Pathway specific - see Table CW-5.
RAF_{nc} - Relative Absorption Factor for Noncancer Effects	chemical specific	dimensionless	Pathway specific - see Table CW-5.
EF - Exposure Frequency	0.714	event/day	5 events (days) / 7 events (days) in a week; MADEP 1995 Guidance for Disposal Site Risk Characterization, pg B-38.
$EF_{cyanide}$ - Exposure Frequency for Cyanide Exposures	1.00	event/day	MADEP, 1995. Guidance for Disposal Site Risk Characterization. Page 5-5.
$ED_{ing/derm}$ - Exposure Duration for ingestion or dermal exposure	1	day/event	
ED_{inh} - Exposure Duration for inhalation exposure	0.333	day/event	Represents 8 hours / event.
EP - Exposure Period	182	days	6 months; MADEP 1995 Guidance for Disposal Site Risk Characterization.
$EP_{cyanide}$ - Exposure period for cyanide exposure	1	day	MADEP, 1995. Guidance for Disposal Site Risk Characterization. Page 5-5.
BW - Body Weight	58.0	kg	U.S. EPA, 1997. Exposure Factors Handbook. Table 7-7. [illegible], Ages 18 - 25.
$AP_{lifetime}$ - Averaging Period for lifetime	25,550	days	Represents 70 years.
$AP_{noncancer}$ - Averaging Period for noncancer	182	days	6 months; MADEP 1995 Guidance for Disposal Site Risk Characterization.
$AP_{cyanide}$ - Averaging period for assessing cyanide exposures	1	day	MADEP, 1995. Guidance for Disposal Site Risk Characterization. Page 5-5.
AF - Adherence Factor	0.29	mg/cm^2	MADEP, 2002 Technical Update: Weighted Skin-Soil Adherence Factors. (http://www.mass.gov/dep/ors/orspubs.htm)
VR_{work} - Ventilation Rate during Work (heavy exertion)	60	L/min	Table B-4 MADEP 1995 Guidance for Disposal Site Risk Characterization.
SA - Surface Area	3473	cm^2/day	MADEP, 1995. Guidance for Disposal Site Risk Characterization. 50th percentile for females. Appendix Table B-2.
$RCAF_{GI}$ - Relative Concentration Adjustment Factor, gastrointestinal	1.5	dimensionless	MADEP 2007. Characterization of Risks Due to Inhalation of Particulates by Construction Workers.
$RCAF_{inh}$ - Relative Concentration Adjustment Factor, inhalation	0.5	dimensionless	MADEP 2002. Characterization of Risks Due to Inhalation of Particulates by Construction Workers.
PM10 - Concentration of PM_{10}	60	µg/m^3	MADEP 1995 Guidance for Disposal Site Risk Characterization pg B-33.

TABLE 23
SUMMATION OF RISK TO CONSTRUCTION WORKERS (>15')
Sum of Soil Exposure Risk
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Exposure Pathways	Hazard Index	Excess Lifetime Cancer Risk
Incidental Ingestion	3.E-02	8.E-09
Dermal Exposure	5.E-02	3.E-09
Particulate Inhalation GI	8.E-04	2.E-10
Particulate Inhalation	2.E-03	4.E-11
Sum of Exposures	8.E-02	1.E-08
MCP Limits	1.E+00	1.E-05
Significant Risk	NO	NO

ATTACHMENT A

Sovereign Consulting Inc.
4 Open Square Way, Suite 307
Holyoke, MA 01040

Boring/Well ID: SB-200

Sheet 1 of 1

Client:	Motiva Enterprises	Drilling Co.:	Geosearch
Project:	Former Shell-Branded Station	Drill Rig:	NA
Project Number:	2R759	Drill Method:	Vacuum Excavation
Location:	620 Broadway Somerville, MA	Foreman:	Rob Gerard-Maillet
		URS Inspector:	Joseph Kiker
		Start Date:	4/8/2014
		Completion Date:	4/8/2014

Casing	Sampler
Type: NA	NA
Size: NA	NA
Hammer	Fall
NA lbs	NA"

Casing Elevation: _____
Surface Elevation: _____
Wellhead Type: _____

Depth	Sample Information: Sample ID	Pen./Rec. (in.)	Interval (Ft.)	Blow/6"	PID (ppmv)	Sample Type	Water Detected	Sample Description	Stratum Change (ft.)	Notes	Test Boring/ Monitoring Well Construction
								0-0.5', 6" Asphalt			
2	S-1		1-1.5		16.1			0.5-3', Olive gray SILT, rock fragments, fill material.		1	No well constructed, backfilled to grade.
	S-2		2-2.5		11.0						
4	S-3		3-3.5		4.7			3-4', Brown SILT, fill material.			
	S-4		4-4.5		3.6						
6	S-5		5-5.5		4.2			4-7.5', Light brown SILT, fill material.			
	S-6		6-6.5		5.7						
8	S-7		7-7.5		4.1			Refusal encountered at 7.5'			
10											

Notes: 1) Composite sample taken from 1-4' and 4-7' for lab analysis.
2)
3)
4)

Key: Cement; Grout; Bentonite; Sand

Remarks: 1) Stratification lines represent approximate boundaries between soil types and the transition may be gradual. Water level readings have been completed at times and under condtions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
2) Field testing values represent total volatile organic vapors (referenced to an isobutylene standard) measured in the headspace of a sealed soil sample with a photoionization detector.
3) Sample is designated as either "C" for composite or "GS" for a discrete grab sample.

Sovereign Consulting Inc.
4 Open Square Way, Suite 307
Holyoke, MA 01040

Boring/Well ID: **SB-201**

Sheet 1 of 1

Client:	Motiva Enterprises	Drilling Co.:	Geosearch
Project:	Former Shell-Branded Station	Drill Rig:	NA
Project Number:	2R759	Drill Method:	Vacuum Excavation
Location:	620 Broadway Somerville, MA	Foreman:	Rob Gerard-Maillet
		URS Inspector:	Joseph Kiker
		Start Date:	4/8/2014
		Completion Date:	4/8/2014

Casing	Sampler
Type: NA	NA
Size: NA	NA
Hammer	Fall
NA lbs	NA"

Casing Elevation: _____
Surface Elevation: _____
Wellhead Type: _____

Depth	Sample ID	Pen./Rec. (in.)	Interval (ft.)	Blow/6"	PID (ppmv)	Sample Type	Water Detected	Sample Description	Stratum Change (ft.)	Notes	Test Boring/ Monitoring Well Construction
								0-0.5', 6" Asphalt 0.5-1', Rock fragments, fill material.			
2	S-1		1-1.5		14.6					1	No well constructed, backfilled to grade.
	S-2		2-2.5		10.5			1-4', Olive gray fine SAND, fill material.			
4	S-3		3-3.5		8.0						
			4-4.5		9.1			4-5', Olive gray SILT, fill material.			
			5-5.5		7.4			5-6', Light brown SILT, fill material.			
6			6-6.5		17.7			6-6.5', Light brown SILT, fill material.			
8											
10											

Notes: 1) Composite samples taken from 1-4' and 4-6' for lab analysis.
2)
3)
4)

Key: Cement, Grout, Bentonite, Sand

Remarks: 1) Stratification lines represent approximate boundaries between soil types and the transition may be gradual. Water level readings have been completed at times and under condtions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
2) Field testing values represent total volatile organic vapors (referenced to an isobutylene standard) measured in the headspace of a sealed soil sample with a photoionization detector.
3) Sample is designated as either "C" for composite or "GS" for a discrete grab sample.

Sovereign Consulting Inc.
4 Open Square Way, Suite 307
Holyoke, MA 01040

Boring/Well ID: **SB-202**

Sheet 1 of 1

Client:	Motiva Enterprises	Drilling Co.:	Geosearch
Project:	Former Shell-Branded Station	Drill Rig:	NA
Project Number:	2R759	Drill Method:	Vacuum Excavation
Location:	620 Broadway Somerville, MA	Foreman:	Rob Gerard-Maillet
		URS Inspector:	Joseph Kiker
		Start Date:	4/8/2014
		Completion Date:	4/8/2014

Casing		Sampler	
Type:	NA		NA
Size:	NA		NA
Hammer		Fall	
	NA lbs		NA"

Casing Elevation: _____
Surface Elevation: _____
Wellhead Type: _____

Depth	Sample Information: Sample ID	Pen./Rec. (in.)	Interval (Ft.)	Blow/6"	PID (ppmv)	Sample Type	Water Detected	Sample Description	Stratum Change (ft.)	Notes	Test Boring/ Monitoring Well Construction
								0-0.5', 6" Asphalt 0.5-1', Rock fragments, fill material.			
2	S-1		1-1.5		18.9			1-3.5', Olive gray fine SAND with some silt, some urban fill materials and building debris (brick, glass, concrete).		1	No well constructed, backfilled to grade.
	S-2		2-2.5		16.6						
4	S-3		3-3.5		19.9			Refusal encountered at 3.5'			
6											
8											
10											

Notes: 1) Composite sample taken from 1-3' for lab analysis.
2)
3)
4)

Key: Cement; Grout; Bentonite; Sand

Remarks: 1) Stratification lines represent approximate boundaries between soil types and the transition may be gradual. Water level readings have been completed at times and under condtions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
2) Field testing values represent total volatile organic vapors (referenced to an isobutylene standard) measured in the headspace of a sealed soil sample with a photoionization detector ( ) and a _____Ev lamp.
3) Sample is designated as either "C" for composite or "GS" for a discrete grab sample.

Sovereign Consulting Inc. 4 Open Square Way, Suite 307 Holyoke, MA 01040	Boring/Well ID: SB-203	Sheet 1 of 1

Client:	Motiva Enterprises	Drilling Co.:	Geosearch	Casing	Sampler
Project:	Former Shell-Branded Station	Drill Rig:	NA	Type: NA	NA
Project Number:	2R759	Drill Method:	Vacuum Excavation	Size: NA	NA
Location:	620 Broadway Somerville, MA	Foreman:	Rob Gerard-Maillet	Hammer	Fall
		URS Inspector:	Joseph Kiker	NA lbs	NA"
		Start Date:	4/8/2014	Casing Elevation:	
		Completion Date:	4/8/2014	Surface Elevation:	
				Wellhead Type:	

Depth	Sample Information: Sample ID	Pen./Rec. (in.)	Interval (Ft.)	Blow/6"	PID (ppmv)	Sample Type	Water Detected	Sample Description	Stratum Change (ft.)	Notes	Test Boring/ Monitoring Well Construction
								0-0.5', 6" Asphalt 0.5-1', Rock fragments, fill material.			
2	S-1		1-1.5		12.1						No well constructed, backfilled to grade.
	S-2		2-2.5		8.2			1-4', Dark gray fine SAND with some silt, rock fragments, some fill materials, building debris (brick, glass, concrete).		1	
4	S-3		3-3.5		11.2						
	S-4		4-4.5		7.2						
6	S-5		5-5.5		2.2						
	S-6		6-6.5		4.9			4-9.5', Olive gray SILT, little fine sand, trace organic material.			
8	S-7		7-7.5		7.2						
	S-8		8-8.5		8.0						
10	S-9		9-9.5		8.2						

Notes:
1) Composite sample taken from 1-3' and 4-9' for lab analysis.
2)
3)
4)

Key:
- Cement
- Grout
- Bentonite
- Sand

Remarks:
1) Stratification lines represent approximate boundaries between soil types and the transition may be gradual. Water level readings have been completed at times and under condtions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
2) Field testing values represent total volatile organic vapors (referenced to an isobutylene standard) measured in the headspace of a sealed soil sample with a photoionization detector.
3) Sample is designated as either "C" for composite or "GS" for a discrete grab sample.

ATTACHMENT B

Table 4

Level 1 Soil Vapor Monitoring Results

Former Shell-branded Service Station #137847
620 Broadway
Somerville, MA
August 15, 2002 through June 6, 2005

Hydrocarbon Fraction and Target Analytes which exceed applicable Method 1 GW-2 Standards	Level 1 Standards (ppmv)
Benzene	NA
Total Xylenes	26
C_5-C_8 Aliphatic Hydrocarbons	7
C_9-C_{12} Aliphatic Hydrocarbons	7
C_9-C_{10} Aromatic Hydrocarbons	29

Vapor Point ID	Date	PID Response (ppmv)
SGS-1	8/15/02	1.5
	8/15/02	1.2
	8/15/02	1.2
SGS-2	8/15/02	0.4
	8/15/02	0.7
	8/15/02	0.4
SGS-3	8/15/02	0.4
	8/15/02	0.1
	8/15/02	0.1
SVP-101	3/28/03	0.8
	3/28/03	0.8
	3/28/03	0.8
	12/22/03	VPI
	10/27/04	Well Destroyed
SVP-102	3/28/03	0.2
	3/28/03	0.2
	3/28/03	0.2
	12/22/03	ND
	12/22/03	0.2
	12/22/03	ND
	10/27/04	0.4
	10/27/04	ND
	10/27/04	0.1
	6/6/05	0.1
	6/6/05	ND
	6/6/05	ND
SVP-103	3/28/03	0.2
	3/28/03	0.2
	3/28/03	0.2
	12/22/03	0.1
	12/22/03	0.1
	12/22/03	ND
	10/27/04	ND
	10/27/04	ND
	10/27/04	ND
	6/6/05	ND
	6/6/05	0.1
	6/6/05	ND

Notes:
PID - photoionization detector
ppmv - parts per million volume
NA - not applicable
VPI - vapor point inaccessable
PID used a 10.6 eV lamp calibrated to read as benzene
ND - not detected

GEOLOGIC SERVICES CORPORATION
science, engineering & technology
30 Porter Road, Littleton, MA

ATTACHMENT C

Vlookup Version v0424

OIL OR HAZARDOUS MATERIAL	CAS	Chronic Oral Reference Dose (Or Substitute) mg/kg/day	REF	Subchronic Oral Reference Dose (Or Substitute) mg/kg/day	REF	Chronic Inhalation Reference Concentration (or substitute) mg/m3	REF	Subchronic Inhalation Reference Concentration (or substitute) mg/m3	REF	Oral Cancer Slope Factor 1/(mg/kg/day)	CLASS	REF	Inhalation Unit Risk 1/(µg/m3)	REF	Subchronic Inhalation Reference Dose (or Substitute) mg/kg/day	REF	Inhalation Cancer Slope Factor (mg/kg/day)$^{-1}$	REF
ACENAPHTHENE	83-32-9	6.0E-02	1	2.0E-01	6	5.0E-02	5d	5.0E-01	5d						1.4E-01	5f	0.0E+00	
ACENAPHTHYLENE	208-96-8	3.0E-02	5d	3.0E-01	5d	5.0E-02	5d	5.0E-01	5d		D	1			1.4E-01	5f	0.0E+00	
ACETONE	67-64-1	9.0E-01	1	2.7E+00	1i	8.0E-01	3	8.0E-01	7c		D	1			2.3E-01	5f	0.0E+00	
ALDRIN	309-00-2	3.0E-05	1	4.0E-05	6	1.1E-04	7b	2.0E-04	7b	1.70E+01	B2	1	4.9E-03	1	5.7E-05	5f	1.7E+01	5g
ANTHRACENE	120-12-7	3.0E-01	1	1.0E+00	6	5.0E-02	5d	5.0E-01	5d		D	1			1.4E-01	5f	0.0E+00	
ANTIMONY	7440-36-0	4.0E-04	1	4.0E-04	6	1.0E-02	3	1.0E-02	7c						2.9E-03	5f	0.0E+00	
ARSENIC	7440-38-2	3.0E-04	1	3.0E-04	2	2.0E-05	3a	2.0E-05	7c	1.50E+00	A	1	3.0E-03	3a	5.7E-06	5f	1.1E+01	5g
BARIUM	7440-39-3	2.0E-01	1	7.00E-02	1d	5.0E-04	2e	5.0E-03	2b						1.4E-03	5f	0.0E+00	
BENZENE	71-43-2	4.0E-03	1	1.0E-02	1i	1.0E-02	3a	1.0E-02	7c	5.50E-02	A	1	7.8E-06	1	2.9E-03	5f	2.7E-02	5g
BENZO(a)ANTHRACENE	56-55-3	3.0E-02	5d	3.0E-01	5d	5.0E-02	5d	5.0E-01	5d	7.30E-01	B2	1e	2.1E-04	7a	1.4E-01	5f	7.3E-01	5g
BENZO(a)PYRENE	50-32-8	3.0E-02	5d	3.0E-01	5d	5.0E-02	5d	5.0E-01	5d	7.30E+00	B2	1	2.1E-03	7a	1.4E-01	5f	7.3E+00	5g
BENZO(b)FLUORANTHENE	205-99-2	3.0E-02	5d	3.0E-01	5d	5.0E-02	5d	5.0E-01	5d	7.30E-01	B2	1e	2.1E-04	7a	1.4E-01	5f	7.3E-01	5g
BENZO(g,h,i)PERYLENE	191-24-2	3.0E-02	5d	3.0E-01	5d	5.0E-02	5d	5.0E-01	5d						1.4E-01	5f	0.0E+00	
BENZO(k)FLUORANTHENE	207-08-9	3.0E-02	5d	3.0E-01	5d	5.0E-02	5d	5.0E-01	5d	7.30E-02	B2	1e	2.1E-05	7a	1.4E-01	5f	7.3E-02	5g
BERYLLIUM	7440-41-7	2.0E-03	1	5.0E-03	2	2.0E-05	1	2.0E-05	1j				2.4E-03	1	5.7E-06	5f	8.4E+00	5g
BIPHENYL, 1,1-	92-52-4	5.0E-01	1	5.0E-01	1d	2.0E-03	3	2.0E-03	7c	8.00E-03	D	1			5.7E-04	5f	0.0E+00	
BIS(2-CHLOROETHYL)ETHER	111-44-4									1.10E+00	B2	1	3.3E-04	1	0.0E+00		1.2E+00	5g
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9	4.0E-02	1	4.0E-02	1d	1.4E-01	7b	1.4E-01	7c	7.00E-02	C	2d	1.0E-05	2	4.0E-02	5f	3.5E-02	5g
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	2.0E-02	1	2.0E-02	2d	7.0E-03	3	7.0E-03	7c	1.40E-02	B2	1	1.3E-06	3	2.0E-03	5f	4.6E-03	5g
BROMODICHLOROMETHANE	75-27-4	3.0E-03	6b	8.0E-03	6	1.0E-02	7b	2.0E-02	6	6.20E-02	B2	1	1.8E-05	7a	5.7E-03	5f	6.2E-02	5g
BROMOFORM	75-25-2	2.0E-02	1	3.0E-02	6	7.0E-02	7b	9.0E-02	7b	7.90E-03	B2	1	1.1E-06	1	2.6E-02	5f	3.9E-03	5g
BROMOMETHANE	74-83-9	1.4E-03	1	5.0E-03	6	5.0E-03	1	1.0E-01	6		D	1			2.9E-02	5f	0.0E+00	
1,3 BUTADIENE	106-99-0					2.0E-03	1	2.0E-03	1				3.0E-05	1				
CADMIUM	7440-43-9	5.0E-04	1c	5.0E-04	1d	2.0E-05	3a	2.0E-05	7c		B1	1	1.8E-03	3	5.7E-06	5f	6.3E+00	5g
CARBON TETRACHLORIDE	56-23-5	4.0E-03	1	1.0E-02	1i	1.0E-01	1	1.0E-01	7c	7.00E-02	B2	1	6.0E-06	1	2.9E-02	5f	2.1E-02	5g
CHLORDANE	12789-03-6	5.0E-04	1	5.0E-04	1d	7.0E-04	1	7.0E-03	1k	3.50E-01	B2	1	1.0E-04	1	2.0E-03	5f	3.5E-01	5g
CHLOROANILINE, p-	106-47-8	5.0E-04	6a	5.0E-04	6	2.0E-03	7b	2.0E-03	7c	2.0E-01		6			5.7E-04	5f	0.0E+00	
CHLOROBENZENE	108-90-7	2.0E-02	1	7.0E-02	6	5.0E-02	6	5.0E-01	6		D	1			1.4E-01	5f	0.0E+00	
CHLOROFORM	67-66-3	1.0E-02	1	1.0E-02	2	6.6E-01	3	6.6E-01	7c		B2	1	2.3E-05	1	1.9E-01	5f	8.1E-02	5g
CHLOROPHENOL, 2-	95-57-8	5.0E-03	1	8.0E-03	6	1.8E-02	7b	3.0E-02	6						8.6E-03	5f	0.0E+00	
CHROMIUM (TOTAL)	7440-47-3	3.0E-03	1	2.0E-02	2	1.0E-04	1	3.0E-04	1k				1.2E-02	1	8.6E-05	5f	4.2E+01	5g
CHROMIUM(III)	16065-83-1	1.5E+00	1	1.5E+00	1d	1.0E-04	1h	3.0E-04	1k						8.6E-05	5f	0.0E+00	
CHROMIUM(VI)	18540-29-9	3.0E-03	1	2.0E-02	2	1.0E-04	1	3.0E-04	1k				1.2E-02	1	8.6E-05	5f	4.2E+01	5g
CHRYSENE	218-01-9	3.0E-02	5d	3.0E-01	5d	5.0E-02	5d	5.0E-01	5d	7.30E-02	B2	1e	2.1E-05	7a	1.4E-01	5f	7.3E-02	5g
CYANIDE	57-12-5	6.0E-04	1	6.0E-03	1i	8.0E-04	1	3.0E-03	1k		D	1			8.6E-04	5f	0.0E+00	
DIBENZO(a,h)ANTHRACENE	53-70-3	3.0E-02	5d	3.0E-01	5d	5.0E-02	5d	5.0E-01	5d	7.30E+00	B2	1e	2.1E-03	7a	1.4E-01	5f	7.3E+00	5g
DIBROMOCHLOROMETHANE	124-48-1	2.0E-02	1	7.0E-02	6	7.0E-02	7b	2.0E-01	7b	8.40E-02	C	1	2.4E-05	7a	5.7E-02	5f	8.4E-02	5g
DICHLOROBENZENE, 1,2- (o-DCB)	95-50-1	9.0E-02	1	9.0E-01	2d	8.0E-01	1m	2.4E+00	1m		D	1			6.9E-01	5f	0.0E+00	
DICHLOROBENZENE, 1,3- (m-DCB)	541-73-1	9.0E-02	1b	9.0E-01	2a	8.0E-01	1m	2.4E+00	1m		D	1			6.9E-01	5f	0.0E+00	
DICHLOROBENZENE, 1,4- (p-DCB)	106-46-7	9.0E-02	1b	9.0E-01	2a	8.0E-01	1	2.4E+00	1k	2.40E-02	C	2	6.9E-06	7a	6.9E-01	5f	2.4E-02	5g
DICHLOROBENZIDINE, 3,3'-	91-94-1									4.50E-01	B2	1	1.3E-04	7a	0.0E+00		4.5E-01	5g
DICHLORODIPHENYL DICHLOROETHANE, P,P'- (DDD)	72-54-8	5.0E-04	1g	5.0E-04	2g	1.8E-03	7b	1.8E-03	7c	2.40E-01	B2	1	6.9E-05	7a	5.1E-04	5f	2.4E-01	5g
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'- (DDE)	72-55-9	5.0E-04	1g	5.0E-04	2g	1.8E-03	7b	1.8E-03	7c	3.40E-01	B2	1	9.7E-05	7a	5.1E-04	5f	3.4E-01	5g
DICHLORODIPHENYLTRICHLOROETHANE, P,P'- (DDT)	50-29-3	5.0E-04	1	5.0E-04	2	1.8E-03	7b	1.8E-03	7c	3.40E-01	B2	1	9.7E-05	1	5.1E-04	5f	3.4E-01	5g
DICHLOROETHANE, 1,1-	75-34-3	2.0E-01	6	2.0E+00	6	8.0E-01	7b	8.0E+00	7b		C	1		7a	2.3E+00	5f	0.0E+00	
DICHLOROETHANE, 1,2-	107-06-2	2.0E-02	4	2.0E-02	6	7.0E-03	6	7.0E-02	6	9.10E-02	B2	1	2.6E-05	1	2.0E-02	5f	9.1E-02	5g
DICHLOROETHYLENE, 1,1-	75-35-4	5.0E-02	1	5.0E-02	1d	2.0E-01	1	2.0E-01	1j		C	1		1	5.7E-02	5f	0.0E+00	
DICHLOROETHYLENE, CIS-1,2-	156-59-2	2.0E-03	1	2.0E-02	6	6.0E-03	7b	6.0E-02	7b		D	1			1.7E-02	5f	0.0E+00	
DICHLOROETHYLENE, TRANS-1,2-	156-60-5	2.0E-02	1	2.0E-01	1i	6.0E-02	6	6.0E-02	7c						1.7E-02	5f	0.0E+00	
DICHLOROMETHANE	75-09-2	6.0E-03	1	6.0E-03	1d	6.0E-01	1	6.0E-01	1j	2.00E-03	B2	1	1.0E-08	1	1.7E-01	5f	3.5E-05	5g
DICHLOROPHENOL, 2,4-	120-83-2	3.0E-03	1	2.0E-02	6	1.1E-02	7b	6.0E-02	7b						1.7E-02	5f	0.0E+00	
DICHLOROPROPANE, 1,2-	78-87-5					4.0E-03	1	1.2E-02	1k	6.80E-02	B2	2	1.9E-05	3	3.4E-03	5f	6.7E-02	5g
DICHLOROPROPENE, 1,3-	542-75-6	3.0E-02	1	3.0E-02	1d	2.0E-02	1	2.0E-02	7c	1.00E-01	B2	1	4.0E-06	1	5.7E-03	5f	1.4E-02	5g
DIELDRIN	60-57-1	5.0E-05	1	5.0E-05	2	1.8E-04	7b	1.8E-04	7c	1.60E+01	B2	1	4.6E-03	1	5.1E-05	5f	1.6E+01	5g
DIETHYL PHTHALATE	84-66-2	8.0E-01	1	8.0E+00	2	2.8E+00	7b	2.8E+01	7b		D	1			8.0E+00	5f	0.0E+00	
DIMETHYL PHTHALATE	131-11-3	1.0E-01	6a	1.0E-01	6c	4.0E-01	7b	4.0E-01	7b		D	1			1.1E-01	5f	0.0E+00	
DIMETHYLPHENOL, 2,4-	105-67-9	2.0E-02	1	5.0E-02	6	7.0E-02	7b	2.0E-01	7b						5.7E-02	5f	0.0E+00	
DINITROPHENOL, 2,4-	51-28-5	2.0E-03	1	2.0E-02	6	7.0E-03	7b	7.0E-02	7b						2.0E-02	5f	0.0E+00	
DINITROTOLUENE, 2,4-	121-14-2	2.0E-03	1	2.0E-03	2	7.0E-03	7b	7.0E-03	7c	6.80E-01	B2	1a	1.9E-04	7a	2.0E-03	5f	6.8E-01	5g
DIOXANE, 1,4-	123-91-1	3.0E-02	1	3.0E-02	1d	3.0E-02	1	3.0E-02	7c	1.00E-01	B2	1	5.0E-06	1	8.6E-03	5f	1.8E-02	5g
ENDOSULFAN	115-29-7	6.0E-03	1	6.0E-03	2	2.1E-02	7b	2.1E-02	7c						6.0E-03	5f	0.0E+00	
ENDRIN	72-20-8	3.0E-04	1	3.0E-04	2	1.1E-03	7b	1.1E-03	7c		D	1			3.1E-04	5f	0.0E+00	
ETHYLBENZENE	100-41-4	5.0E-02	6a	5.0E-02	6	1.0E+00	1	9.0E+00	6		D	1			2.6E+00	5f	0.0E+00	

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OIL OR HAZARDOUS MATERIAL	CAS	Chronic Oral Reference Dose (Or Substitute) mg/kg/day	REF	Subchronic Oral Reference Dose (Or Substitute) mg/kg/day	REF	Chronic Inhalation Reference Concentration (or substitute) mg/m3	REF	Subchronic Inhalation Reference Concentration (or substitute) mg/m3	REF	Oral Cancer Slope Factor 1/(mg/kg/day)	CLASS	REF	Inhalation Unit Risk 1/(µg/m3)	REF	Subchronic Inhalation Reference Dose (or Substitute) mg/kg/day	REF	Inhalation Cancer Slope Factor $(mg/kg/day)^{-1}$	REF
ETHYLENE DIBROMIDE	106-93-4	9.0E-03	1	9.0E-03	1d	9.0E-03	1	9.0E-03	7c	2.00E+00	B2	1	3.0E-04	1	2.6E-03	5f	1.1E+00	5g
FLUORANTHENE	206-44-0	4.0E-02	1	1.0E-01	2	5.0E-02	5d	5.0E-01	5d		D	1			1.4E-01	5f	0.0E+00	
FLUORENE	86-73-7	4.0E-02	1	4.0E-01	6	5.0E-02	5d	5.0E-01	5d						1.4E-01	5f	0.0E+00	
HEPTACHLOR	76-44-8	5.0E-04	1	5.0E-04	2	1.0E-03	3	1.0E-03	7c	4.50E+00	B2	1	1.3E-03	1	2.9E-04	5f	4.6E+00	5g
HEPTACHLOR EPOXIDE	1024-57-3	1.3E-05	1	1.3E-05	2	4.6E-05	7b	4.6E-05	7c	9.10E+00	B2	1	2.6E-03	1	1.3E-05	5f	9.1E+00	5g
HEXACHLOROBENZENE	118-74-1	1.0E-05	6a	1.0E-05	6	4.0E-05	7b	4.0E-05	7b	1.60E+00	B2	1	4.6E-04	1	1.1E-05	5f	1.6E+00	5g
HEXACHLOROBUTADIENE	87-68-3	1.0E-03	6	1.0E-03	6	4.0E-03	7b	4.0E-03	7b	7.80E-02	C	1	2.2E-05	1	1.1E-03	5f	7.7E-02	5g
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	58-89-9	3.0E-04	1	3.0E-03	2	1.1E-03	7b	1.1E-02	7b	1.30E+00	B2-C	2	3.7E-04	7a	3.1E-03	5f	1.3E+00	5g
HEXACHLOROETHANE	67-72-1	7.0E-04	1	2.0E-03	1i	3.0E-02	1	3.0E-01	1k	4.00E-02	C	1	4.0E-06	1f	8.6E-02	5f	1.4E-02	5g
HMX	2691-41-0	5.0E-02	1	5.0E-02	1d	1.8E-01	7b	1.8E-01	7c		D	1			5.1E-02	5f	0.0E+00	
INDENO(1,2,3-cd)PYRENE	193-39-5	3.0E-02	5d	3.0E-01	5d	5.0E-02	5d	5.0E-01	5d	7.30E-01	B2	1e	2.1E-04	7a	1.4E-01	5f	7.3E-01	5g
LEAD	7439-92-1	7.5E-04	4	7.5E-04	4	1.0E-03	3	1.0E-03	7c		B2	1			2.9E-04	5f	0.0E+00	
MERCURY	7439-97-6	3.0E-04	2d	3.0E-04	2d	3.0E-04	1	3.0E-04	7c		D	1			8.6E-05	5f	0.0E+00	
METHOXYCHLOR	72-43-5	5.0E-03	1	5.0E-03	2	1.8E-02	7b	1.8E-02	7c		D	1			5.1E-03	5f	0.0E+00	
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3	6.0E-01	1	6.0E-01	1d	5.0E+00	1	5.0E+00	1j		D	1			1.4E+00	5f	0.0E+00	
METHYL ISOBUTYL KETONE (MIBK)	108-10-1	8.0E-02	2	8.0E-01	2	3.0E+00	1	3.0E+00	7c						8.6E-01	5f	0.0E+00	
METHYL MERCURY	22967-92-6	1.0E-04	1	1.0E-04	2	2.0E-05	3	2.0E-05	7c		C	1			5.7E-06	5f	0.0E+00	
METHYL TERT BUTYL ETHER	1634-04-4	1.0E-01	5a	1.0E+00	5a	3.0E+00	1	3.0E+00	7c		C				8.6E-01	5f	0.0E+00	
METHYLNAPHTHALENE, 2-	91-57-6	4.0E-03	1	4.0E-03	6	5.0E-02	5d	5.0E-01	5d						1.4E-01	5f	0.0E+00	
NAPHTHALENE	91-20-3	2.0E-02	1	2.0E-01	1i	3.0E-03	1	3.0E-03	7c						8.6E-04	5f	0.0E+00	
NICKEL	7440-02-0	2.0E-02	1	2.0E-02	2	1.0E-03	3	1.0E-03	7c		A	1	4.8E-04	1	2.9E-04	5f	1.7E+00	5g
N-NITROSODIMETHYLAMINE (NDMA)	62-75-9					0.0E+00				51	B2	1	1.4E-02	1	0.0E+00		4.9E+01	5g
PENTACHLOROPHENOL	87-86-5	5.0E-03	1	5.0E-03	1d	7.0E-05	3	7.0E-05	7c	4.00E-01	B2	1	1.0E-04	7a	2.0E-05	5f	3.5E-01	5g
PERCHLORATE	NA	7.0E-05	5e	7.0E-05	5e	2.0E-04	7b	2.0E-04	7c						5.7E-05	5f	0.0E+00	
PETROLEUM HYDROCARBONS	NA														0.0E+00		0.0E+00	
Aliphatics C5 to C8	NA	4.0E-02	5c	4.0E-01	5c	2.0E-01	5c	2.0E-01	7c						5.7E-02	5f	0.0E+00	
Aliphatics C9 to C12	NA	1.0E-01	5c	1.0E+00	5c	2.0E-01	5c	6.0E-01	5c						1.7E-01	5f	0.0E+00	
Aliphatics C9 to C18	NA	1.0E-01	5c	1.0E+00	5c	2.0E-01	5c	6.0E-01	5c						1.7E-01	5f	0.0E+00	
Aliphatics C19 to C36	NA	2.0E+00	5c	6.0E+00	5c										0.0E+00		0.0E+00	
Aromatics C9 to C10	NA	3.0E-02	5c	3.0E-01	5c	5.0E-02	5c	5.0E-01	5c						1.4E-01	5f	0.0E+00	
Aromatics C11 to C22	NA	3.0E-02	5c	3.0E-01	5c	5.0E-02	5c	5.0E-01	5c						1.4E-01	5f	0.0E+00	
PHENANTHRENE	85-01-8	3.0E-02	5d	3.0E-01	5d	5.0E-02	5d	5.0E-01	5d		D	1			1.4E-01	5f	0.0E+00	
PHENOL	108-95-2	3.0E-01	1	3.0E-01	1d	2.6E-01	3	2.6E-01	7c		D	1			7.4E-02	5f	0.0E+00	
POLYCHLORINATED BIPHENYLS (PCBs)	1336-36-3	2.0E-05	1	5.0E-05	2	2.0E-05	3	2.0E-05	7c	2.00E+00	B2	1	1.0E-04	1	5.7E-06	5f	3.5E-01	5g
PYRENE	129-00-0	3.0E-02	1	3.0E-01	6	5.0E-02	5d	5.0E-01	5d		D	1			1.4E-01	5f	0.0E+00	
RDX	121-82-4	3.0E-03	1	3.0E-03	1d	1.1E-02	7b	1.1E-02	7c	1.1E-01	C	1	3.1E-05	7a	3.1E-03	5f	1.1E-01	5g
SELENIUM	7782-49-2	5.0E-03	1	5.0E-03	2	3.0E-03	3	3.0E-03	7c		D	1			8.6E-04	5f	0.0E+00	
SILVER	7440-22-4	5.0E-03	1	5.0E-03	2	1.4E-04	5b	1.4E-04	7c		D	1			4.0E-05	5f	0.0E+00	
STYRENE	100-42-5	2.0E-01	1	2.0E+00	2d	1.0E+00	1	3.0E+00	1k	3.00E-02	B2	2d	5.7E-07	2d	8.6E-01	5f	2.0E-03	5g
TCDD, 2,3,7,8- (equivalents)	1746-01-6	7.0E-10	1	7.0E-10	1d	2.0E-09	7b	2.0E-09	7b	1.50E+05	B2	2	3.3E+01	2	5.7E-10	5f	1.2E+05	5g
TETRACHLOROETHANE, 1,1,1,2-	630-20-6	3.0E-02	1	9.0E-02	6	1.1E-01	7b	3.0E-01	7b	2.60E-02	C	1	7.4E-06	1	8.6E-02	5f	2.6E-02	5g
TETRACHLOROETHANE, 1,1,2,2-	79-34-5	2.0E-02	1	5.0E-02	1	9.3E-02	3	9.3E-02	7c	2.00E-01	C	1	5.8E-05	1f	2.7E-02	5f	2.0E-01	5g
TETRACHLOROETHYLENE (PCE)	127-18-4	6.0E-03	1	6.0E-03	1d	4.0E-02	1	4.0E-02	7c	2.00E-02		5h	3.0E-06	5h	1.1E-02	5f	1.1E-02	5g
THALLIUM	7440-28-0	8.0E-05	1f	8.0E-04	1f	1.4E-05	5b	1.4E-05	7c						4.0E-06	5f	0.0E+00	
TOLUENE	108-88-3	8.0E-02	1	8.0E-01	6	5.0E+00	1	5.0E+00	6		D	1			1.4E+00	5f	0.0E+00	
TRICHLOROBENZENE, 1,2,4-	120-82-1	1.0E-02	1	9.0E-02	6	2.0E-03	6	2.0E-02	6		D	1			5.7E-03	5f	0.0E+00	
TRICHLOROETHANE, 1,1,1-	71-55-6	2.0E+00	1	7.0E+00	1	5.0E+00	1	5.0E+00	1		D	1			1.4E+00	5f	0.0E+00	
TRICHLOROETHANE, 1,1,2-	79-00-5	4.0E-03	1	4.0E-03	6	7.4E-02	3	7.4E-02	7c	5.70E-02	C	1	1.6E-05	1	2.1E-02	5f	5.6E-02	5g
TRICHLOROETHYLENE (TCE)	79-01-6	5.0E-04	1	5.0E-04	1d	2.0E-03	1	2.0E-03	1j	5.00E-02	C-B2	1	5.0E-06	1	5.7E-04	5f	1.8E-02	5g
TRICHLOROPHENOL, 2,4,5-	95-95-4	1.0E-01	1	3.0E-01	6	3.5E-01	7b	1.0E+00	7b						2.9E-01	5f	0.0E+00	
TRICHLOROPHENOL 2,4,6-	88-06-2	1.0E-03	6	1.0E-02	6d	4.0E-03	7b	4.0E-02	7b	1.10E-02	B2	1	3.1E-06	1	1.1E-02	5f	1.1E-02	5g
VANADIUM	7440-62-2	9.0E-03	1	9.0E-03	1	1.0E-03	3	1.0E-03	7c						2.9E-04	5f	0.0E+00	
VINYL CHLORIDE	75-01-4	3.0E-03	1	3.0E-03	1d	1.0E-01	1	1.0E-01	7c	1.40E+00	A	1	8.8E-06	1	2.9E-02	5f	3.1E-02	5g
XYLENES (Mixed Isomers)	1330-20-7	2.0E-01	1	4.0E-01	6	1.0E-01	1	4.0E-01	6		D	1			1.1E-01	5f	0.0E+00	
ZINC	7440-66-6	3.0E-01	1	3.0E-01	2	1.4E-03	5b	1.4E-03	7c		D	1			4.0E-04	5f	0.0E+00	

		Relative Absorption Factors (RAFs)													
		Soil												Air	
		Chronic		Chronic		Subchronic		Subchronic		Cancer		Cancer		Subchronic	Cancer
OIL OR HAZARDOUS MATERIAL	CAS	Ingestion	Ref.	Dermal	Ref.	Ingestion	Ref.	Dermal	Ref.	Ingestion	Ref.	Dermal	Ref.	Inhalation	Inhalation
ACENAPHTHENE	83-32-9	0.3	9d	0.1	9d	0.3	9d	0.1	9d	NC		NC		1	
ACENAPHTHYLENE	208-96-8	0.3	9d	0.1	9d	0.3	9d	0.1	9d	NC		NC		1	
ACETONE	67-64-1	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
ALDRIN	309-00-2	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e	1	1
ANTHRACENE	120-12-7	0.3	9d	0.1	9d	0.3	9d	0.1	9d	NC		NC		1	
ANTIMONY	7440-36-0	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	
ARSENIC	7440-38-2	0.5	9e	0.03	9f	0.5	9e	0.03	9f	0.5	9e	0.03	9e	1	1
BARIUM	7440-39-3	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	
BENZENE	71-43-2	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
BENZO(a)ANTHRACENE	56-55-3	0.3	9d	0.02	9d	0.3	9d	0.02	9d	0.3	9d	0.02	9d	1	1
BENZO(a)PYRENE	50-32-8	0.3	9d	0.02	9d	0.3	9d	0.02	9d	0.3	9d	0.02	9d	1	1
BENZO(b)FLUORANTHENE	205-99-2	0.3	9d	0.02	9d	0.3	9d	0.02	9d	0.3	9d	0.02	9d	1	1
BENZO(g,h,i)PERYLENE	191-24-2	0.3	9d	0.1	9d	0.3	9d	0.1	9d	NC		NC		1	
BENZO(k)FLUORANTHENE	207-08-9	0.3	9d	0.02	9d	0.3	9e	0.02	9d	0.3	9d	0.02	9d	1	1
BERYLLIUM	7440-41-7	1	9e	0.1	9e	1	9e	0.1	9e	NC				1	1
BIPHENYL, 1,1-	92-52-4	1	9e	0.1	9e	1	9e	0.1	9e	1		0.1		1	
BIS(2-CHLOROETHYL)ETHER	111-44-4	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e		1
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9	1	9e	0.03	9e	1	9	0.03	9e	1	9e	0.03	9e	1	1
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e	1	1
BROMODICHLOROMETHANE	75-27-4	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
BROMOFORM	75-25-2	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
BROMOMETHANE	74-83-9	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
CADMIUM	7440-43-9	0.5	9g	0.01	9e	0.5	9g	0.01	9e	NC		NC		1	1
CARBON TETRACHLORIDE	56-23-5	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
CHLORDANE	12789-03-6	1	9e	0.04	9e	1	9e	0.04	9e	1	9e	0.04	9e	1	1
CHLOROANILINE, p-	106-47-8	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e	1	
CHLOROBENZENE	108-90-7	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
CHLOROFORM	67-66-3	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	1
CHLOROPHENOL, 2-	95-57-8	1	9e	0.3	9b	1	9e	0.3	9e	NC		NC		1	
CHROMIUM (TOTAL)	7440-47-3	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	1
CHROMIUM(III)	16065-83-1	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	
CHROMIUM(VI)	18540-29-9	1	9e	0.1	9e	1	9d	0.1	9e	NC		NC		1	1
CHRYSENE	218-01-9	0.3	9d	0.02	9d	0.3	9e	0.02	9d	0.3	9d	0.02	9d	1	1
CYANIDE	57-12-5	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	
DIBENZO(a,h)ANTHRACENE	53-70-3	0.3	9d	0.02	9d	0.3	9d	0.02	9d	0.3	9d	0.02	9d	1	1
DIBROMOCHLOROMETHANE	124-48-1	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
DICHLOROBENZENE, 1,2- (o-DCB)	95-50-1	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
DICHLOROBENZENE, 1,3- (m-DCB)	541-73-1	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
DICHLOROBENZENE, 1,4- (p-DCB)	106-46-7	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
DICHLOROBENZIDINE, 3,3'-	91-94-1	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e		1
DICHLORODIPHENYL DICHLOROETHANE,	72-54-8	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
DICHLORODIPHENYLDICHLOROETHYLEN	72-55-9	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
DICHLORODIPHENYLTRICHLOROETHANE,	50-29-3	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
DICHLOROETHANE, 1,1-	75-34-3	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
DICHLOROETHANE, 1,2-	107-06-2	1	9e	0.03	9e	1	9d	0.03	9e	1	9e	0.03	9e	1	1
DICHLOROETHYLENE, 1,1-	75-35-4	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
DICHLOROETHYLENE, CIS-1,2-	156-59-2	1	9e	0.03	9e	1	9d	0.03	9e	NC		NC		1	
DICHLOROETHYLENE, TRANS-1,2-	156-60-5	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
DICHLOROMETHANE	75-09-2	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
DICHLOROPHENOL, 2,4-	120-83-2	1	9e	0.3	9b	1	9e	0.3	9b	NC		NC		1	
DICHLOROPROPANE, 1,2-	78-87-5	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
DICHLOROPROPENE, 1,3-	542-75-6	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
DIELDRIN	60-57-1	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e	1	1
DIETHYL PHTHALATE	84-66-2	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	
DIMETHYL PHTHALATE	131-11-3	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	
DIMETHYLPHENOL, 2,4-	105-67-9	1	9e	0.3	9b	1	9e	0.3	9b	NC		NC		1	
DINITROPHENOL, 2,4-	51-28-5	1	9e	0.3	9b	1	9e	0.3	9b	NC		NC		1	
DINITROTOLUENE, 2,4-	121-14-2	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e	1	1
DIOXANE, 1,4-	123-91-1	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
ENDOSULFAN	115-29-7	1	9e	0.1	9e	1	9d	0.1	9e	NC		NC		1	
ENDRIN	72-20-8	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	
ETHYLBENZENE	100-41-4	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
ETHYLENE DIBROMIDE	106-93-4	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
FLUORANTHENE	206-44-0	0.3	9d	0.1	9d	0.3	9d	0.1	9d	NC		NC		1	
FLUORENE	86-73-7	0.3	9d	0.1	9d	0.3	9e	0.1	9d	NC		NC		1	
HEPTACHLOR	76-44-8	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e	1	1
HEPTACHLOR EPOXIDE	1024-57-3	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e	1	1
HEXACHLOROBENZENE	118-74-1	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e	1	1
HEXACHLOROBUTADIENE	87-68-3	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
HEXACHLOROCYCLOHEXANE, GAMMA (g	58-89-9	1	9e	0.04	9e	1	9e	0.04	9e	1	9e	0.04	9e	1	1
HEXACHLOROETHANE	67-72-1	1	9e	0.03	9c	1	9e	0.03	9e	1	9d	0.03	9e	1	1
HMX	2691-41-0	1	9	0.03	9	1	9	0.03	9	NC		NC		1	
INDENO(1,2,3-cd)PYRENE	193-39-5	0.3	9d	0.02	9d	0.3	9d	0.02	9d	0.3	9d	0.02	9d	1	1
LEAD	7439-92-1	0.5	9	0.006	9	0.5	9	0.006	9	NC		NC		1	
MERCURY	7439-97-6	0.5	9e	0.1	9e	0.5	9e	0.1	9e	NC		NC		1	
METHOXYCHLOR	72-43-5	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
METHYL ISOBUTYL KETONE (MIBK)	108-10-1	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
METHYL MERCURY	22967-92-6	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	
METHYL TERT BUTYL ETHER	1634-04-4	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
METHYLNAPHTHALENE, 2-	91-57-6	0.3	9d	0.1	9d	0.3	9d	0.1	9d	NC		NC		1	
NAPHTHALENE	91-20-3	0.3	9d	0.1	9d	0.3	9d	0.1	9d	NC		NC		1	
NICKEL	7440-02-0	1	9e	0.2	9e	1	9e	0.2	9e	NC		NC		1	1
N-NITROSODIMETHYLAMINE (NDMA)	62-75-9									1		0.2			1
PENTACHLOROPHENOL	87-86-5	1	9e	0.3	9e	1	9e	0.3	9c	1	9e	0.3	9c	1	1
PERCHLORATE	NA	1	9	0.1	9	1	9	0.1	9	NC		NC		1	
PETROLEUM HYDROCARBONS	NA														
Aliphatics C5 to C8	NA	1	9e	0.2	9e	1	9e	0.2	9e	NC		NC		1	
Aliphatics C9 to C12	NA	1	9e	0.2	9e	1	9e	0.2	9e	NC		NC		1	
Aliphatics C9 to C18	NA	1	9e	0.2	9e	1	9e	0.2	9e	NC		NC		1	
Aliphatics C19 to C36	NA	1	9e	0.2	9e	1	9e	0.2	9e	NC		NC			
Aromatics C9 to C10	NA	1	9e	0.2	9e	1	9e	0.2	9e	NC		NC		1	
Aromatics C11 to C22	NA	0.3	9d	0.1	9d	0.3	9d	0.1	9d	NC		NC		1	
PHENANTHRENE	85-01-8	0.3	9d	0.1	9d	0.3	9e	0.1	9d	NC		NC		1	
PHENOL	108-95-2	1	9e	0.3	9b	1	9e	0.3	9b	NC		NC		1	
POLYCHLORINATED BIPHENYLS (PCBs)	1336-36-3	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e	1	1
PYRENE	129-00-0	0.3	9d	0.1	9d	0.3	9d	0.1	9d	NC		NC		1	
RDX	121-82-4	1	9	0.02	9	1	9	0.02	9	1	9	0.02	9	1	1
SELENIUM	7782-49-2	1	9e	0.01	9e	1	9e	0.01	9e	NC		NC		1	
SILVER	7440-22-4	1	9e	0.3	9e	1	9e	0.3	9e	NC		NC		1	
STYRENE	100-42-5	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
TCDD, 2,3,7,8- (equivalents)	1746-01-6	1	9e	0.1	9e	1	9e	0.1	9e	1	9e	0.1	9e	1	1
TETRACHLOROETHANE, 1,1,1,2-	630-20-6	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
TETRACHLOROETHANE, 1,1,2,2-	79-34-5	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
TETRACHLOROETHYLENE (PCE)	127-18-4	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
THALLIUM	7440-28-0	1	9e	0.01	9e	1	9e	0.01	9e	NC		NC		1	
TOLUENE	108-88-3	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
TRICHLOROBENZENE, 1,2,4-	120-82-1	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
TRICHLOROETHANE, 1,1,1-	71-55-6	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
TRICHLOROETHANE, 1,1,2-	79-00-5	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
TRICHLOROETHYLENE (TCE)	79-01-6	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
TRICHLOROPHENOL, 2,4,5-	95-95-4	1	9e	0.3	9b	1	9e	0.3	9b	NC		NC		1	
TRICHLOROPHENOL 2,4,6-	88-06-2	1	9e	0.3	9b	1	9e	0.3	9b	1	9e	0.3	9b	1	1
VANADIUM	7440-62-2	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	
VINYL CHLORIDE	75-01-4	1	9e	0.03	9e	1	9e	0.03	9e	1	9e	0.03	9e	1	1
XYLENES (Mixed Isomers)	1330-20-7	1	9e	0.03	9e	1	9e	0.03	9e	NC		NC		1	
ZINC	7440-66-6	1	9e	0.1	9e	1	9e	0.1	9e	NC		NC		1	

1: Default values. If there is no Reference Concentration, a non-cancer inhalation RAF was not implied. If there is no Inhalation Unit Risk, a cancer inhalation RAF was not implied.

OIL OR HAZARDOUS MATERIAL	CAS	Relative Absorption Factors (RAFs)								Oral Absorption Efficiency Tox Study OAEnoncancer	Oral Absorption Efficiency Tox Study OAEcancer	Outside Effective Predictive Domain	Fraction Absorbed[1] FA
		Subchronic Ingestion	REF	Water Chronic Ingestion	REF	Cancer Ingestion	REF	Produce Noncancer Ingestion	Produce Cancer Ingestion				
ACENAPHTHENE	83-32-9	1	9	1	9					0.92	NC		1
ACENAPHTHYLENE	208-96-8	1	9	1	9					0.92	NC	*	1
ACETONE	67-64-1	1	9	1	9					1	NC		1
ALDRIN	309-00-2	1	9	1	9	1	9			0.8	0.8		1
ANTHRACENE	120-12-7	1	9	1	9	1	9			0.92	NC	*	1
ANTIMONY	7440-36-0	1	9	1	9					0.1	NC		1
ARSENIC	7440-38-2	1	9	1	9	1	9	1	1	0.95	0.95		1
BARIUM	7440-39-3	1	9	1	9					0.91	NC		1
BENZENE	71-43-2	1	9	1	9	1	9			1	1		1
BENZO(a)ANTHRACENE	56-55-3	1	9	1	9	1	9			0.92	0.92	*	1
BENZO(a)PYRENE	50-32-8	1	9	1	9	1	9			0.92	0.92	*	1
BENZO(b)FLUORANTHENE	205-99-2	1	9	1	9	1	9			0.92	0.92	*	1
BENZO(g,h,i)PERYLENE	191-24-2	1	9	1	9					0.92	NC	*	1
BENZO(k)FLUORANTHENE	207-08-9	1	9	1	9	1	9			0.92	0.92	*	1
BERYLLIUM	7440-41-7	1	9	1	9	1	9			0.01	0.01		1
BIPHENYL, 1,1-	92-52-4	1	9	1	9	1	9			1	1		1
BIS(2-CHLOROETHYL)ETHER	111-44-4	1	9	1	9	1	9			0.95	0.95		1
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9	1	9	1	9	1	9			0.95	0.95		1
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	1	9	1	9	1	9			1	1	*	0.6
BROMODICHLOROMETHANE	75-27-4	1	9	1	9	1	9			0.95	0.95		1
BROMOFORM	75-25-2	1	9	1	9	1	9			0.9	0.9		1
BROMOMETHANE	74-83-9	1	9	1	9					0.97	NC		1
CADMIUM	7440-43-9	1	9	1	9			1		0.07	NC		1
CARBON TETRACHLORIDE	56-23-5	1	9	1	9	1	9			1	1		1
CHLORDANE	12789-03-6	1	9	1	9	1	9	0.91	1	0.8	0.8	*	0.7
CHLOROANILINE, p-	106-47-8	1	9	1	9	1	9			1	1		1
CHLOROBENZENE	108-90-7	1	9	1	9					1	NC		1
CHLOROFORM	67-66-3	1	9	1	9					1	1		1
CHLOROPHENOL, 2-	95-57-8	1	9	1	9					1	NC		1
CHROMIUM (TOTAL)	7440-47-3	1	9	1	9			1		0.11	NC		1
CHROMIUM(III)	16065-83-1	1	9	1	9			1		0.26	NC		1
CHROMIUM(VI)	18540-29-9	1	9	1	9			1		0.11	NC		1
CHRYSENE	218-01-9	1	9	1	9	1	9			0.82	0.92	*	1
CYANIDE	57-12-5	1	9	1	9					1	NC		1
DIBENZO(a,h)ANTHRACENE	53-70-3	1	9	1	9	1	9			0.92	0.92	*	0.6
DIBROMOCHLOROMETHANE	124-48-1	1	9	1	9	1	9			0.98	0.98		1
DICHLOROBENZENE, 1,2- (o-DCB)	95-50-1	1	9	1	9					1	NC		1
DICHLOROBENZENE, 1,3- (m-DCB)	541-73-1	1	9	1	9					1	NC		1
DICHLOROBENZENE, 1,4- (p-DCB)	106-46-7	1	9	1	9	1	9			1	1		1
DICHLOROBENZIDINE, 3,3'-	91-94-1	1	9	1	9	1	9			0.9	0.9		1
DICHLORODIPHENYL DICHLOROETHANE, P,P'- (DDD)	72-54-8	1	9	1	9	1	9			0.8	0.8	*	0.8
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'- (DDE)	72-55-9	1	9	1	9	1	9			0.9	0.8	*	0.8
DICHLORODIPHENYLTRICHLOROETHANE, P,P'- (DDT)	50-29-3	1	9	1	9	1	9			0.9	0.8	*	0.7
DICHLOROETHANE, 1,1-	75-34-3	1	9	1	9					0.75	NC		1
DICHLOROETHANE, 1,2-	107-06-2	1	9	1	9	1	9			1	1		1
DICHLOROETHYLENE, 1,1-	75-35-4	1	9	1	9					1	0.95		1
DICHLOROETHYLENE, CIS-1,2-	156-59-2	1	9	1	9					0.84	NC		1
DICHLOROETHYLENE, TRANS-1,2-	156-60-5	1	9	1	9					0.84	NC		1
DICHLOROMETHANE	75-09-2	1	9	1	9	1	9			1	1		1
DICHLOROPHENOL, 2,4-	120-83-2	1	9	1	9					1	NC		1
DICHLOROPROPANE, 1,2-	78-87-5	1	9	1	9	1	9			1	1		1
DICHLOROPROPENE, 1,3-	542-75-6	1	9	1	9	1	9			1	1		1
DIELDRIN	60-57-1	1	9	1	9	1	9			0.8	0.8	*	0.8
DIETHYL PHTHALATE	84-66-2	1	9	1	9					1	NC		1
DIMETHYL PHTHALATE	131-11-3	1	9	1	9					1	NC		1
DIMETHYLPHENOL, 2,4-	105-67-9	1	9	1	9					1	NC		1
DINITROPHENOL, 2,4-	51-28-5	1	9	1	9					1	NC		1
DINITROTOLUENE, 2,4-	121-14-2	1	9	1	9	1	9			0.9	0.9		1
DIOXANE, 1,4-	123-91-1	1	9	1	9	1	9			1	1		1
ENDOSULFAN	115-29-7	1	9	1	9					1	NC	*	1
ENDRIN	72-20-8	1	9	1	9					0.8	NC	*	0.8
ETHYLBENZENE	100-41-4	1	9	1	9					1	NC		1
ETHYLENE DIBROMIDE	106-93-4	1	9	1	9	1	9			1	1		1
FLUORANTHENE	206-44-0	1	9	1	9					0.92	NC	*	1
FLUORENE	86-73-7	1	9	1	9					0.92	NC	*	1
HEPTACHLOR	76-44-8	1	9	1	9	1	9			0.65	0.65	*	0.5
HEPTACHLOR EPOXIDE	1024-57-3	1	9	1	9	1	9			0.65	0.65	*	1
HEXACHLOROBENZENE	118-74-1	1	9	1	9	1	9			0.8	0.8	*	0.9
HEXACHLOROBUTADIENE	87-68-3	1	9	1	9	1	9			1	1	*	0.9
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	58-89-9	1	9	1	9	1	9			1	1		0.9
HEXACHLOROETHANE	67-72-1	1	9	1	9	1	9			1	1		1
HMX	2691-41-0	1	9	1	9					0.3	NC		1
INDENO(1,2,3-cd)PYRENE	193-39-5	1	9	1	9	1	9			0.92	0.92	*	0.5
LEAD	7439-92-1	1	9	1	9			0.5		0.5	NC		1
MERCURY	7439-97-6	1	9	1	9					0.95	NC		1
METHOXYCHLOR	72-43-5	1	9	1	9					1	NC	*	1
METHYL ETHYL KETONE	78-93-3	1	9	1	9					1	NC		1
METHYL ISOBUTYL KETONE	108-10-1	1	9	1	9					1	NC		1
METHYL MERCURY	22967-92-6	1	9	1	9					0.95	NC		1
METHYL TERT BUTYL ETHER	1634-04-4	1	9	1	9					1			1
METHYLNAPHTHALENE, 2-	91-57-6	1	9	1	9					0.92	NC		1
NAPHTHALENE	91-20-3	1	9	1	9					0.92	NC		1
NICKEL	7440-02-0	1	9	1	9			1		0.1	NC		1
N-NITROSODIMETHYLAMINE (NDMA)	62-75-9					1					1		1
PENTACHLOROPHENOL	87-86-5	1	9	1	9	1	9			0.9	0.9	*	0.9
PERCHLORATE	NA	1	9	1	9			1		1			1
PETROLEUM HYDROCARBONS	NA												
ALIPHATICS C5 to C8	NA	1	9	1	9					1	NC		1
ALIPHATICS C9 to C12	NA	1	9	1	9					1	NC	*	1
ALIPHATICS C9 to C18	NA	1	9	1	9					1	NC	*	1
ALIPHATICS C19 to C35	NA	1	9	1	9					1	NC	*	1
AROMATICS C9 to C10	NA	1	9	1	9					0.92	NC		1
AROMATICS C11 to C22	NA	1	9	1	9					0.92	NC	*	1
PHENANTHRENE	85-01-8	1	9	1	9					0.92	NC	*	1
PHENOL	108-95-2	1	9	1	9					1	NC		1
POLYCHLORINATED BIPHENYLS (PCBs)	1336-36-3	1	9	1	9	1	9	1	1	0.89	0.89	*	0.5
PYRENE	129-00-0	1	9	1	9					0.92	NC	*	1
RDX	121-82-4	1	9	1	9	1	9			1	1		1
SELENIUM	7782-49-2	1	9	1	9					0.8	NC		1
SILVER	7440-22-4	1	9	1	9					0.04	NC		1
STYRENE	100-42-5	1	9	1	9	1	9			1	1		1
TCDD, 2,3,7,8- (equivalents)	1746-01-6	1	9	1	9	1	9			1	1	*	0.5
TETRACHLOROETHANE, 1,1,1,2-	630-20-6	1	9	1	9	1	9			0.7	0.7		1
TETRACHLOROETHANE, 1,1,2,2-	79-34-5	1	9	1	9	1	9			1	0.7		1
TETRACHLOROETHYLENE	127-18-4	1	9	1	9	1	9			1	1		1
THALLIUM	7440-28-0	1	9	1	9	1	9			1	NC		1
TOLUENE	108-88-3	1	9	1	9					1	NC		1
TRICHLOROBENZENE, 1,2,4-	120-82-1	1	9	1	9	1	9			1	NC		1
TRICHLOROETHANE, 1,1,1-	71-55-6	1	9	1	9					1	NC		1
TRICHLOROETHANE, 1,1,2-	79-00-5	1	9	1	9	1	9			1	1		1
TRICHLOROETHYLENE	79-01-6	1	9	1	9	1	9			1	1		1
TRICHLOROPHENOL, 2,4,5-	95-95-4	1	9	1	9	1	9			1	NC		1
TRICHLOROPHENOL 2,4,6-	88-06-2	1	9	1	9	1	9			1	1		1
VANADIUM	7440-62-2	1	9	1	9					0.05	NC		1
VINYL CHLORIDE	75-01-4	1	9	1	9	1	9			0.95	0.64		1
XYLENES (Mixed Isomers)	1330-20-7	1	9	1	9					1	NC		1
ZINC	7440-66-6	1	9	1	9			1		0.45	NC		1

[1] U.S. EPA (2001) Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual
(Part E, Supplemental Guidance for Dermal Risk Assessment) Interim (http://www.epa.gov/superfund/programs/risk/ragse/). Appendix B (Exhibit B-3).

OIL OR HAZARDOUS MATERIAL	CAS #	Molecular Weight g/mole	log K_{ow}	Permeability Coefficient Kp^1 cm/hr	Henry's Law Constant HLC atm-m³/mol	Metal	Plant Uptake Factor Kxp mg-soil/kg-plant	Outside Effective Predictive Domain	Diffusivity in air, Da (cm^2/s)	REF	Diffusivity in water, Dw (cm^2/s)	REF
Acenaphthene	83-32-9	154	3.92	8.410E-02	1.84E-04				4.21E-02	17	7.69E-06	17
Acenaphthylene	208-96-8	154	4.07	1.056E-01	1.14E-04			*	4.39E-02	29	7.07E-06	30
Acetone	67-64-1	58	-0.24	5.210E-04	3.97E-05				1.24E-01	17	1.14E-05	17
Aldrin	309-00-2	365	3.01	1.389E-03	4.40E-05				1.32E-02	17	4.86E-06	17
Anthracene	120-12-7	178	4.55	1.660E-01	5.56E-05			*	3.24E-02	17	7.74E-06	17
Antimony	7440-36-0	122		1.000E-03		yes						
Arsenic	7440-38-2	75		1.000E-03		yes	0.05					
Barium	7440-39-3	137		1.000E-03		yes						
Benzene	71-43-2	78	2.13	1.476E-02	5.55E-03				8.80E-02	17	9.80E-06	17
Benzo(a)anthracene	56-55-3	228	5.66	4.558E-01	1.20E-05			*	3.10E-02	17	9.00E-06	17
Benzo(a)pyrene	50-32-8	252	6.1	6.528E-01	4.57E-07			*	4.30E-02	17	9.00E-06	17
Benzo(b)fluoranthene	205-99-2	252	6.12	6.730E-01	6.57E-07			*	2.26E-02	17	5.56E-06	17
Benzo(g,h,i)perylene	191-24-2	276	6.51	8.933E-01	3.31E-07			*	4.90E-02	29	5.65E-05	30
Benzo(k)fluoranthene	207-08-9	252	6.06	6.143E-01	5.84E-07			*	2.26E-02	17	5.56E-06	17
Beryllium	7440-41-7	9		1.000E-03		yes						
Biphenyl, 1,1-	92-52-4	154	4.09	1.089E-01	3.03E-04				5.73E-02	29	6.71E-06	30
Bis(2-chloroethyl)ether	111-44-4	143	1.29	1.781E-03	1.70E-05				6.92E-02	29	7.53E-06	30
Bis(2-chloroisopropyl)ether	39638-32-9	171	2.1	4.250E-03	3.32E-04				6.00E-02	17	6.40E-06	17
Bis(2-ethylhexyl)phthalate	117-81-7	391	5.11	2.415E-02	2.70E-07			*	3.51E-02	17	3.66E-06	17
Bromodichloromethane	75-27-4	164	2.09	4.581E-03	2.12E-03				2.98E-02	17	1.06E-05	17
Bromoform	75-25-2	253	2.37	2.225E-03	5.35E-04				1.49E-02	17	1.03E-05	17
Bromomethane	74-83-9	95			7.34E-03				7.28E-02	17	1.21E-05	17
1,3 Butadiene					3.00E+00				2.49E-01	31	1.08E-05	31
Cadmium	7440-43-9	112		1.000E-03		yes	1.9					
Carbon tetrachloride	56-23-5	154	2.83	1.605E-02	2.76E-02				7.80E-02	17	8.80E-06	17
Chlordane	12789-03-6	410	5.54	3.634E-02	7.03E-05		11	*	1.18E-02	17	4.37E-06	17
Chloroaniline, p-	106-47-8	128	1.85	5.061E-03	1.16E-06				4.83E-02	17	1.01E-05	17
Chlorobenzene	108-90-7	113	2.84	2.764E-02	3.11E-03				7.30E-02	17	8.70E-06	17
Chloroform	67-66-3	119	1.97	6.820E-03	3.67E-03				1.04E-01	17	1.00E-05	17
Chlorophenol, 2-	95-57-8	129	2.16	8.002E-03	1.12E-05				5.01E-02	17	9.46E-06	17
Chromium (total)	7440-47-3	52		2.000E-03		yes	0.093					
Chromium(III)	16065-83-1	52		1.000E-03		yes	0.095					
Chromium(VI)	18540-29-9	52		2.000E-03		yes	0.095					
Chrysene	218-01-9	228	5.66	4.338E-01	5.23E-06			*	2.48E-02	17	6.21E-06	17
Cyanide	57-12-5	27		1.000E-03	2.42E-02	yes						
Dibenzo(a,h)anthracene	53-70-3	278	6.84	1.437E+00	1.23E-07			*	2.02E-02	17	5.18E-06	17
Dibromochloromethane	124-48-1	208	2.17	2.934E-03	7.83E-04				1.96E-02	17	1.05E-05	17
Dichlorobenzene, 1,2- (o-DCB)	95-50-1	147	3.38	4.051E-02	1.92E-03				6.90E-02	17	7.90E-06	17
Dichlorobenzene, 1,3- (m-DCB)	541-73-1	147	3.6	5.660E-02	2.63E-03				6.80E-02	17	8.13E-06	17
Dichlorobenzene, 1,4- (p-DCB)	106-46-7	147	3.39	4.113E-02	2.41E-03				6.90E-02	17	7.90E-06	17
Dichlorobenzidine, 3,3'-	91-94-1	253	3.51	1.258E-02	2.84E-11				1.94E-02	17	6.74E-06	17
DDD	72-54-8	320	5.8	1.722E-01	6.60E-06			*	1.69E-02	17	4.76E-06	17
DDE	72-55-9	318	5.69	1.495E-01	4.16E-05			*	1.44E-02	17	5.87E-06	17
DDT	50-29-3	354	6.36	2.601E+01	8.32E-06			*	1.37E-02	17	4.95E-06	17
Dichloroethane, 1,1-	75-34-3	99	1.79	6.714E-03	5.62E-03				7.42E-02	17	1.05E-05	17
Dichloroethane, 1,2-	107-06-2	99	1.48	4.192E-03	1.18E-03				1.04E-01	17	9.90E-06	17
Dichloroethylene, 1,1-	75-35-4	97	2.13	1.155E-02	2.61E-02				9.00E-02	17	1.04E-05	17
Dichloroethylene, cis-1,2-	156-59-2	97	1.86	7.663E-03	4.08E-03				7.36E-02	17	1.13E-05	17
Dichloroethylene, trans-1,2-	156-60-5	97	1.86	7.663E-03	9.38E-03				7.07E-02	17	1.19E-05	17
Dichloromethane	75-09-2	85	1.25	3.540E-03	3.25E-03				1.01E-01	17	1.17E-05	17
Dichlorophenol, 2,4-	120-83-2	163	2.92	1.638E-02	5.51E-06				3.46E-02	17	8.77E-06	17
Dichloropropane, 1,2-	78-87-5	113	2	7.713E-03	2.82E-03				7.82E-02	17	8.73E-06	17
Dichloropropene, 1,3-	542-75-6	111	1.6	4.309E-03	3.55E-03				6.26E-02	17	1.00E-05	17
Dieldrin	60-57-1	381	4.56	1.191E-02	1.00E-05			*	1.25E-02	17	4.74E-06	17
Diethyl phthalate	84-66-2	222	2.47	3.864E-03	6.10E-07				2.56E-02	17	6.35E-06	17
Dimethyl phthalate	131-11-3	194	1.56	1.391E-03	1.97E-07				5.68E-02	29	6.30E-06	30
Dimethylphenol, 2,4-	105-67-9	122	2.3	1.083E-02	9.51E-07				5.84E-02	17	8.69E-06	17
Dinitrophenol, 2,4-	51-28-5	184	1.55	1.558E-03	8.60E-08				2.73E-02	17	9.06E-06	17
Dinitrotoluene, 2,4-	121-14-2	182	1.98	3.073E-03	5.40E-08				2.03E-01	17	7.06E-06	17
Dioxane, 1,4-	123-91-1	88	-0.32	3.133E-04	4.80E-06				2.30E-01	29	1.00E-05	30
Endosulfan	115-29-7	407	4.1	4.234E-03	6.50E-05			*	1.15E-02	17	4.55E-06	17
Endrin	72-20-8	381	4.56	1.191E-02	6.36E-06			*	1.25E-02	17	4.74E-06	17
Ethylbenzene	100-41-4	106	3.15	4.846E-02	7.88E-03				7.50E-02	17	7.80E-06	17
Ethylene dibromide	106-93-4	188	1.96	2.759E-03	6.50E-04				2.17E-02	29	1.90E-05	30
Fluoranthene	206-44-0	202	4.95	2.167E-01	8.86E-06			*	3.02E-02	17	6.35E-06	17
Fluorene	86-73-7	166	4.21	1.119E-01	9.62E-05			*	3.63E-02	17	7.88E-06	17
Heptachlor	76-44-8	374	4.27	8.391E-03	2.94E-04			*	1.12E-02	17	5.69E-06	17
Heptachlor epoxide	1024-57-3	389	5	2.097E-02	2.10E-05			*	1.32E-02	17	4.23E-06	17
Hexachlorobenzene	118-74-1	285	5.31	1.284E-01	1.70E-03			*	5.42E-02	17	5.91E-06	17
Hexachlorobutadiene	87-68-3	261	4.78	7.820E-02	1.03E-02			*	5.61E-02	17	6.16E-06	17
gamma-HCH	58-89-9	291	3.73	1.077E-02	5.14E-06				1.42E-02	17	7.34E-06	17
Hexachloroethane	67-72-1	237	3.93	2.928E-02	3.89E-03				2.50E-02	17	6.80E-06	17
Hmx	2691-41-0	296.2	0.26	5.163E-05	8.67E-10				4.30E-02	29	4.95E-06	30
Indeno(1,2,3-cd)pyrene	193-39-5	276	6.58	9.936E-01	3.48E-07			*	1.90E-02	17	5.66E-06	17
Lead	7439-92-1	207		1.000E-04		yes	0.15					
Mercury	7439-97-6	201		1.000E-03		yes			3.07E-02	17	6.30E-06	17
Methoxychlor	72-43-5	346	5.08	4.123E-02	2.03E-07			*	1.56E-02	17	4.46E-06	17
Methyl ethyl ketone (2-Butanone)	78-93-3	72	0.29	9.732E-04	5.69E-05				8.08E-02	29	9.80E-06	30
Methyl isobutyl ketone (MIBK)	108-10-1	100	1.19	2.663E-03	1.38E-04				7.50E-02	29	7.80E-06	30
Methyl mercury	22967-92-6	231		1.000E-03		yes			5.30E-02	29	6.10E-06	30
Methyl tert butyl ether	1634-04-4	88	1.05	2.513E-03	5.87E-04				2.37E-02	29	8.63E-06	30
Methylnaphthalene, 2-	91-57-6	142	3.86	8.962E-02	5.18E-04				6.29E-02	29	7.20E-06	30
Naphthalene	91-20-3	128	3.3	4.584E-02	4.40E-04				5.90E-02	17	7.50E-06	17
Nickel	7440-02-0	59		2.000E-04		yes	0.38					
N-nitrosodimethylamine (NDMA)	62-75-9	74.0822	-0.57	2.564E-04	1.82E-06				1.13E-01	18b	1.24E-05	18b
Pentachlorophenol	87-86-5	266	5.86	3.784E-01	2.45E-08			*	5.60E-02	17	6.10E-06	17
Perchlorate	NA			0.000E+00								
Petroleum hydrocarbons	NA											
Aliphatics C5 to C8	NA	93	3.85	1.660E-01	1.29E				8.00E-02		1.00E-06	17
Aliphatics C9 to C12	NA	149	5.52	1.020E+00	1.56			*	7.00E-02		1.00E-06	17
Aliphatics C9 to C18	NA	170	5.94	1.474E+00	1.656			*	7.00E-02		5.00E-06	17
Aliphatics C19 to C36	NA		11	0.000E+00				*				
Aromatics C9 to C10	NA	120	3.93	1.324E-01	0.00792				7.00E-02		1.00E-06	17
Aromatics C11 to C22	NA	150	5.09	5.241E-01	0.00072			*	6.00E-02		1.00E-06	17
Phenanthrene	85-01-8	178	4.46	1.402E-01	4.23E-05			*	3.33E-02	29	7.47E-06	30
Phenol	108-95-2	94	1.46	4.337E-03	3.33E-07				8.20E-02	17	9.10E-06	17
Polychlorinated biphenyls (PCBs)	1336-36-3	328	6.72	6.286E-01	4.15E-04		0.84	*	1.38E-02	29	4.32E-06	30
Pyrene	129-00-0	202	5.11	2.763E-01	1.19E-05			*	2.72E-02	17	7.24E-06	17
Rdx	121-82-4	222.26	0.87	3.385E-04	6.32E-08				5.20E-02	29	6.00E-06	30
Selenium	7782-49-2	79		1.000E-03		yes						
Silver	7440-22-4	108		6.000E-04		yes						
Styrene	100-42-5	104	2.95	3.669E-02	2.75E-03				7.10E-02	17	8.00E-06	17
TCDD, 2,3,7,8- (equivalents)	1746-01-6	322	6.8	7.670E-01	5.00E-05			*	4.70E-02	17	8.00E-06	17
Tetrachloroethane, 1,1,1,2-	630-20-6	168	3.03	1.816E-02	2.45E-03				7.10E-02	29	7.90E-06	30
Tetrachloroethane, 1,1,2,2-	79-34-5	168	2.39	6.864E-03	3.67E-04				7.10E-02	17	7.90E-06	17
Tetrachloroethylene (PCE)	127-18-4	166	3.4	3.269E-02	1.77E-02				7.20E-02	17	8.20E-06	17
Thallium	7440-28-0	204		1.000E-03		yes						
Toluene	108-88-3	92	2.73	3.066E-02	6.64E-03				8.70E-02	17	8.60E-06	17
Trichlorobenzene, 1,2,4-	120-82-1	181	3.98	6.504E-02	1.42E-03				7.80E-02	17	8.80E-06	17
Trichloroethane, 1,1,1-	71-55-6	133	2.49	1.253E-02	1.72E-02				7.80E-02	17	8.80E-06	17
Trichloroethane, 1,1,2-	79-00-5	133	2.05	6.430E-03	8.24E-04				7.80E-02	17	8.80E-06	17
Trichloroethylene (TCE)	79-01-6	131	2.42	1.158E-02	9.85E-03				7.90E-02	17	9.10E-06	17
Trichlorophenol, 2,4,5-	95-95-4	197	3.9	4.686E-02	1.62E-06				2.91E-02	17	7.03E-06	17
Trichlorophenol 2,4,6-	88-06-2	197	3.69	3.402E-02	2.60E-06				3.18E-02	17	6.25E-06	17
Vanadium	7440-62-2	51		1.000E-03		yes						
Vinyl chloride	75-01-4	63	1.36	5.556E-03	2.78E-02				1.06E-01	17	1.23E-05	17
Xylenes (mixed isomers)	1330-20-7	106	3.2	5.229E-02	6.63E-03				7.69E-02	17	8.44E-06	17
Zinc	7440-66-6	65		6.000E-04		yes	1.5					

[1] U.S. EPA (2001) Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual
(Part E, Supplemental Guidance for Dermal Risk Assessment) Interim (http://www.epa.gov/superfund/programs/risk/ragse/). Chapter 3 for metals, Appendix B (Exhibit B-2) for organics.

References used in calculating Method 3 Risk

Reference #	Description
	Toxicity Values
1	USEPA, Integrated Risk Information System (IRIS). Current as of May 2012.
1a	The oral cancer slope factor for a mix of 2,4- and 2,6- Dinitrotoluene (from IRIS) has been used as the cancer slope factor equivalent for pure 2,4-Dinitrotoluene.
1b	The chronic oral RfD for 1,2-Dichlorobenzene has been used as the chronic oral RfD equivalent for 1,3-Dichlorobenzene and 1,4-Dichlorobenzene.
1c	IRIS lists two oral RfDs for cadmium, one for food and one for water exposure. The more conservative is used.
1d	The chronic oral RfD (from IRIS) has been used here as a subchronic oral RfD equivalent.
1e	The IRIS Oral Cancer Slope Factor for benzo(a)pyrene is the basis for the Oral Cancer Slope Factor applied to the seven PAH compounds which are designated as category A, B1, B2 or C carcinogens.
1f	This Inhalation Unit Risk was withdrawn from IRIS. MassDEP continues to use it pending new information.
1g	The chronic oral Reference Dose for DDT has been adopted for DDD and DDE as well.
1h	The IRIS chronic RfC for Cr VI was used for CR III.
1i	The subchronic RfD is based upon the subchronic toxicity data that is the basis of the chronic RfD presented in the IRIS file.
1j	The subchronic RfC is set equal to the chronic RfC based on information in the IRIS file.
1k	The subchronic RfC is based upon the subchronic toxicity data that is the basis of the chronic RfC presented in the IRIS file.
1l	This value is presented in IRIS as the Oral Cancer Slope Factor that would result from including leukemia data in the development of the value.
1m	The chronic and subchronic RfCs for 1,4-Dichlorobenze are used for 1,2- and 1,3- Dichlorobenzene.
2	USEPA Health Effects Assessment Summary Tables (HEAST), Annual FY-1996.
2a	This subchronic oral RfD (from HEAST) for 1,2-Dichlorobenzene has been used as the subchronic oral RfD equivalent for 1,3- and 1,4- Dichlorobenzene.
2b	The subchronic RfC is based upon the subchronic toxicity data that is the basis of the chronic RfC presented in HEAST.
2c	This Cancer Slope Factor or Unit Risk was taken from a fact sheet distributed by the USEPA Superfund Health Risk Technical Support Center at ECAO-Cincinnati, current as of September 2, 1992.
2d	This value has been withdrawn from HEAST, MassDEP continues to use it pending new information.
2e	From Table 2 of HEAST. Values in Table 2 were calculated by an alternative method.
2f	The chronic Reference Concentration for 1,2-dichlorobenzene has been used for 1,3 dichlorobenzene.
2g	The subchronic oral RfD for DDT has been adopted for DDE and DDD as well.
3	MassDEP Chemical Health Effects Assessment Methodology and Method to Derive Allowable Ambient Limits (CHEM/AAL) http://www.mass.gov/dep/toxics/stypes/telaal.htm
4	Developed for the Risk Assessment ShortForm - Residential Scenario (MassDEP, 1992) by MassDEP staff. Documentation of this value may be found in Appendix D of that document.
5a	The chronic and subchronic RfDs for MTBE were developed by MassDEP ORS Air/Water Toxics staff. See http://www.mass.gov/dep/water/drinking/standards/mtbe.htm
5b	The RfCs for silver, thallium, and zinc were developed by MassDEP ORS Air/Water Toxics staff.
5c	Final Updated Petroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology. See: http://www.mass.gov/dep/cleanup/laws/tphtox03.doc
5d	Toxicity values for PAHs are consistent with the approach presented in "Updated Petroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology" MassDEP 2003 and Characterizing Risks Posed by Petroleum Contaminated Sites MassDEP 2002.
5e	MassDEP (2006) Perchlorate Toxicological Profile And Health Assessment. (http://www.mass.gov/dep/toxics/perchlorate-toxicity-061206.pdf)
5f	Conversion of the chronic or subchronic Reference Concentration to an inhalation Reference Dose using the equation: RfC x Ventilation Rate/ Body Weight (RfC x V) / BW = (RfC x 20 m3/day) / 70 kg
5g	Conversion of the Inhalation Unit Risk Factor to an Inhalation Cancer Slope Factor using the equation: URF x Conversion Factor x Body Weight / Ventilation Rate (URF x CF x V) / BW = (URF x 1000 x 20 m^3/day) / 70 kg
6	PPRTVs
6a	The chronic values is set equal to the PPRTV subchronic value.
6b	Value used in USEPA Drinking Water Program and cited in PPRTV documentation.
6c	PPRTV Screening Value
6d	This subchronic value is from the subchronic study on which the chronic RfD is based.
7a	Conversion of the oral Cancer Slope Factor to the inhalation Unit Risk, using the equation: Slope Factor x Ventilation Rate x Constant / Body Weight (CSF x V x C)/BW = (CSF x 20 m3/day x 0.001 mg/µg) / 70 kg
7b	Conversion of the oral Reference Dose to a Reference Concentration, using the equation: RfD x BW / Ventilation Rate RfC= (RfD x 70 kg) / 20 m3/day
7c	The Subchronic Inhalation Reference Concentration for this chemical is taken to be equal to the chronic value, absent clear chemical-specific information justifying a higher value..
	RAFs
9	MassDEP 2012 RAF Review. Unless specified otherwise, due to data limitations and consistent with the approach in Ontario Ministry of the Environment (2011 - for full reference see note 48e), a default RAF of 1 was chosen for all organic compounds for oral ingestion of contaminated soil and water.
9a	MassDEP 2012 RAF Review - Dermal RAFs for dioxins, furans, and PCBs consider data presented in: Brewster DW, Banks YB, Clark AM and Birbaum LS. (1998). Comparative Dermal Absorption of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Three Polychlorinated Dibenzofurans. Toxicol Appl Pharacol 97(1):156-166. Mayes BA, Brown GL, Mondello FJ, Holtzclaw KW, Hamilton SB, Ramsey AA. (2002).Dermal Absorption in Rhesus Monkeys of Polychlorinated Biphenyls from Soil Contaminated With Aroclor 1260. Regul Toxicol Pharmacol 35(3):289-295. Roy TA, Hammerstron AK and Schaum J. (2006). Percutaneous Absorption of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) from Soil. J. Toxicol Environ Health, Part A: Current Issues: 1509-1515. Wester RC, Maibach HI, Sedik L, Melendres J, and Wade M. (1993). Percutaneous Absorption of PCBs from Soil: In-vivo Rhesus Monkey, In-vitro Human Skin, and Binding to Powered Human Stratum Corneum. J. Toxicol. Environ. Health 39:375-382. Absorption of these compounds from soil with high to low organic content has been reported to range from less than 1% to over 10%. In light of the variability in the reported dermal absorption values and study characteristics, a default value of 0.1 was selected, which is toward the high end of the reported values.
9b	MassDEP 2012 RAF Review - RAFs for phenols consider data presented in Baranowska-Dutkiewicz, B. (1981) Skin absorption of phenol from aqueous solutions in men. Int. Arch. Environ. Health 49:99-104
9c	MassDEP 2012 RAF Review - Pentachlorophenol RAFs consider data presented in Baranowska-Dutkiewicz 1981 (see note 48b), OME 2011 (see note 48e), and USEPA 2004 (see note 48a
9d	MassDEP 2012 RAF Review - Based on Magee B, Andersen P and Burmaster. (1996). Absorption Adjustment Factor (AAF) Distributions for Polycyclic Aromatic Hydrocarbons (PAHs). Human and Ecological Risk Assessment 2:841-873.
9e	MassDEP 2012 RAF Review - Based on Ontario Ministry of the Environment (2011). Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in

References used in calculating Method 3 Risk

Reference #	Description
	Toxicity Values
	Ontario (April 15, 2011, Standards Development Branch, Ontario Ministry of the Environment (see Section 2.6, Development of Relative Absorption Factors, pp 61-67 and Table 2.35b Estimation of Dermal Relative Absorption Factors (RAFs) PP 120- 141) http://www.ene.gov.on.ca/environment/en/resources/STDPROD_081485.html; Accessed March 22, 2012.
9f	MassDEP 2012 RAF Review - Based on USEPA (2004). Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual Part E, Supplemental Guidance for Dermal Risk Assessment.
	PQLs
10a	PQLs from the Guide to Environmental Analytical Methods, Robert E. Wagner, editor; Genium Publishing Corporation, Schenectady, NY; 1992.
10b	PQLs from USEPA Test Methods for Evaluating Solid Waste, SW-846, Third Edition (Revision O), November 1986.
10c	PQL from USEPA Method 1613.
10d	PQL from Standard Methods for the Examination of Water and Wastewater, 17th edition; Water Environment Federation.
10e	The PQL for 1,4 Dioxane is cited in the documentation for the Massachusetts Drinking Water Guideline for 1,4-dioxane and is the LCMRL (Lowest Concentration Minimum Reporting Level) . Set in 2012 when the ORSGL was changed. Note that US EPA has replaced the term PQL (practical Quantitation Limit) with LCMRL. Analytical Methods that can achieve this concentration are U.S.EPA Method 522, Modified SW-846 8260 SIM, and Modified SW-846 8270 SIM. See http://www.mass.gov/dep/water/drinking/standards/14dioxan.htm
10f	The PQL for Perchlorate is cited in the documentation for the Massachusetts Drinking Water Guidelines and is based on U.S. EPA Method 314.0, revision 1.0 (U.S. EPA, 1999b) See http://www.mass.gov/dep/water/drinking/standards/perchlor.htm
10g	PQL from MassDEP WSC Memorandum #99-145 "PRESERVATION TECHNIQUES FOR VOLATILE ORGANIC COMPOUND (VOC) SOIL SAMPLE ANALYSES" using methanol preservation techniques.
	Chemical Characteristics and Physical Constants
11	Chemical constants from United States Environmental Protection Agency (USEPA), 1986. "Superfund Public Health Evaluation Manual"; U.S. Environmental Protection Agency; Office of Emergency and Remedial Response, EPA/540/1-86/060 (OSWER Directive 9285.4-1); Washington, D.C., Oct
12	Chemical and physical constants from U.S. Department of Defense, 1989
13	Chemical and physical constants from ATSDR, Toxicological Profiles for specific chemicals. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service.
14	Log Kow based on USEPA Draft Health Advisory for Methyl t-Butyl Ether, 1989.
15	Molecular Weights from Risk Reduction Engineering Laboratory (RREL) Treatability Database, Version 4.0.
16	OSHA Documentation of TLV -TWA
17	Chemical Constants from USEPA Soil Screening (SSL) Guidance: Technical Background Document, EPA/540/R95/128, May 1996
17a	Measured Koc (from the SSL Guidance), Table 39
17b	Calculated Koc (from the SSL Guidance), Table 39
18a	Average Kow for all constituents in fraction. Kows from "Selection of Representative TPH Fractions Based on Fate and Transport Considerations", Total Petroleum Hydrocarbon Criteria Working Group Series, Volume 3, July 1997.
18b	Chemical constants consistent with the approach presented in "Updated Petroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology" MassDEP 2003 and Characterizing Risks Posed by Petroleum Contaminated Sites MassDEP 2002.
19	Chemical constants from Texas NRCC document for soil standards
20	Chemical Constants from Training Workshop for Massachusetts Certified Laboratories - Handout Material - MassDEP Division of Environmental Analysis, Wall Experiment Station (8/21/95)
21	Koc for 1,1-Biphenyl from Montgomery (Andrew Friedmann, ORS)
22	Chemical Constants from Syracuse Research Corporation (http://www.syrres.com/esc/physdemo.htm)
23	Risk Assessment Information System (http://risk.lsd.ornl.gov/index.shtml)
24	Odor Thresholds from Handbook of Environmental Data on Organic Chemicals, 2nd edition, Karel Verschueren; Van Nostrand Reinhold Co. Inc., NY; 1983.
25	Odor thresholds from Compilation of Odor and Taste Threshold Values Data, F.A. Fazzalari, editor; ASTM Data Service DS48A; 1978.
27	Odor thresholds from USEPA, 1992. "Reference Guide to Odor Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendment of 1990", U.S. Environmental Protection Agency; Office of Research and Development, EPA/600/R-92/047; Washington, D.C., March 1992.
28	Odor thresholds from USEPA, 1992. "Indoor Air Quality Database for Organic Compounds", U.S. Environmental Protection Agency; Research Triangle Park, NC, February 1992.
29	Calculated according to the FSG Method presented in Chapter 17 of "The Handbook of Chemical Property Estimation Methods" by WJ Lyman, WF Reehl, and DH Rosenblatt, 1982.
30	Calculated according to the Hayduk-Laudie Method presented in Chapter 17 of "The Handbook of Chemical Property Estimation Methods" by WJ Lyman, WF Reehl, and DH Rosenblatt, 1982.
31	U.S. EPA On-line Tools for Site Assessment Calculations. Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with Two Variable/Uncertain Parameters (Source Depth, Moisture Content). See: http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.html
	Abbreviations
AL	Action Level in drinking water. See: http://www.state.ma.us/dep/brp/dws/dwspubs.htm for the current list of Massachusetts Drinking Water Standards & Guidelines
MMCL	Massachusetts Maximum Contaminant Level in drinking water. 310 CMR 22. See: http://www.state.ma.us/dep/brp/dws/dwspubs.htm for the current list of Massachusetts Drinking Water Standards & Guidelines
SMCL	Secondary Maximum Contaminant Level in drinking water.

References used in calculating Method 3 Risk

Reference #	Description
	Toxicity Values See: http://www.state.ma.us/dep/brp/dws/dwspubs.htm for the current list of Massachusetts Drinking Water Standards & Guidelines
NA	Not Available
NC	Not Calculated.
ORSGL	Massachusetts DEP Drinking Water Guideline developed by the Office of Research and Standards for the Drinking Water Program.

ATTACHMENT D

Resident - Soil: Table RS-2
Exposure Point Concentration (EPC)
Based on Resident Ages 1-31 (Cancer), 1-8 (Chronic Noncancer), and 1-2 (Subchronic Noncancer)

Vlookup Version v0414

ELCR (all chemicals) =
Chronic HI (all chemicals) = 1.13E+00
Subchronic HI (all chemicals) = 2.42E-01

*Vegetable uptake is informational only and NOT included in totals on EPC tab.

Do not insert or delete any rows

Click on empty cell below and select OHM using arrow.

Oil or Hazardous Material		EPC (mg/kg)	Chronic ELCR Vegetable*	Chronic HQ Vegetable*	Subchronic HQ Vegetable*
ALIPHATICS	C5 to C8	7.0E+02			
ALIPHATICS	C9 to C12	9.8E+02			
AROMATICS	C9 to C10	1.1E+03			
BENZENE					
ETHYLBENZENE		3.0E+01			
TOLUENE		3.9E+01			
XYLENES (Mixed Isomers)		1.1E+02			
METHYL TERT BUTYL ETHER		2.8E+00			
NAPHTHALENE		7.3E+01			
BARIUM		1.1E+02			
CHROMIUM (TOTAL)		5.0E+01		1.1E+00	2.4E-01

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ATTACHMENT E

Public Review Draft

Best Management Practices ("BMPs") for Gardening at Remediated M.G.L. Chapter 21E Disposal Sites

Why Should Gardening Best Management Practices Be Used?

It is common for properties in Massachusetts to have measurable levels – usually low levels – of contaminants such as lead or petroleum hydrocarbons in soil. Even residential properties that have been cleaned up to meet the Massachusetts Department of Environmental Protection's soil standards may still contain residual levels of contaminants. Since gardening is one way people come into direct contact with soil, residents who wish to further reduce any exposure they may have to these materials can take the simple steps described in below. These recommendations are designed to be consistent with national guidance on urban gardening and reflect a consensus among gardening experts on measures that can effectively reduce additional exposure to common contaminants.

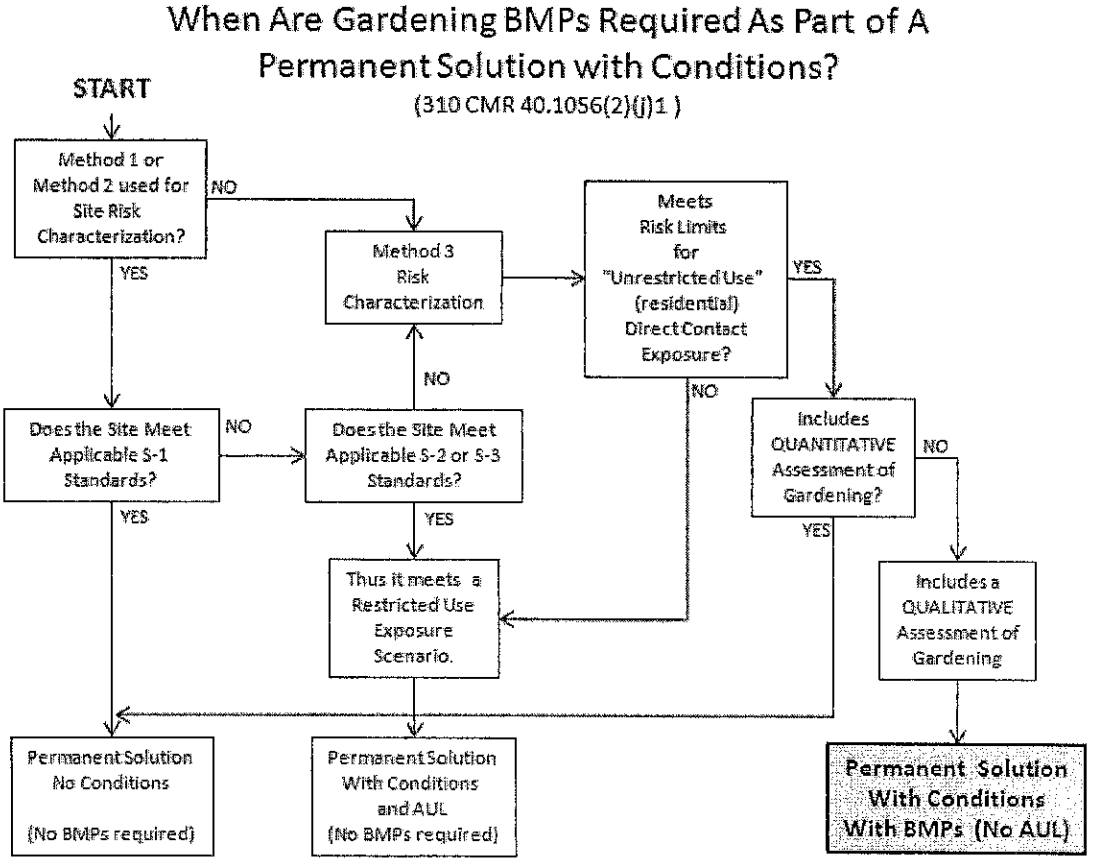
In a residential setting, yards and gardens are areas where people are most likely to have increased direct and indirect contact with soils. Alternatives to traditional gardening, such as container gardening and raised garden beds, are possible, and may reduce plant contact with contaminants, allowing you to work safely in your fruit or vegetable garden, and making produce safe for you and your family.

These practices work by isolating one's garden from any contamination remaining in the soil by means of impermeable barriers. Container gardening utilizes containers, such as pots or even old bath tubs, to keep clean soil used in gardening from contaminated soils that may be present in the rest of the yard. Raised garden beds are constructed by laying down concrete or plastic sheeting, building a wooden perimeter, and then adding clean soil within the holding unit, on top of the soil barrier.

Purpose: The attached Best Management Practices describe optional steps potential gardeners may take to further reduce their exposure to levels of oil or hazardous material that may remain at a M.G.L. Chapter 21E disposal site after a Permanent Solution has been achieved. These or similar BMPs must be included in the site's Permanent Solution Statement.

Applicability: The Gardening BMPs requirement is applicable to disposal sites that are demonstrated to pose No Significant Risk of Harm to Health using a Method 3 Risk Characterization that includes:

(a) the assumption of unrestricted use (including residential use) of the property,
(b) a quantitative assessment of direct contact exposures (ingestion, dermal contact and inhalation) to soil, and
(c) a qualitative assessment of incremental exposures associated with gardening activities.



Authority: The recommendation of Gardening Best Management Practices is a requirement of a Permanent Solution with Conditions pursuant to:

- 310 CMR 40.1056(2)(j)1 (Content of Permanent Solution Statements);
- 310 CMR 40.1041(2)(c)2. (Categories of Permanent Solutions);
- 310 CMR 40.40.1013 (Limitations, Assumptions and Conditions on Site Activities and Uses That Do Not Require an AUL); and
- 310 CMR 40.0923(3)(c) (Identification of Site Activity and Uses).

Best Management Practices for Gardening at Remediated M.G.L. Chapter 21E Disposal Sites

This property is part of a M.G.L. Chapter 21E disposal site that has been assessed and determined to meet the requirements of a Permanent Solution with Conditions under the Massachusetts Contingency Plan (310 CMR 40.0000), where the Conditions include the recommendation of Best Management Practices ("BMPs") for gardening to reduce the potential risks from exposure to contamination that remains on the site.

While the property has been determined to be safe for unrestricted use, including residential use, there are residual levels of contaminants remaining in the soil. Gardeners should consider implementing BMPs to further reduce potential exposure to material in the soil, regardless of the contaminant levels remaining. Implementing BMPs such as those suggested below will allow safer gardening in a wider range of site conditions. Not every BMP is necessary for every single site, but a combination of BMPs appropriate for your particular site will help reduce the potential for additional exposure.

Construct physical controls

Actions to reduce contaminant levels (such as amending the soil) and minimize contact (covering the soil) will further reduce potential risks. Many good gardening practices, like adding compost and soil amendments, improve the soil while reducing the amount of contaminants and exposure to them.

- Build your garden away from areas known or suspected to be contaminated. Sources of contamination can include painted structures (particularly older buildings that may have been painted with lead paint), roads and rail lines.
- Build a hedge or fence to reduce windblown contamination from mobile sources and busy streets.
- Cover existing soil and walkways with mulch, landscape fabric, stones, or bricks.
- Use mulch in your garden beds to reduce dust and soil splash back, reduce weed establishment, regulate soil temperature and moisture, and add organic matter.
- Use soil amendments (such as lime) to maintain neutral pH and add organic matter to improve soil structure.
    - Not all amendments are the same; be sure to choose the right amendments for your soil - amendments that improve conditions at one garden may not work well in others.
    - Keep in mind that each amendment type will have different application rates and techniques (e.g. rototilling), and may need to be maintained and reapplied annually.
    - Be sure to work with your local or state regulatory agency, and ask if your municipality provides free compost or mulch. Some amendments, such as Class A biosolids from sewage sludge, may be regulated under various regulatory programs.

Best Management Practices for Gardening at Remediated M.G.L. Chapter 21E Disposal Sites

- Add topsoil or clean fill to ensure the soil is safe for handling by children or gardeners of all ages and for food production.
- Build raised beds or container gardens
  - Raised beds help improve water drainage in heavy clay soils or low-lying areas. They also create accessible gardening locations for many users and allow for more precise soil management.
  - Foot traffic should not be necessary in the bed, so the soil does not become compacted and soil preparation in the coming years is minimized.
  - Place a water permeable fabric cover or geotextile as the bottom layer of your raised bed to further reduce exposure to soils of concern.
  - Raised beds can be made by simply mounding soil into windrows or by building containers.
  - Sided beds can be made from wood, synthetic wood, stone, concrete block, brick or naturally rot-resistant woods such as cedar and redwood. Avoid using chemical-treated lumber for the raised bed because chemicals used in the treated wood could make their way into the soils and plants.

Minimize Ongoing Contact with Soil

Actions to further reduce contact with soil during and after gardening activities can also minimize potential risks from any contaminants remaining in the soil.

- Do not use plants grown in contaminated soil for compost.
- Work in the garden when soil is moist or damp to minimize creation of dust.
- Wear gloves, long sleeves and pants while gardening to prevent skin exposure;
- Wash hands after gardening.
- Wash all vegetables thoroughly.
- Remove gardening shoes and garments before entering the home, and wash gardening clothes separately from other clothing.

For More Information

These recommended Best Management Practices are consistent with federal, state and local guidance on urban gardening in general. MassDEP has additional information available online at: http://www.mass.gov/eea/agencies/massdep/cleanup/regulations/site-cleanup-policies-guidance.html.

ATTACHMENT F

SOVEREIGN CONSULTING INC.

August 29, 2014

Mayor Joseph A. Curtatone
City Hall
93 Highland Avenue
Somerville, Massachusetts 02143

Ms. Paulette Renault-Caragianes
Director of Health Department
City Hall Annex
50 Evergreen Avenue
Somerville, Massachusetts 02143

Re: AVAILABILITY OF METHOD 3 RISK CHARACTERIZATION AND PERMANENT SOLUTION STATEMENT WITH CONDITIONS
Former Shell-Branded Service Station No. 137847
620 Broadway, Somerville, Massachusetts
RTN 3-1322

To Whom It May Concern:

In accordance with 310 CMR 40.1403, this letter is to notify you of the availability of Method 3 Risk Characterization (M3RC) and Permanent Solution Statement with Conditions (PSSC) regarding the above-referenced disposal site. This report summarizes environmental response actions conducted under Release Tracking Number (RTN) 3-1322. This report concludes that a Condition of "No Significant Risk" to human health, safety, public welfare and the environment has been achieved for this site for current and future site use scenarios.

A copy of the above referenced report, as well as other applicable documents pertaining to RTN 3-2937 can be obtained at the Massachusetts Department of Environmental Protection Northeast Regional Office located at 205B Lowell Street in Wilmington, Massachusetts. If you have any questions please call the undersigned at (413) 540-0650.

Sincerely,
SOVEREIGN CONSULTING INC.

Tamara Hagie
Project Manager

Philip D. McBain, LSP
Senior Project Manager

cc: Ms. Annette Dokken – Motiva
Mr. Galal F. Ibrahim – property owner
Mr. Paul Passman – Dialysis Clinic Inc.
Mr. James Herra – Disabled American Veterans Chapter 27
MBTA c/o Transit Realty Associates.
MassDOR – 21J
Sovereign File – 2R759

SOVEREIGN CONSULTING INC.

August 29, 2014

Mr. Galal F. Ibrahim
c/o Robert G. Cohen, Esq.
188 Oaks Road
Framingham, Massachusetts 01702

Re: **Informational Notice to Property Owner**
Former Shell-branded Station No. 137847
620 Broadway
Somerville, Massachusetts 02145
RTN 3-1322

Dear Mr. Ibrahim:

In accordance with 310 CMR 40.1406(3), this letter is to notify you that a portion of your property is included within the disposal site boundary for which a *Permanent Solution Statement with Conditions* (PSSC) has been submitted to the Massachusetts Department of Protection (MassDEP). The report documents the response activities associated with RTN 3-1322. This report concludes that a Condition of "No Significant Risk" to human health, safety, public welfare and the environment has been achieved for this site for current and future site use scenarios.

On behalf of Motiva Enterprises LLC (Motiva), Sovereign Consulting Inc. (Sovereign) has submitted MassDEP Form BWSC 122 *Informational Notice to Property Owners* (Notice) with regard to the above-referenced location. This Notice complies with public notification requirements for properties within the boundaries of a "disposal site." This Notice is being provided pursuant to 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP). Note that background information for the Notice requirements is summarized on the second page of the Notice.

Based upon the results of the M3RC and previous investigations, the requirements for a PSSC related to RTN 3-1322 have been achieved as outlined below:

1. The sources of the releases at the disposal site were adequately defined and appear to be related to the historic use of the facility as a retail gasoline station and automotive repair facility. The release was detected in 1987 during UST removal activities and the site was listed with the MassDEP as a LTBI on January 15, 1990.

2. According to data obtained from the Mass GIS there are no estimated habitats of rare wildlife, certified vernal pools, priority sites of rare species habitats or exemplary natural communities within 500 feet of the disposal site. An area of Protected Open Space is

located approximately 500 feet to the southeast of the site. The closest surface water body is the Mystic River, which is located approximately 4,000 feet east of the facility. No other surface water bodies are located within one mile of the facility. The City of Somerville obtains its potable water from the MWRA. The MWRA obtains its water through a series of surface water intakes on the Quabbin and Wachusett Reservoir, located more than 50 miles west of the facility. According to the Somerville Health Department, no private wells exist within 2,000 feet of the facility. The facility is not located within a potentially productive aquifer, a MassDEP-Approved Wellhead Protection Area (Zone II), or an Interim Wellhead Protection Area.

3. Subsurface structures within 1,000 feet of the facility include many half and full basements and utility conduits located along Broadway, Albion, and Winchester Streets. The closest residence with a basement is located approximately 75 feet east of the facility. The closest school or institution is Brown School, located approximately 1,300 feet southwest of the facility. No other schools or institutions are known to exist within 1,500 feet of the facility.

4. Groundwater beneath the disposal site is impacted with COCs (petroleum constituents) above Method 1 GW-2 Standards and is limited to monitoring well MW-105. The groundwater flow direction at the site has historically varied. Data from the December 2013 event indicates groundwater flows in a north-northeasterly direction. Data from the May 2014 event indicates groundwater flows to the north, west and southwest direction. The extent of impacted groundwater was adequately defined.

5. Vertical and horizontal extents of COC soil impacts have been defined through subsurface investigations conducted at the disposal site and are limited to the former OWS area, the area to the south of the on-site building and the current and former gasoline UST area at depths ranging from zero to 29 feet bgs. Impacted soil is located beneath paved surface. Since the future use of the disposal site is unrestricted, residential use was considered in the risk assessment.

6. APH concentrations detected in SVP-102 are below the VI Guidance Residential and Industrial/Commercial Soil Gas Screening Values. Additionally, based upon a review of soil gas data collected from SVP-101 through SVP-103 between 2003 and 2005, TOV results from SVP-101 through SVP-103 were less than 1 ppmv while COC concentrations in monitoring wells MW-105 and MW-106 were greater than current concentrations in these wells. These results indicated that there is an incomplete vapor migration pathway.

7. COC concentrations in soil and groundwater are below applicable UCLs.

8. Based on data collected at the site, SRM, CEP, and IH conditions do not exist at the disposal site. Response actions conducted at the site have eliminated all threats of release and no release of OHM to the environment has occurred.

9. The M3RC concludes that a Condition of "No Significant Risk" to human health, safety, public welfare and the environment exists for current and all future site use scenarios.

10. A permanent solution has been achieved, concentrations of COCs are approaching background, and an AUL is not required to maintain a level of "No Significant Risk."

If you have any questions please call the undersigned at (413) 540-0650.

Sincerely,
SOVEREIGN CONSULTING INC.

Tamara Hagie
Project Manager

Attachments: Disposal Site Map
BWSC-122 Transmittal Form

cc: Annette Dokken, Motiva Enterprises LLC (attached within report)
Sovereign File - 2R759

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC122

This notice is related to:
Release Tracking Number
3 - 1322

INFORMATIONAL NOTICE TO PROPERTY OWNERS

As Required by 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP)

A. DISPOSAL SITE ADDRESS: (associated with Release Tracking Number provided above)

1. Street Address: 620 Broadway
2. City/Town: Somerville 3. ZIP Code: 02145-0000
4. Assessor's Parcel ID: Map 27, Block L, Lot 2

B. THIS NOTICE IS BEING PROVIDED TO THE FOLLOWING PROPERTY OWNER:

1. Name of Property Owner: Galil Ibrahim, Somerville Citgo Inc.
2. Address of Property For Which This Notice is Being Provided: (property owned by person named in B1)
   a. Street Address: 620 Broadway
   b. City/Town: Somerville c. ZIP Code: 02145-0000
3. Assessor's Parcel ID: Map 27, Block L, Lot 2

C. THIS NOTICE IS BEING GIVEN : (check one)

- ☐ 1. Upon Completion of a Phase II Comprehensive Site Assessment.
- ☑ 2. Upon Submittal of a Permanent or Temporary Solution Statement (i.e., Site Closure Report).
- ☐ 3. Upon Completion of Additional Investigation showing that Oil or Hazardous Material is not Present at the Property.

D. DESCRIPTION OF OIL AND/OR HAZARDOUS MATERIAL PRESENT OR LIKELY TO BE PRESENT AT THE PROPERTY : (check all that apply)

AFFECTED ENVIRONMENTAL MEDIA	PRINCIPAL CHEMICAL(S) PRESENT
☑ 1. Soil	petroleum compounds
☑ 2. Groundwater	petroleum compounds
☐ 3. Surface Water	
☐ 4. Sediment	
☐ 5. Indoor Air	
☐ 6. Soil Gas	
☐ 7. Other: (specify)	

E. ATTACHMENTS PROVIDED WITH THIS NOTICE, AS REQUIRED BY 310 CMR 40.1406:

- ☑ 1. A Copy of the Map Showing or a Description Describing the Area where the Oil and/or Hazardous Material is or is likely to be Present.
- ☑ 2. A Copy of the Phase II Comprehensive Site Assessment or Permanent or Temporary Solution Statement Conclusions.
- ☑ 3. Specify the category of Solution that applies to the Disposal Site.
  - ☐ 1. Permanent Solution with No Conditions.
  - ☑ 2. Permanent Solution with Conditions.
    - ☐ i. An Activity and Use Limitation has been implemented.
    - ☑ ii. An Activity and Use Limitation has not been implemented.
  - ☐ 3. Temporary Solution.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC122

This notice is related to:
Release Tracking Number

3 - 1322

INFORMATIONAL NOTICE TO PROPERTY OWNERS

As Required by 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP)

F. CONTACT INFORMATION RELATING TO THE PARTY PROVIDING THIS NOTICE:

1. Name of Organization: Sovereign Consulting Inc.
2. Contact First Name: Tammie 3. Last Name: Hagie
4. Street: 4 Open Square Way 5. Title: Project Manager
6. City/Town: Holyoke 7. State: MA 8. ZIP Code: 01040-0000
9. Telephone: (413) 540-0650 10. Email: thagie@sovcon.com

MASSACHUSETTS REGULATIONS THAT REQUIRE THIS NOTICE

This notice is being provided pursuant to the Massachusetts Contingency Plan and the notification requirement at 310 CMR 40.1406. The Massachusetts Contingency Plan is a state regulation that specifies requirements for parties who are taking actions to address releases of chemicals (oil or hazardous material) to the environment.

THE PERSON(S) PROVIDING THIS NOTICE

This notice has been sent to you by the party(ies) who is/are addressing a release of oil or hazardous material to the environment at the location listed in **Section A** on the reverse side of this form.

PURPOSE OF THIS NOTICE

Parties who are taking actions to respond to releases of oil or hazardous material to the environment are required by state regulations (referred to above) to notify the owners of property where the oil or hazardous material is or is likely to be present. These same parties are also required to notify property owners upon completion of actions to address the oil or hazardous material, or if additional investigations show that the oil or hazardous material is not present at a property. **Section C** on the reverse side of this form indicates the circumstance under which you are receiving this notice at this time.

INFORMATION RELATED TO YOUR PROPERTY

Section D on the reverse side of this form indicates the type(s) of oil or hazardous material that is or is likely to be present at your property, and the environmental medium (e.g., soil or groundwater) where it is or is likely to be present. **Please note** that when an investigation indicates that the oil or hazardous material is or is likely to be present at your property, this does not mean that the oil or hazardous material is posing a health risk to you. Parties who are taking actions to address oil and hazardous material releases are required by state regulations to adequately investigate these releases and take necessary actions to ensure that affected properties meet standards that are protective of human health and the environment.

ATTACHED MAP OR DESCRIPTION AND REPORT CONCLUSIONS

The party providing this notice to you is required to attach a map or description that indicates the boundaries of the area where the oil or hazardous material is or is likely to be present, and the conclusions of the site investigation or closure report **(Section E)**. These attachments should give you additional information about the nature and location of the oil or hazardous material with respect to your property.

FOR MORE INFORMATION

Information about the general process for addressing releases of oil or hazardous material under the Massachusetts Contingency Plan and related public involvement opportunities may be found at http://www.mass.gov/eea/agencies/massdep/cleanup.

For more information regarding this notice, you may contact the party listed in **Section F** of this form. Information about the disposal site identified in **Section A** is also available in files at the Massachusetts Department of Environmental Protection.

See http://public.dep.state.ma.us/SearchableSites2/Search.aspx to view site-specific files on-line or http://mass.gov/eea/agencies/massdep/about/contacts/conduct-a-file-review.html if you would like to make an appointment to see these files in person. Please reference the **Release Tracking Number** listed in the upper right hand corner on the reverse side of this form when making file review appointments.

SOVEREIGN CONSULTING INC.

August 29, 2014

Executive Director
Attn: L0216
MBTA c/o Transit Realty Associates
77 Franklin Street 9th Floor
Boston, Massachusetts 02110

Re: **Informational Notice to Property Owner**
Former Shell-branded Station No. 137847
620 Broadway
Somerville, Massachusetts 02145
RTN 3-1322

To Whom It May Concern:

In accordance with 310 CMR 40.1406(3), this letter is to notify you that a portion of your property is included within the disposal site boundary for which a *Permanent Solution Statement with Conditions* (PSSC) has been submitted to the Massachusetts Department of Protection (MassDEP). The report documents the response activities associated with RTN 3-1322. This report concludes that a Condition of "No Significant Risk" to human health, safety, public welfare and the environment has been achieved for this site for current and future site use scenarios.

On behalf of Motiva Enterprises LLC (Motiva), Sovereign Consulting Inc. (Sovereign) has submitted MassDEP Form BWSC 122 *Informational Notice to Property Owners* (Notice) with regard to the above-referenced location. This Notice complies with public notification requirements for properties within the boundaries of a "disposal site." This Notice is being provided pursuant to 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP). Note that background information for the Notice requirements is summarized on the second page of the Notice.

Based upon the results of the M3RC and previous investigations, the requirements for a PSSC related to RTN 3-1322 have been achieved as outlined below:

1. The sources of the releases at the disposal site were adequately defined and appear to be related to the historic use of the facility as a retail gasoline station and automotive repair facility. The release was detected in 1987 during UST removal activities and the site was listed with the MassDEP as a LTBI on January 15, 1990.

2. According to data obtained from the Mass GIS there are no estimated habitats of rare wildlife, certified vernal pools, priority sites of rare species habitats or exemplary natural

communities within 500 feet of the disposal site. An area of Protected Open Space is located approximately 500 feet to the southeast of the site. The closest surface water body is the Mystic River, which is located approximately 4,000 feet east of the facility. No other surface water bodies are located within one mile of the facility. The City of Somerville obtains its potable water from the MWRA. The MWRA obtains its water through a series of surface water intakes on the Quabbin and Wachusett Reservoir, located more than 50 miles west of the facility. According to the Somerville Health Department, no private wells exist within 2,000 feet of the facility. The facility is not located within a potentially productive aquifer, a MassDEP-Approved Wellhead Protection Area (Zone II), or an Interim Wellhead Protection Area.

3. Subsurface structures within 1,000 feet of the facility include many half and full basements and utility conduits located along Broadway, Albion, and Winchester Streets. The closest residence with a basement is located approximately 75 feet east of the facility. The closest school or institution is Brown School, located approximately 1,300 feet southwest of the facility. No other schools or institutions are known to exist within 1,500 feet of the facility.

4. Groundwater beneath the disposal site is impacted with COCs (petroleum constituents) above Method 1 GW-2 Standards and is limited to monitoring well MW-105. The groundwater flow direction at the site has historically varied. Data from the December 2013 event indicates groundwater flows in a north-northeasterly direction. Data from the May 2014 event indicates groundwater flows to the north, west and southwest direction. The extent of impacted groundwater was adequately defined.

5. Vertical and horizontal extents of COC soil impacts have been defined through subsurface investigations conducted at the disposal site and are limited to the former OWS area, the area to the south of the on-site building and the current and former gasoline UST area at depths ranging from zero to 29 feet bgs. Impacted soil is located beneath paved surface. Since the future use of the disposal site is unrestricted, residential use was considered in the risk assessment.

6. APH concentrations detected in SVP-102 are below the VI Guidance Residential and Industrial/Commercial Soil Gas Screening Values. Additionally, based upon a review of soil gas data collected from SVP-101 through SVP-103 between 2003 and 2005, TOV results from SVP-101 through SVP-103 were less than 1 ppmv while COC concentrations in monitoring wells MW-105 and MW-106 were greater than current concentrations in these wells. These results indicated that there is an incomplete vapor migration pathway.

7. COC concentrations in soil and groundwater are below applicable UCLs.

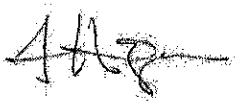
8. Based on data collected at the site, SRM, CEP, and IH conditions do not exist at the disposal site. Response actions conducted at the site have eliminated all threats of release and no release of OHM to the environment has occurred.

9. The M3RC concludes that a Condition of "No Significant Risk" to human health, safety, public welfare and the environment exists for current and all future site use scenarios.

10. A permanent solution has been achieved, concentrations of COCs are approaching background, and an AUL is not required to maintain a level of "No Significant Risk."

If you have any questions please call the undersigned at (413) 540-0650.

Sincerely,
SOVEREIGN CONSULTING INC.



Tamara Hagie
Project Manager

Attachments: Disposal Site Map
BWSC-122 Transmittal Form

cc: Annette Dokken, Motiva Enterprises LLC (attached within report)
Sovereign File - 2R759

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

INFORMATIONAL NOTICE TO PROPERTY OWNERS

As Required by 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP)

BWSC122

This notice is related to:
Release Tracking Number

3 - 1322

A. DISPOSAL SITE ADDRESS: (associated with Release Tracking Number provided above)

1. Street Address: 620 Broadway

2. City/Town: Somerville 3. ZIP Code: 02145-0000

4. Assessor's Parcel ID: Map 27, Block L, Lot 2

B. THIS NOTICE IS BEING PROVIDED TO THE FOLLOWING PROPERTY OWNER:

1. Name of Property Owner: MBTA c/o Transit Realty Associates

2. Address of Property For Which This Notice is Being Provided: (property owned by person named in B1)

a. Street Address: Map 27, Block L, Lot 1

b. City/Town: Somerville c. ZIP Code: 02145-0000

3. Assessor's Parcel ID: Map 27, Block L, Lot 1

C. THIS NOTICE IS BEING GIVEN : (check one)

- [ ] 1. Upon Completion of a Phase II Comprehensive Site Assessment.
- [x] 2. Upon Submittal of a Permanent or Temporary Solution Statement (i.e., Site Closure Report).
- [ ] 3. Upon Completion of Additional Investigation showing that Oil or Hazardous Material is not Present at the Property.

D. DESCRIPTION OF OIL AND/OR HAZARDOUS MATERIAL PRESENT OR LIKELY TO BE PRESENT AT THE PROPERTY : (check all that apply)

AFFECTED ENVIRONMENTAL MEDIA	PRINCIPAL CHEMICAL(S) PRESENT
[x] 1. Soil	petroleum compounds
[x] 2. Groundwater	petroleum compounds
[ ] 3. Surface Water	
[ ] 4. Sediment	
[ ] 5. Indoor Air	
[ ] 6. Soil Gas	
[ ] 7. Other: (specify)	

E. ATTACHMENTS PROVIDED WITH THIS NOTICE, AS REQUIRED BY 310 CMR 40.1406:

- [x] 1. A Copy of the Map Showing or a Description Describing the Area where the Oil and/or Hazardous Material is or is likely to be Present.
- [x] 2. A Copy of the Phase II Comprehensive Site Assessment or Permanent or Temporary Solution Statement Conclusions.
- [x] 3. Specify the category of Solution that applies to the Disposal Site.
  - [ ] 1. Permanent Solution with No Conditions.
  - [x] 2. Permanent Solution with Conditions.
    - [ ] i. An Activity and Use Limitation has been implemented.
    - [x] ii. An Activity and Use Limitation has not been implemented.
  - [ ] 3. Temporary Solution.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC122

This notice is related to:
Release Tracking Number

3 - 1322

INFORMATIONAL NOTICE TO PROPERTY OWNERS

As Required by 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP)

F. CONTACT INFORMATION RELATING TO THE PARTY PROVIDING THIS NOTICE:

1. Name of Organization: Sovereign Consulting Inc.
2. Contact First Name: Tammie 3. Last Name: Hagie
4. Street: 4 Open Square Way 5. Title: Project Manager
6. City/Town: Holyoke 7. State: MA 8. ZIP Code: 01040-0000
9. Telephone: (413) 540-0650 10. Email: thagie@sovcon.com

MASSACHUSETTS REGULATIONS THAT REQUIRE THIS NOTICE

This notice is being provided pursuant to the Massachusetts Contingency Plan and the notification requirement at 310 CMR 40.1406. The Massachusetts Contingency Plan is a state regulation that specifies requirements for parties who are taking actions to address releases of chemicals (oil or hazardous material) to the environment.

THE PERSON(S) PROVIDING THIS NOTICE

This notice has been sent to you by the party(ies) who is/are addressing a release of oil or hazardous material to the environment at the location listed in **Section A** on the reverse side of this form.

PURPOSE OF THIS NOTICE

Parties who are taking actions to respond to releases of oil or hazardous material to the environment are required by state regulations (referred to above) to notify the owners of property where the oil or hazardous material is or is likely to be present. These same parties are also required to notify property owners upon completion of actions to address the oil or hazardous material, or if additional investigations show that the oil or hazardous material is not present at a property. **Section C** on the reverse side of this form indicates the circumstance under which you are receiving this notice at this time.

INFORMATION RELATED TO YOUR PROPERTY

Section D on the reverse side of this form indicates the type(s) of oil or hazardous material that is or is likely to be present at your property, and the environmental medium (e.g., soil or groundwater) where it is or is likely to be present. **Please note** that when an investigation indicates that the oil or hazardous material is or is likely to be present at your property, this does not mean that the oil or hazardous material is posing a health risk to you. Parties who are taking actions to address oil and hazardous material releases are required by state regulations to adequately investigate these releases and take necessary actions to ensure that affected properties meet standards that are protective of human health and the environment.

ATTACHED MAP OR DESCRIPTION AND REPORT CONCLUSIONS

The party providing this notice to you is required to attach a map or description that indicates the boundaries of the area where the oil or hazardous material is or is likely to be present, and the conclusions of the site investigation or closure report **(Section E)**. These attachments should give you additional information about the nature and location of the oil or hazardous material with respect to your property.

FOR MORE INFORMATION

Information about the general process for addressing releases of oil or hazardous material under the Massachusetts Contingency Plan and related public involvement opportunities may be found at http://www.mass.gov/eea/agencies/massdep/cleanup.

For more information regarding this notice, you may contact the party listed in **Section F** of this form. Information about the disposal site identified in **Section A** is also available in files at the Massachusetts Department of Environmental Protection.

See http://public.dep.state.ma.us/SearchableSites2/Search.aspx to view site-specific files on-line or http://mass.gov/eea/agencies/massdep/about/contacts/conduct-a-file-review.html if you would like to make an appointment to see these files in person. Please reference the **Release Tracking Number** listed in the upper right hand corner on the reverse side of this form when making file review appointments.

SOVEREIGN CONSULTING INC.

August 29, 2014

Mr. James Herra
Disabled American Veterans
616 Broadway
Somerville, Massachusetts 02145

Re: **Informational Notice to Property Owner**
Former Shell-branded Station No. 137847
620 Broadway
Somerville, Massachusetts 02145
RTN 3-1322

Dear Mr. Herra:

In accordance with 310 CMR 40.1406(3), this letter is to notify you that a portion of your property is included within the disposal site boundary for which a *Permanent Solution Statement with Conditions* (PSSC) has been submitted to the Massachusetts Department of Protection (MassDEP). The report documents the response activities associated with RTN 3-1322. This report concludes that a Condition of "No Significant Risk" to human health, safety, public welfare and the environment has been achieved for this site for current and future site use scenarios.

On behalf of Motiva Enterprises LLC (Motiva), Sovereign Consulting Inc. (Sovereign) has submitted MassDEP Form BWSC 122 *Informational Notice to Property Owners* (Notice) with regard to the above-referenced location. This Notice complies with public notification requirements for properties within the boundaries of a "disposal site." This Notice is being provided pursuant to 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP). Note that background information for the Notice requirements is summarized on the second page of the Notice.

Based upon the results of the M3RC and previous investigations, the requirements for a PSSC related to RTN 3-1322 have been achieved as outlined below:

1. The sources of the releases at the disposal site were adequately defined and appear to be related to the historic use of the facility as a retail gasoline station and automotive repair facility. The release was detected in 1987 during UST removal activities and the site was listed with the MassDEP as a LTBI on January 15, 1990.

2. According to data obtained from the Mass GIS there are no estimated habitats of rare wildlife, certified vernal pools, priority sites of rare species habitats or exemplary natural communities within 500 feet of the disposal site. An area of Protected Open Space is

located approximately 500 feet to the southeast of the site. The closest surface water body is the Mystic River, which is located approximately 4,000 feet east of the facility. No other surface water bodies are located within one mile of the facility. The City of Somerville obtains its potable water from the MWRA. The MWRA obtains its water through a series of surface water intakes on the Quabbin and Wachusett Reservoir, located more than 50 miles west of the facility. According to the Somerville Health Department, no private wells exist within 2,000 feet of the facility. The facility is not located within a potentially productive aquifer, a MassDEP-Approved Wellhead Protection Area (Zone II), or an Interim Wellhead Protection Area.

3. Subsurface structures within 1,000 feet of the facility include many half and full basements and utility conduits located along Broadway, Albion, and Winchester Streets. The closest residence with a basement is located approximately 75 feet east of the facility. The closest school or institution is Brown School, located approximately 1,300 feet southwest of the facility. No other schools or institutions are known to exist within 1,500 feet of the facility.

4. Groundwater beneath the disposal site is impacted with COCs (petroleum constituents) above Method 1 GW-2 Standards and is limited to monitoring well MW-105. The groundwater flow direction at the site has historically varied. Data from the December 2013 event indicates groundwater flows in a north-northeasterly direction. Data from the May 2014 event indicates groundwater flows to the north, west and southwest direction. The extent of impacted groundwater was adequately defined.

5. Vertical and horizontal extents of COC soil impacts have been defined through subsurface investigations conducted at the disposal site and are limited to the former OWS area, the area to the south of the on-site building and the current and former gasoline UST area at depths ranging from zero to 29 feet bgs. Impacted soil is located beneath paved surface. Since the future use of the disposal site is unrestricted, residential use was considered in the risk assessment.

6. APH concentrations detected in SVP-102 are below the VI Guidance Residential and Industrial/Commercial Soil Gas Screening Values. Additionally, based upon a review of soil gas data collected from SVP-101 through SVP-103 between 2003 and 2005, TOV results from SVP-101 through SVP-103 were less than 1 ppmv while COC concentrations in monitoring wells MW-105 and MW-106 were greater than current concentrations in these wells. These results indicated that there is an incomplete vapor migration pathway.

7. COC concentrations in soil and groundwater are below applicable UCLs.

8. Based on data collected at the site, SRM, CEP, and IH conditions do not exist at the disposal site. Response actions conducted at the site have eliminated all threats of release and no release of OHM to the environment has occurred.

9. The M3RC concludes that a Condition of "No Significant Risk" to human health, safety, public welfare and the environment exists for current and all future site use scenarios.

10. A permanent solution has been achieved, concentrations of COCs are approaching background, and an AUL is not required to maintain a level of "No Significant Risk."

If you have any questions please call the undersigned at (413) 540-0650.

Sincerely,
SOVEREIGN CONSULTING INC.

Tamara Hagie
Project Manager

Attachments: Disposal Site Map
BWSC-122 Transmittal Form

cc: Annette Dokken, Motiva Enterprises LLC (attached within report)
Sovereign File – 2R759

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC122

This notice is related to:
Release Tracking Number
3 - 1322

INFORMATIONAL NOTICE TO PROPERTY OWNERS

As Required by 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP)

A. DISPOSAL SITE ADDRESS: (associated with Release Tracking Number provided above)

1. Street Address: 620 Broadway

2. City/Town: Somerville 3. ZIP Code: 02145-0000

4. Assessor's Parcel ID: Map 27, Block L, Lot 2

B. THIS NOTICE IS BEING PROVIDED TO THE FOLLOWING PROPERTY OWNER:

1. Name of Property Owner: Mr. James Herra, Disabled Veterans of America

2. Address of Property For Which This Notice is Being Provided: (property owned by person named in B1)

a. Street Address: 616 Broadway

b. City/Town: Somerville c. ZIP Code: 02145-0000

3. Assessor's Parcel ID: NA

C. THIS NOTICE IS BEING GIVEN : (check one)

- [ ] 1. Upon Completion of a Phase II Comprehensive Site Assessment.
- [x] 2. Upon Submittal of a Permanent or Temporary Solution Statement (i.e., Site Closure Report).
- [ ] 3. Upon Completion of Additional Investigation showing that Oil or Hazardous Material is not Present at the Property.

D. DESCRIPTION OF OIL AND/OR HAZARDOUS MATERIAL PRESENT OR LIKELY TO BE PRESENT AT THE PROPERTY : (check all that apply)

AFFECTED ENVIRONMENTAL MEDIA	PRINCIPAL CHEMICAL(S) PRESENT
[x] 1. Soil	petroleum compounds
[x] 2. Groundwater	petroleum compounds
[ ] 3. Surface Water	
[ ] 4. Sediment	
[ ] 5. Indoor Air	
[ ] 6. Soil Gas	
[ ] 7. Other: (specify)	

E. ATTACHMENTS PROVIDED WITH THIS NOTICE, AS REQUIRED BY 310 CMR 40.1406:

- [x] 1. A Copy of the Map Showing or a Description Describing the Area where the Oil and/or Hazardous Material is or is likely to be Present.
- [x] 2. A Copy of the Phase II Comprehensive Site Assessment or Permanent or Temporary Solution Statement Conclusions.
- [x] 3. Specify the category of Solution that applies to the Disposal Site.
  - [ ] 1. Permanent Solution with No Conditions.
  - [x] 2. Permanent Solution with Conditions.
    - [ ] i. An Activity and Use Limitation has been implemented.
    - [x] ii. An Activity and Use Limitation has not been implemented.
  - [ ] 3. Temporary Solution.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC122

This notice is related to:
Release Tracking Number

3 - 1322

INFORMATIONAL NOTICE TO PROPERTY OWNERS

As Required by 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP)

F. CONTACT INFORMATION RELATING TO THE PARTY PROVIDING THIS NOTICE:

1. Name of Organization: Sovereign Consulting Inc.
2. Contact First Name: Tammie
3. Last Name: Hagie
4. Street: 4 Open Square Way
5. Title: Project Manager
6. City/Town: Holyoke
7. State: MA
8. ZIP Code: 01040-0000
9. Telephone: (413) 540-0650
10. Email: thagie@sovcon.com

MASSACHUSETTS REGULATIONS THAT REQUIRE THIS NOTICE

This notice is being provided pursuant to the Massachusetts Contingency Plan and the notification requirement at 310 CMR 40.1406. The Massachusetts Contingency Plan is a state regulation that specifies requirements for parties who are taking actions to address releases of chemicals (oil or hazardous material) to the environment.

THE PERSON(S) PROVIDING THIS NOTICE

This notice has been sent to you by the party(ies) who is/are addressing a release of oil or hazardous material to the environment at the location listed in **Section A** on the reverse side of this form.

PURPOSE OF THIS NOTICE

Parties who are taking actions to respond to releases of oil or hazardous material to the environment are required by state regulations (referred to above) to notify the owners of property where the oil or hazardous material is or is likely to be present. These same parties are also required to notify property owners upon completion of actions to address the oil or hazardous material, or if additional investigations show that the oil or hazardous material is not present at a property. **Section C** on the reverse side of this form indicates the circumstance under which you are receiving this notice at this time.

INFORMATION RELATED TO YOUR PROPERTY

Section D on the reverse side of this form indicates the type(s) of oil or hazardous material that is or is likely to be present at your property, and the environmental medium (e.g., soil or groundwater) where it is or is likely to be present. **Please note** that when an investigation indicates that the oil or hazardous material is or is likely to be present at your property, this does not mean that the oil or hazardous material is posing a health risk to you. Parties who are taking actions to address oil and hazardous material releases are required by state regulations to adequately investigate these releases and take necessary actions to ensure that affected properties meet standards that are protective of human health and the environment.

ATTACHED MAP OR DESCRIPTION AND REPORT CONCLUSIONS

The party providing this notice to you is required to attach a map or description that indicates the boundaries of the area where the oil or hazardous material is or is likely to be present, and the conclusions of the site investigation or closure report **(Section E).** These attachments should give you additional information about the nature and location of the oil or hazardous material with respect to your property.

FOR MORE INFORMATION

Information about the general process for addressing releases of oil or hazardous material under the Massachusetts Contingency Plan and related public involvement opportunities may be found at http://www.mass.gov/eea/agencies/massdep/cleanup.

For more information regarding this notice, you may contact the party listed in **Section F** of this form. Information about the disposal site identified in **Section A** is also available in files at the Massachusetts Department of Environmental Protection.

See http://public.dep.state.ma.us/SearchableSites2/Search.aspx to view site-specific files on-line or http://mass.gov/eea/agencies/massdep/about/contacts/conduct-a-file-review.html if you would like to make an appointment to see these files in person. Please reference the **Release Tracking Number** listed in the upper right hand corner on the reverse side of this form when making file review appointments.

TABLE 3

SUMMARY OF GROUNDWATER ANALYTICAL DATA - VOLATILE PETROLEUM HYDROCARBONS

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Concentrations in micrograms per liter (ug/L) equivalent to parts per billion (ppb)

			Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	C_5-C_8 Aliphatics	C_9-C_{12} Aliphatics	C_9-C_{10} Aromatics
Method 1 Standards		GW-2	1,000	50,000	20,000	3,000	50,000	700	3,000	5,000	4,000
		GW-3	10,000	40,000	5,000	5,000	50,000	20,000	50,000	50,000	50,000
Well ID (GW Category)	Data Usability Assessment Bias	Date									
MW-18		4/24/2002	9,480	34,900	8,360	30,060	52,900	2,830	41,200	14,800	54,300
GW-3		5/29/2002	3,040	13,400	2,750	11,258	9,480	7,650	27,100	65,400	92,500
		8/15/2002	1,040	10,200	2,960	2,690	6,360	1,080	31,000	7,120	22,100
		3/28/2003	87.4	444	1,120	2,604	494	389	18,900	<500	12,500
		12/22/2003	92.1	327	2,720	5,986	616	982	36,900	<500	22,700
		6/6/2005	14.0	1.8	27.7	6.8	1.3	5.9	337	191	144
		11/22/2005	115	19.5	281	97.9	34.8	134	1,440	307	773
		5/11/2006	157	84.8	420	209	245	111	7,320	4,270	2,230
		11/2/2006	19.4	5.16	52.5	5.82	20.5	11.9	401	104	119
		5/8/2007	34.2	8.89	196	9.43	17.7	21.1	1,220	203	468
	None	11/6/2007	173	237	389	232.1	20.6	70.0	1,300	540	627
	None	5/20/2008	4.5	<2.0	4.1	<4.0	6.8	<3.0	51.2	<50	54.6
	None	11/20/2008	4.3	14.2	244.0	129.7	5.3	43.5	544	103	288
	None	5/7/2009	<2.0	<2.0	<2.0	<4.0	<1.0	<3.0	98.8	<50	60.4
	None	11/11/2009	5.00	11.0	175	49.0	26.0	54.0	434	303	382
	None	5/26/2010	<2.0	4.5	66.4	15.9	5.1	23.1	334	153	233
	None	12/3/2010	5.6	22.5	536	167	<1.0	97.2	1,900	227	587
	High[1]	6/9/2011	<2.0	<2.0	4.9	<2.0	<1.0	<3.0	73.4	<50	53.2
	None	11/16/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/14/2012	1.6	11.0	48.0	101.3	<1.0	132	647	83.0	340
	None	11/27/2012	6.3	38.1	710	282.8	<1.0	267	1,710	204	893
	None	5/6/2013	1.1	<2.0	<2.0	<2.0	4.3	13	255	<50	175
	None	12/6/2013	8.9	38.9	36.4	47.3	<1.0	25.6	467	<50	120
	None	5/15/2014	<1.0	<2.0	6.1	<2.0	<1.0	<3.0	98.3	<50	<50
EPCs			4.20	19.75	188.38	83.03	1.45	76.73	632.58	69.75	303.25
MW-101		3/28/2003	1,730	4,350	2,080	5,680	26,500	527	<250	<250	5910
GW-3		12/22/2003	770	3,150	1,330	3,526	8,810	366	7720	<500	4910
		10/27/2004	294	683	1,840	2,732	8,620	470	8,550	4,420	5,860
		6/6/2005	6.8	<1.0	9.6	<1.0	179	<3.0	350	91.6	208
		11/22/2005	197	110	600	268	8,010	185	5,680	1,130	2,060
		5/11/2006	126	75.7	483	130.7	3,130	82.1	2,330	1,060	694
		11/2/2006	165	139	1,410	211.5	3,090	195	4,510	1,220	1,310
		5/8/2007	99.5	36.8	719	140.2	1,690	42.1	2,190	652	819
	None	11/6/2007	61.3	85.1	763	143.6	339	78.8	1,310	708	866
	None	5/20/2008	52.9	18.3	264	25.1	377	6.1	219	<50	198
	None	11/20/2008	13.7	4.4	93.7	18.0	37.9	6.0	440	<50	119
	None	5/7/2009	13.4	8.2	146	9.6	22.9	<3.0	347	52.4	110
	None	11/11/2009	11.0	8.00	52.0	14.0	26.0	24.0	410	158	223
	None	5/26/2010	31.5	12.5	192	23.0	31.8	3.6	522	113	188
	None	12/3/2010	16.9	19.5	126	79.3	18.2	45.4	1,500	185	388
	NA	6/9/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS
	None	11/16/2011	2.1	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/14/2012	4.2	<2.0	<2.0	<2.0	<1.0	<3.0	531	<50	<50
		11/27/2012	well inaccessible								
MW-102		3/28/2003	1,330	10,100	4,610	14,410	<20	1,350	54,300	4,480	31,600
GW-3		12/22/2003	16.1	415	397	1,061	33.1	71.3	3,630	<50	1,440
		10/27/2004	14.1	979	1,110	3,568	181	239	13,800	3,500	3,830
		6/6/2005	<0.50	<1.0	<1.0	<1.0	2.9	<3.0	<50	<50	<50
		5/11/2006	2.66	37.8	194	738	34.0	71.5	2,670	1,430	1,000
		11/20/2008	9.7	8.0	512	690	11.1	60.3	1,410	288	515
	None	5/7/2009	<2.0	<2.0	5.8	7.4	1.8	<3.0	<50	<50	<50
	None	11/11/2009	7.00	6.00	558	775	18.0	92.0	1,590	1,120	533
	None	5/26/2010	<2.0	<2.0	<2.0	<2.0	4.0	<3.0	<50	<50	<50
	NA	12/3/2010	NS	NS	NS	NS	NS	NS	NS	NS	NS
	High[1]	6/9/2011	<2.0	<2.0	<2.0	<2.0	4.1	<3.0	<50	<50	<50
	None	11/16/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/14/2012	<1.0	2.3	127	423.2	<1.0	78.7	1,350	<50	340
	None	11/27/2012	9.8	12.6	2,050	2,069	<1.0	378	5,330	578	2,590
	None	5/6/2013	<1.0	<2.0	<2.0	<2.0	4.8	<3.0	53.2	<50	<50
	None	12/6/2013	2.0	5.6	642	732.3	<1.0	267	1,620	971	1,056
	None	5/15/2014	<1.0	<2.0	<2.0	<2.0	1.4	<3.0	<50	<50	<50
EPCs			3.20	5.05	673.50	700.83	1.80	147.00	1,757.05	399.75	920.00

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Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Concentrations in micrograms per liter (ug/L) equivalent to parts per billion (ppb)

			Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	C_5-C_8 Aliphatics	C_9-C_{12} Aliphatics	C_9-C_{10} Aromatics
Method 1 Standards		GW-2	2,000	50,000	20,000	3,000	50,000	700	3,000	5,000	4,000
		GW-3	10,000	40,000	5,000	5,000	50,000	20,000	50,000	50,000	50,000
Well ID (GW Category)	Data Usability Assessment Bias	Date									
MW-103		3/28/2003	622	7,110	2,970	8,520	<10	970	21,600	1,260	13,200
GW-3		12/22/2003	118	1,910	4,540	14,290	344	1,350	92,700	<2500	52,300
		10/27/2004	21.1	200	826	2,203	<4.0	201	12,600	5,970	6,120
		6/6/2005	8.6	52.0	385	773	68.6	127	10,200	2,800	3,220
		11/22/2005	7.5	21.8	211	479	144	74.5	6,370	719	2,176
		5/11/2006	4.32	12.0	191	481	34.4	61.3	4,680	1,550	1,970
		11/2/2006	11.6	18.4	229	484.6	25.7	53.2	3,830	1,130	1,690
		5/8/2007	4.78	6.57	108	87.6	7.74	11.6	1,260	224	590
		11/6/2007	32.0	4.91	70.3	124.83	13.7	20.0	1,110	447	528
	None	5/20/2008	4.3	2.4	64.9	39.6	<2.0	3.9	407	<50	397
	None	11/20/2008	6.7	4.5	42.0	69.5	14.9	17.0	898	98.4	439
	None	5/7/2009	<2.0	<2.0	37.9	23.5	<1.0	3.1	518	117	247
	None	11/11/2009	<5.00	5.00	26.0	67.0	20.0	24.0	729	217	410
	None	5/26/2010	<2.0	<2.0	19.7	19.1	8.3	4.1	550	75.0	197
	None	12/3/2010	3.1	3.5	13.1	30.1	12.3	13.6	1,050	165	315
	High[1]	6/9/2011	<2.0	<2.0	16.2	13.8	2.2	3.6	457	73.6	228
	High	11/16/2011	<2.0	<2.0	5.1	10.5	2.9	6.5	648	82.2	221
	None	5/14/2012	<1.0	2.0	10	19.7	13.2	20.2	1,120	138	405
	None	11/27/2012	1.8	2.5	4.5	8.8	<1.0	23.6	803	57.7	408
	None	5/6/2013	3.0	2.3	5.4	5.1	7.5	6.8	747	54.4	285
	None	12/6/2013	2.6	3.0	5.2	7.9	20.6	10.5	651	<50	240
	None	5/15/2014	<1.0	2.1	12.3	5.6	<1.0	4.9	1,060	74.8	263
DUPLICATE	None	5/15/2014	<1.0	<2.0	10.3	4.9	<1.0	3.4	869	60.5	234
EPCs			1.98	2.48	6.85	6.85	7.28	11.45	815.25	52.98	299.00
MW-103D		3/28/2003	604	872	1,330	3,024	6,899	623	3,540	265	5,790
GW-3		12/22/2003	177	83.3	1,040	411	1,540	165	5,990	<100	1,790
		10/27/2004	52.4	23.8	383	142	1,840	30.1	3,050	663	709
		6/6/2005	3.4	3.6	30.9	21.2	120	<3.0	805	136	225
		11/22/2005	16.8	5.0	103	24.8	137	4.7	1,100	116	186
		5/11/2006	36.0	7.42	177	17.7	166	11.4	1,150	284	162
		11/2/2006	9.15	3.09	12.2	5.17	267	<3.0	498	116	<100
		5/8/2007	4.27	3.20	2.02	<4.00	139	<5.00	361	116	<100
	None	11/6/2007	38.9	31.20	137	8.42	197	<5.00	793	<100	246
	None	5/20/2008	10.1	7.8	18.8	4.7	772	<3.0	<50	<50	<50
	None	11/20/2008	90.6	10.7	191	17.1	68.5	9.7	1,380	90.9	191
	None	5/7/2009	125	10.6	204	15.2	34.4	13.5	1,720	170	237
	None	11/11/2009	104	11.0	138	20.0	51.0	29.0	874	241	239
	None	5/26/2010	362	22.8	184	22.1	65.5	17.7	2,770	198	338
	None	12/3/2010	103	12.4	137	20.7	75.3	12.0	1,090	156	181
	High[1]	6/9/2011	255	23.7	320	28.2	<2.0	31.0	3,090	<100	382
	High	11/16/2011	150	13.6	92.7	21.3	<1.0	14.6	2,120	93.8	275
	None	5/14/2012	60.5	6.0	28.6	7.6	<1.0	5.3	1,020	<50	153
	None	11/27/2012	49.6	6.8	7.7	4.9	20.4	4.7	792	<50	143
	None	5/6/2013	77.0	6.9	22.5	4.2	13.6	4.1	895	<50	172
	None	12/6/2013	115	3.5	6.2	2.8	132	<3.0	977	<50	130
	None	5/15/2014	30.3	4.3	20.2	4.6	23.9	<3.0	938	<50	114
EPCs			67.98	5.38	14.15	4.13	42.48	2.95	900.50	ND	139.75
MW-104		3/28/2003	2.2	6.5	110	103.6	7.3	104	314	<50	314
GW-3		12/22/2003	<2.0	2.3	128	80.8	<2.0	49.6	2,220	<50	537
		6/6/2005	<0.50	<1.0	5.4	4.6	<1.0	<3.0	207	<50	<50

TABLE 3

SUMMARY OF GROUNDWATER ANALYTICAL DATA - VOLATILE PETROLEUM HYDROCARBONS

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Concentrations in micrograms per liter (ug/L) equivalent to parts per billion (ppb)

			Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	C_5-C_8 Aliphatics	C_9-C_{12} Aliphatics	C_9-C_{12} Aromatics
Method 1 Standards		GW-2	1,000	50,000	20,000	3,000	50,000	700	3,000	5,000	4,000
		GW-3	10,000	40,000	5,000	5,000	50,000	20,000	50,000	50,000	50,000
Well ID (GW Category)	Data Usability Assessment Bias	Date									
MW-105		3/28/2003	34.6	3,150	2,450	7,970	<20	523	3,470	<500	6,220
GW-2/GW-3		12/22/2003	6.2	1,150	2,360	6,410	<2.0	516	8,820	<50	5,940
		10/27/2004	<10	651	2,490	5,548	<10	540	9,400	2,700	6,460
		6/6/2005	<5.0	202	2,590	3,620	<10	590	8,430	4,560	5,690
		11/22/2005	<2.0	45.8	359	492	<2.0	115	1,510	468	1,130
		5/11/2006	<1.00	305	1,750	3,518	224	395	6,950	6,820	6,470
		11/2/2006	5.17	268	2,500	6,860	8.25	450	12,800	4,340	10,000
		5/8/2007	11.4	123	1,980	4,475	23.5	353	12,900	4,220	9,130
	None	11/6/2007	4.00	356	3,870	9,840	4.42	728	7,770	8,540	8,150
	High	5/20/2008	<2.0	21.1	658	511	<2.0	165	2,630	176	4,400
	None	11/20/2008	<4.0	28.9	956	1,217	<2.0	219	3,240	1,380	4,540
	None	5/7/2009	<2.0	2.3	53.6	51.3	<1.0	20.6	1,950	1,290	3,120
	None	11/11/2009	10.0	<5.00	<5.00	<15.0	49.0	<5.00	332	47.0	52.0
	None	5/26/2010	<2.0	<2.0	36.8	48.1	<1.0	10.6	1,330	515	1,040
	None	12/3/2010	<2.0	13.9	196	201.6	<1.0	33.2	2,540	547	2,120
	Low	6/9/2011	4.0	6.2	49.1	38.7	<1.0	10.8	3,020	564	2,290
	Low	7/19/2011	2.6	3.1	34.6	24.0	<1.0	9.1	1,900	486	1,600
	High	11/16/2011	<2.0	<2.0	42.8	16.6	<1.0	17.9	992	215	785
	None	5/14/2012	<1.0	3.4	162	62.6	<1.0	38.8	2,720	588	1,530
	High	11/27/2012	5.9	12.3	850	1,636.50	<1.0	207	3,770	1,670	3,340
	None	5/6/2013	<1.0	5.4	241	210.6	<1.0	45.5	3,070	418	2,160
	None	12/6/2013	<1.0	17.9	1,810	3,180	<1.0	355	5,330	*	3,930
	None	5/15/2014	<5.0	17.6	920	1,103	<5.0	132	3,830	563	2,650
EPCs			2.35	13.30	955.25	1,507.53	ND	184.88	4,000.00	883.67	3,020.00
MW-106		3/28/2003	10,800	5,190	2,140	4,090	<40	386	8,110	<1000	4,780
GW-2/GW-3		12/22/2003	7,350	4,180	2,140	4,035	17.2	386	18,200	220	4,230
		10/27/2004	3,690	2,600	1,810	4,590	23.3	433	12,900	5,130	5,140
		6/6/2005	289	97.4	278	409	17.1	198	2,400	564	1,160
		11/22/2005	658	146	214	539	<2.0	226	6,040	796	2,050
		5/11/2006	1,430	194	780	503	259	220	6,040	1,950	1,710
		11/2/2006	687	88.9	578	271.7	5.34	143	6,000	950	1,360
	None	11/6/2007	<1.00	<3.00	13.3	19.71	<3.00	<5.00	<100	<100	<100
	None	5/20/2008	<2.0	<2.0	<2.0	<4.0	<2.0	<3.0	<50	<50	<50
	None	11/20/2008	<2.0	<2.0	2.0	2.4	<1.0	<3.0	<50	<50	<50
	None	5/26/2010	4.2	<2.0	<2.0	<4.0	<1.0	<3.0	322	<50	<50
	None	12/3/2010	129	14.3	43.9	15.2	<1.0	<3.0	3,230	<50	81.2
	None	6/9/2011	20.6	3.8	14.2	<2.0	<1.0	<3.0	1,910	<50	<50
	High[1]	6/9/2011	96.9	13.8	31.2	7.4	<1.0	<3.0	1,300	<50	<50
	NA	11/16/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS
	None	5/14/2012	13.6	<2.0	12.5	2.2	<1.0	<3.0	3,330	<50	<50
	None	11/27/2012	1,020	63.0	61.6	56.3	<2.0	8.1	1,390	<100	<100
	None	5/6/2013	185	31.2	36.9	26.4	<1.0	4.2	2,400	<50	196
	NA	12/6/2013	NS	NS	NS	NS	NS	NS	NS	NS	NS
	None	5/15/2014	33.5	4.9	9.3	5.7	<1.0	<3.0	1,280	<50	53.7
EPCs			313.03	25.03	30.08	22.65	ND	3.85	2,225.00	ND	81.18
MW-107		3/28/2003	32.0	15.9	47	104.9	<2	13	782	<50	645
GW-3		12/22/2003	44.2	28.3	254	51.3	<2.0	66.3	1,850	<50	597
		10/27/2004	17.7	22.6	127	33.5	<2.0	39.1	2,890	364	527
		6/6/2005	18.3	107	532	134	2.3	186	2,140	532	775
		5/11/2006	5.07	94.0	339	84.5	41.1	123	2,600	538	569
		11/6/2007	2.05	116	597	267	<3.00	127	3,830	1,090	1,170
	None	11/20/2008	9.9	126	649	227.5	<1.0	114	3,580	314	741
	None	5/7/2009	<2.0	<2.0	<2.0	<4.0	<1.0	<3.0	<50	<50	<50
	None	11/11/2009	11.0	121	650	198	87.0	127	3,060	912	976
	None	5/26/2010	8.7	87.2	605	144.9	<1.0	108	3,550	322	713
	None	12/3/2010	12.8	171	621	333.3	<1.0	134	4,760	814	1,050
DUPLICATE	None	12/3/2010	13.4	171	625	298.8	<1.0	133	4,460	630	955
	High[1]	6/9/2011	4.4	23.4	204	8.4	<1.0	5.7	1,560	83.6	250
DUPLICATE	High[1]	6/9/2011	4.3	21.5	184	7.4	<1.0	5.0	1,280	76.4	221
	None	11/16/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
DUPLICATE	None	11/16/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/14/2012	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
DUPLICATE	None	5/14/2012	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	11/27/2012	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
DUPLICATE	None	11/27/2012	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/6/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
DUPLICATE	None	5/6/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	12/6/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
DUPLICATE	None	12/6/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50

TABLE 3

SUMMARY OF GROUNDWATER ANALYTICAL DATA - VOLATILE PETROLEUM HYDROCARBONS

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Concentrations in micrograms per liter (ug/L) equivalent to parts per billion (ppb)

			Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	C_5-C_8 Aliphatics	C_9-C_{12} Aliphatics	C_9-C_{10} Aromatics
Method 1 Standards		GW-2	1,000	50,000	20,000	3,000	50,000	700	3,000	5,000	4,000
		GW-3	10,000	40,000	5,000	5,000	50,000	20,000	50,000	50,000	50,000
Well ID (GW Category)	Data Usability Assessment Bias	Date									
MW-107D		3/28/2003	876	2.1	22.8	12.4	<2	5.9	398	<50	53.6
GW-3		12/22/2003	370	<2.0	4.5	<4.0	<2.0	3.9	444	<50	<50
		10/27/2004	511	<2.0	3.2	<4.0	<2.0	<3.0	517	<50	<50
		5/11/2006	133	<3.00	1.98	<6.00	<1.00	15.7	166	<100	<100
	None	11/6/2007	<1.00	<3.00	7.68	10.28	<3.00	<5.00	<100	<100	<100
	None	11/20/2008	<2.0	<2.0	18.5	19.7	<1.0	4.8	118	<50	70.7
	None	5/7/2009	6.6	78.4	512	92.7	<1.0	74.8	2,820	484	619
	None	11/11/2009	<5.00	<5.00	<5.00	<15.0	<5.00	<5.00	<15.0	<15.0	<5.00
	None	5/26/2010	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	12/3/2010	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	High[1]	6/9/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	11/16/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/14/2012	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	11/27/2012	<1.0	<2.0	2.2	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/6/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	12/6/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
MW-108		8/5/2003	<2.0	4.7	<2.0	7.5	<2.0	<3.0	<50	<50	<50
GW-3		12/22/2003	<2.0	<2.0	<2.0	<2.0	<2.0	<3.0	<50	<50	<50
		5/11/2006	<1.00	<3.00	<1.00	<6.00	<1.00	<5.00	<100	<100	<100
HMW-1R		3/28/2003	<2.0	<2.0	6.1	<2	<2.0	43	<50	415	1,050
GW-3		12/22/2003	<2.0	<2.0	6.7	<2.0	<2.0	39.5	<50	244	835
		5/11/2006	<1.00	<3.00	14	<6.00	<1.00	87.3	<100	15,200	604
		11/2/2006	DESTROYED								
HMW-2R		3/28/2003	7.6	<2.0	77	43.8	<2.0	94.8	270	<50	1,430
GW-3											
HMW-3R		3/28/2003	<2.0	<2.0	<2.0	<2.0	<2.0	<3.0	<50	<50	<50
GW-3		12/22/2003	<2.0	<2.0	<2.0	<2.0	<2.0	<3.0	96.5	<50	<50
		10/27/2004	<2.0	37.3	283	249	<2.0	129	2,620	931	1,220
		5/11/2006	1.15	10.7	45.6	69.4	3.01	26.8	410	257	245
HMW-4		3/28/2003	<2.0	<2.0	<2.0	<2.0	<2.0	<3.0	<50	<50	<50
TRIP BLANK	None	12/3/2010	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	1/31/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	High[1]	6/9/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	7/19/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	11/16/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/14/2012	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	11/27/2012	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/6/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	12/6/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/15/2014	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
FIELD BLANK	None	12/3/2010	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	High[1]	6/9/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	11/16/2011	<2.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/14/2012	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	11/27/2012	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/6/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	12/6/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	5/15/2014	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50

TABLE 3

SUMMARY OF GROUNDWATER ANALYTICAL DATA - VOLATILE PETROLEUM HYDROCARBONS

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Concentrations in micrograms per liter (ug/L) equivalent to parts per billion (ppb)

			Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	C_5-C_8 Aliphatics	C_9-C_{12} Aliphatics	C_9-C_{10} Aromatics
Method 1 Standards		GW-2	1,000	50,000	20,000	3,000	50,000	700	3,000	5,000	4,000
		GW-3	10,000	40,000	5,000	5,000	50,000	20,000	50,000	50,000	50,000
Well ID (GW Category)	Data Usability Assessment Bias	Date									
RINSATE BLANK	None	1/14/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	1/15/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	1/17/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	1/30/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	2/27/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	2/28/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
	None	4/24/2013	<1.0	<2.0	<2.0	<2.0	<1.0	<3.0	<50	<50	<50
Maximum EPCs			313.03	26.95	955.25	1,507.53	42.48	204.35	4,000.00	883.67	3,020.00

Notes:
"-" - compound not detected above method detection limit
(GW-3) - groundwater category applicable to monitoring well
NA - not applicable or not available
MTBE - methyl tert-butyl ether
Bold-type is concentration detected above laboratory reporting limits
Bold type is concentration above applicable Policy Guidance Values

High[1] - indicates bias high for ethylbenzene
* indicates no result reported
Data collected prior to October 27, 2004 was previously presented in reports prepared and submitted by GSC/Kleinfelder.
Method 1 Standards referenced from 310 CMR 40.0974 of the Massachusetts Contingency Plan, effective April 2014
EPCs - Exposure Point Concentrations averaged from the last four available data sets. If below Method Detection Limits (MDLs), 1/2 the MDL was used.
ND - Not detected above MDLs

For the Data Usability Assessment, the following qualifiers are utilized:
None - no potential bias exists
Low - potential low bias exists
High - potential high bias exists
NC - data is not-CAM compliant

TABLE 4

GROUNDWATER ANALYTICAL DATA - EXTRACTABLE PETROLEUM HYDROCARBONS

Former Shell-Branded Service Station No. 137647
620 Broadway
Somerville, Massachusetts

Concentrations in micrograms per liter (ug/L) equivalent to parts per billion (ppb)

Well ID (GW Category)	Data Usability Assessment Bias	Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Pyrene	C9-C18 Aliphatics	C19-C36 Aliphatics	C11-C22 Aromatics
		GW-2	NA	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,000	700	NA	NA	5,000	NA	50,000
		GW-3	10,000	40	30	1,000	1,000	400	20	100	70	40	200	40	100	20,000	20,000	10,000	20	50,000	50,000	5,000
MW-10R		8/15/2002	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<100	<100	<100
GW-3																						
MW-16	None	3/28/2003	6.90	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	1,230	746	<5.6	<5.9	34,900	<110	6,738
GW-3	Low	5/11/2006	<104	<104	<104	<104	<104	<104	<104	<104	<104	<104	<104	<104	<104	156	283	<104	<104	4,020	<104	2,256
	None	11/6/2007	<59.3	<59.3	<59.3	<59.3	<59.3	<59.3	<59.3	<59.3	<59.3	<59.3	<59.3	<59.3	<59.3	73.4	316	<59.3	<59.3	<148	<148	358
	None	11/20/2008	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	20.2	24.8	<6.3	<6.3	165	<150	285
	None	5/7/2009	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<100	<100	<100
MW-18		8/15/2002	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	500	582	<5	<5	21,900	121	2,700
GW-3	None	3/28/2003	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	147	163	<5.3	<5.3	12,500	211	1,190
MW-1R1	None	5/11/2006	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	52.2	<10.4	<10.4	164	<104	257
GW-3	None	11/6/2007	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	31.9	<10.4	<10.4	<104	<104
	None	11/20/2008	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3	<130	<130	176
	None	5/7/2009	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<100	<100	<100
MW-1R2	None	3/28/2003	7.7	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	585	445	<5.1	<5.1	30,700	1,140	3,310
GW-3	None	5/11/2006	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	15.4	36.9	<10.4	<10.4	174	<104	186
	None	11/20/2008	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	13.7	73.3	<5.6	<5.6	128	<110	248
	None	5/7/2009	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<200	<100	<100
MW-1R3	Low	3/28/2003	6.1	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	6.1	<5.3	<5.3	1,100	870	7.3	5.4	48,800	651	4,350
GW-3																						
MW-1R3D	None	3/28/2003	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	120	223	<5.3	<5.3	2,418	<110	484
GW-3																						
MW-1R5	None	3/28/2003	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	56.2	177	<5.3	<5.3	1,750	<110	257
GW-2/GW-3	None	5/11/2006	<52.1	<52.1	<52.1	<52.1	<52.1	<52.1	<52.1	<52.1	<52.1	<52.1	<52.1	<52.1	<52.1	116.8	288	<52.1	<52.1	<104	<104	478
	None	11/6/2007	<42.1	<42.1	<42.1	<42.1	<42.1	<42.1	<42.1	<42.1	<42.1	<42.1	<42.1	<42.1	<42.1	87.9	316	<42.1	<42.1	<105	<105	377
	Low	11/20/2008	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	24.4	110	<5.3	<5.3	485	<110	361
	None	5/7/2009	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.5	13.5	<5.0	<5.0	207	<100	139
MW-1R6	None	3/28/2003	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	63.1	179	<5.3	<5.3	1,310	<110	391
GW-2/GW-3	None	5/11/2006	<20.8	<20.8	<20.8	<20.8	<20.8	<20.8	<20.8	<20.8	<20.8	<20.8	<20.8	<20.8	<20.8	58.4	125	<20.8	<20.8	<104	<104	387
	None	11/6/2007	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5	<105	<105	<105
	Low	11/20/2008	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<5.6	<110	<110	<110
MW-1R7	None	3/28/2003	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	7.6	<5.3	<5.3	<110	<110	164
GW-3																						
MW-1R7D	None	3/28/2003	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<100	<100	<100
GW-3																						
Maximum EPCs			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.50	13.50	ND	ND	207.00	ND	239.00

Notes:
"<" - compound not detected above method detection limit
(GW-3) - groundwater category applicable to monitoring well
NA - not applicable or not available
Bold-type is concentration detected above laboratory reporting limits
Bold, shaded type is concentration above applicable Policy Guidance Values

Analytical data presented through May 11, 2006 was provided by GSC/Rienzfeisler.

For the Data Usability Assessment, the following qualifiers are utilized:
None - no potential bias exists
Low - potential low bias exists
High - potential high bias exists
NC - data is not-CAM compliant

EPCs - Exposure Point Concentrations. EPC is the highest detection from the groundwater monitoring network during the most recent sampling event (May 2009)
ND - Not detected above MDLs

TABLE 5

SUMMARY OF GROUNDWATER ANALYTICAL DATA
LEAD AND OXYGENATES

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Concentrations in micrograms per liter (ug/L) equivalent to parts per billion (ppb)

Well ID *(GW Category)*	Data Usability Assessment	Date	MTBE	DIPE	TAME	TBA	ETBE	Lead	Ethanol
GW-2			**50,000**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
GW-3			**50,000**	**NA**	**NA**	**NA**	**NA**	**10**	**NA**
MW-10R		4/24/2002	<5.0	NA	NA	NA	NA	<5.0	NA
GW-3		8/15/2002	<2.0	NA	NA	NA	NA	<5.0	NA
		3/28/2003	<2.0	NA	NA	NA	NA	<5.0	NA
		12/22/2003	<2.0	NA	NA	NA	NA	NA	NA
	Low[1]	6/9/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/14/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	11/27/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/6/2013	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	5/15/2014	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
MW-16		4/24/2002	**10,400**	NA	NA	NA	NA	**399**	NA
GW-3		5/29/2002	**3,800**	NA	NA	NA	NA	NA	NA
		8/15/2002	**1,280**	NA	NA	NA	NA	**103**	NA
		3/28/2003	<20	NA	NA	NA	NA	**23.1**	NA
		12/22/2003	**404**	NA	NA	NA	NA	NA	NA
		10/27/2004	<2.0	NA	NA	NA	NA	NA	NA
		6/6/2005	<1.0	<2.0	<2.0	<100	<2.0	NA	NA
		11/22/2005	**111**	NA	NA	NA	NA	NA	NA
		5/11/2006	**69.7**	<1.00	<1.00	**167**	<1.00	<5	NA
		11/6/2007	**11.1**	<1.00	<1.00	**56.8**	<1.00	NA	<100
		11/20/2008	**4.2**	<2.0	<2.0	**21.0**	<2.0	NA	<200
		5/7/2009	<1.0	<2.0	6.0	<20	<2.0	NA	<200
	None	5/26/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	12/3/2010	**3.1**	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	6/9/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/14/2012	**6.5**	<2.0	<2.0	<20	<2.0	NA	<200
	None	11/27/2012	**8.4**	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/6/2013	**6.7**	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	5/15/2014	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
MW-17		4/24/2002	<5.0	NA	NA	NA	NA	**13.8**	NA
GW-3		8/15/2002	<2.0	NA	NA	NA	NA	<5.0	NA
		3/28/2003	<2.0	NA	NA	NA	NA	<5.0	NA
		5/11/2006	<1.00	<1.00	<1.00	<10.0	<1.00	NA	NA
MW-18		4/24/2002	**52,900**	NA	NA	NA	NA	NA	NA
GW-3		5/29/2002	**9,480**	NA	NA	NA	NA	NA	NA
		8/15/2002	**6,360**	NA	NA	NA	NA	**40.4**	NA
		3/28/2003	**494**	NA	NA	NA	NA	**22.4**	NA
		12/22/2003	**616**	NA	NA	NA	NA	NA	NA
		6/6/2005	**1.3**	<2.0	<2.0	<100	<2.0	NA	NA
		11/22/2005	**34.8**	NA	NA	NA	NA	NA	NA
		5/11/2006	**245**	<1.00	<1.00	**138**	<1.00	<5	NA
		11/6/2007	**28.5**	<1.00	**6.20**	**49.3**	<1.00	NA	<100
		11/20/2008	**6.2**	<2.0	<2.0	<20	<2.0	NA	<200
		5/7/2009	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/26/2010	**1.5**	<2.0	<2.0	<20	<2.0	NA	<200
	None	12/3/2010	**1.6**	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	6/9/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/14/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	11/27/2012	**2.4**	<2.0	<2.0	**72.6**	<2.0	NA	<200
	None	5/6/2013	**7.5**	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	5/15/2014	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
MW-101		3/28/2003	**26,500**	NA	NA	NA	NA	**13.8**	NA
GW-3		12/22/2003	**8,810**	NA	NA	NA	NA	NA	NA
		10/27/2004	**8,620**	NA	NA	NA	NA	NA	NA
		6/6/2005	**179**	<2.0	**4.9**	<100	<2.0	NA	NA
		11/22/2005	**8,010**	NA	NA	NA	NA	NA	NA
		5/11/2006	**3,130**	<1.00	**57.3**	**516**	<1.00	NA	NA
		11/6/2007	**311**	<1.00	**17.4**	**328**	<1.00	NA	<100
		11/20/2008	**44.1**	<2.0	**10.8**	**325**	<2.0	NA	<200
		5/7/2009	**23.5**	<2.0	**6.8**	**274**	<2.0	NA	<200
	None	5/26/2010	**23.4**	<2.0	**2.8**	<20	<2.0	NA	<200
	None	12/3/2010	**12.0**	<2.0	<2.0	<20	<2.0	NA	<200
	NA	6/9/2011	NS	NS	NS	NS	NS	NS	NS
	None	5/14/2012	**4.3**	<2.0	<2.0	<20	<2.0	NA	<200
		11/27/2012	well inaccessible						
		5/6/2013	well inaccessible						

TABLE 5

SUMMARY OF GROUNDWATER ANALYTICAL DATA
LEAD AND OXYGENATES

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Concentrations in micrograms per liter (ug/L) equivalent to parts per billion (ppb)

Well ID *(GW Category)*	Data Usability Assessment	Date	MTBE	DIPE	TAME	TBA	ETBE	Lead	Ethanol
GW-2			**50,000**	NA	NA	NA	NA	NA	NA
GW-3			**50,000**	NA	NA	NA	NA	10	NA
MW-102		3/28/2003	<20	NA	NA	NA	NA	31.1	NA
GW-3		12/22/2003	**33.1**	NA	NA	NA	NA	NA	NA
		10/27/2004	**181**	NA	NA	NA	NA	NA	NA
		6/6/2005	**2.9**	<2.0	<2.0	<100	<2.0	NA	NA
		5/11/2006	**34.0**	<1.00	<1.00	<10.0	<1.00	<5	NA
		11/20/2008	**10.5**	<2.0	<2.0	<20	<2.0	<5.0	<200
		5/7/2009	**1.9**	<2.0	<2.0	<20	<2.0	<5.0	<200
	None	5/26/2010	**3.0**	<2.0	<2.0	**170**	<2.0	NA	<200
	NA	12/3/2010	NS	NS	NS	NS	NS	NS	NS
	Low[1]	6/9/2011	**4.2**	<2.0	<2.0	548	<2.0	NA	<200
	None	5/14/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	11/27/2012	**4.2**	<2.0	<2.0	190	<2.0	NA	<200
	None	5/6/2013	**7.3**	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	5/15/2014	**1.2**	<2.0	<2.0	<20	<2.0	NA	<200
MW-103		3/28/2003	<10	NA	NA	NA	NA	75.3	NA
GW-3		12/22/2003	**344**	NA	NA	NA	NA	NA	NA
		10/27/2004	<4.0	NA	NA	NA	NA	NA	NA
		6/6/2005	**68.6**	<2.0	<2.0	<100	<2.0	NA	NA
		11/22/2005	**144**	NA	NA	NA	NA	NA	NA
		5/11/2006	**34.4**	<1.00	<1.00	**72.2**	<1.00	NA	NA
		11/6/2007	**15.5**	<1.00	<1.00	117	<1.00	NA	<100
		11/20/2008	**14.3**	<2.0	<2.0	<20	<2.0	<5.0	<200
		5/7/2009	**2.3**	<2.0	<2.0	<20	<2.0	<5.0	<200
	None	5/26/2010	**3.6**	<2.0	<2.0	<20	<2.0	NA	NA
	None	12/3/2010	**6.9**	<2.0	<2.0	**252**	<2.0	NA	<200
	Low[1]	6/9/2011	**2.3**	<2.0	<2.0	**72.9**	<2.0	NA	<200
	None	5/14/2012	**7.5**	<2.0	<2.0	<20	<2.0	NA	<200
	None	11/27/2012	**5.8**	<2.0	<2.0	100	<2.0	NA	<200
	None	5/6/2013	**9.1**	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	5/15/2014	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
DUPLICATE	Low[1]	5/15/2014	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
MW-103D		3/28/2003	**6,890**	NA	NA	NA	NA	**7.4**	NA
GW-3		12/22/2003	**1,540**	NA	NA	NA	NA	NA	NA
		10/27/2004	**1,840**	NA	NA	NA	NA	NA	NA
		6/6/2005	**120**	<2.0	<2.0	<100	<2.0	NA	NA
		11/22/2005	**137**	NA	NA	NA	NA	NA	NA
		5/11/2006	**166**	<1.00	<1.00	<10.0	<1.00	NA	NA
		11/6/2007	**162**	<1.00	**5.78**	**73.6**	<1.00	NA	<100
		11/20/2008	**83.5**	<2.0	<2.0	<20	<2.0	NA	<200
		5/7/2009	**33.5**	<2.0	**7.2**	**284**	<2.0	NA	<200
	None	5/26/2010	**27.5**	<2.0	**3.3**	<20	<2.0	NA	<200
	None	12/3/2010	**73.4**	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	6/9/2011	**19.6**	<2.0	**2.1**	**155**	<2.0	NA	<200
	None	5/14/2012	<1.0	<2.0	<2.0	**254**	<2.0	NA	<200
	None	11/27/2012	**21.3**	<2.0	<2.0	**313**	<2.0	NA	<200
	None	5/6/2013	**13.7**	<2.0	<2.0	<20	**17.8**	NA	<200
	Low[1]	5/15/2014	<1.0	<2.0	<2.0	**425**	<2.0	NA	<200
MW-104		3/28/2003	**7.3**	NA	NA	NA	NA	<5.0	NA
GW-3		12/22/2003	<2.0	NA	NA	NA	NA	NA	NA
		6/6/2005	<1.0	<2.0	<2.0	<100	<2.0	NA	NA
MW-105		3/28/2003	<20	NA	NA	NA	NA	28.4	NA
GW-2/GW-3		12/22/2003	<2.0	NA	NA	NA	NA	NA	NA
		10/27/2004	<10	NA	NA	NA	NA	NA	NA
		6/6/2005	<10	<20	<20	<1000	<20	NA	NA
		11/22/2005	<2.0	NA	NA	NA	NA	NA	NA
		5/11/2006	**224**	<1.00	<1.00	<10.0	<1.00	14.4	NA
		11/6/2007	<1.00	<1.00	<1.00	<20.0	<1.00	NA	<100
		11/20/2008	<1.0	<2.0	<2.0	<20	<2.0	**5.7**	<200
		5/7/2009	<1.0	<2.0	<2.0	<20	<2.0	**6.7**	<200
	None	5/26/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	12/3/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	6/9/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	7/19/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/14/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	11/27/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/6/2013	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	5/15/2014	<2.0	<4.0	<4.0	<40	<4.0	NA	<400

TABLE 5

SUMMARY OF GROUNDWATER ANALYTICAL DATA
LEAD AND OXYGENATES

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Concentrations in micrograms per liter (ug/L) equivalent to parts per billion (ppb)

Well ID *(GW Category)*	Data Usability Assessment	Date	MTBE	DIPE	TAME	TBA	ETBE	Lead	Ethanol
GW-2			**50,000**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
GW-3			**50,000**	**NA**	**NA**	**NA**	**NA**	**10**	**NA**
MW-106		3/28/2003	<40	NA	NA	NA	NA	**32.4**	NA
GW-2/GW-3		12/22/2003	**17.2**	NA	NA	NA	NA	NA	NA
		10/27/2004	**23.3**	NA	NA	NA	NA	NA	NA
		6/6/2005	**17.1**	<2.0	<2.0	<100	<2.0	NA	NA
		11/22/2005	<2.0	NA	NA	NA	NA	NA	NA
		5/11/2006	**259**	<1.00	**52.2**	**162**	<1.00	**10.3**	NA
		11/6/2007	<1.00	<1.00	<1.00	<20.0	<1.00	NA	<100
		11/20/2008	<1.0	<2.0	<2.0	<20	<2.0	<5.0	<200
	None	5/26/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	12/3/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	6/9/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/14/2012	<1.0	<2.0	<2.0	**49.1**	<2.0	NA	<200
	None	11/27/2012	1.3	<2.0	<2.0	**67.6**	<2.0	NA	<200
	None	5/6/2013	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	5/15/2014	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
MW-107		3/28/2003	<2	NA	NA	NA	NA	<5.0	NA
GW-3		12/22/2003	<2.0	NA	NA	NA	NA	NA	NA
		10/27/2004	<2.0	NA	NA	NA	NA	NA	NA
		6/6/2005	**2.3**	<2.0	<2.0	<100	<2.0	NA	NA
		5/11/2006	**41.1**	<1.00	<1.00	<10.0	<1.00	<5	NA
		11/6/2007	**1.42**	<1.00	<1.00	<20.0	<1.00	NA	<100
		11/20/2008	1.0	<2.0	<1.0	<20	<2.0	NA	<200
		5/7/2009	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/26/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	12/3/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
DUPLICATE	None	12/3/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	6/9/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
DUPLICATE	Low[1]	6/9/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/14/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
DUPLICATE	None	5/14/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	11/27/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
DUPLICATE	None	11/27/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/6/2013	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
DUPLICATE	None	5/6/2013	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
MW-107D		3/28/2003	<2	NA	NA	NA	NA	<5.0	NA
GW-3		12/22/2003	<2.0	NA	NA	NA	NA	NA	NA
		10/27/2004	<2.0	NA	NA	NA	NA	NA	NA
		5/11/2006	<1.00	<1.00	<1.00	<10.0	<1.00	<5	NA
		11/6/2007	<1.00	<1.00	<1.00	<20.0	<1.00	NA	<100
		11/20/2008	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
		5/7/2009	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/26/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	12/3/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	6/9/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/14/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	11/27/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/6/2013	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
MW-108		8/5/2003	<2.0	NA	NA	NA	NA	NA	NA
GW-3		12/22/2003	<2.0	NA	NA	NA	NA	NA	NA
		5/11/2006	<1.00	<1.00	<1.00	<10.0	<1.00	NA	NA
HMW-1R		3/28/2003	<2.0	NA	NA	NA	NA	NA	NA
GW-3		12/22/2003	<2.0	NA	NA	NA	NA	NA	NA
		5/11/2006	<1.00	<1.00	<1.00	<10.0	<1.00	NA	NA
HMW-2R		3/28/2003	<2.0	NA	NA	NA	NA	NA	NA
GW-3									
HMW-3R		3/28/2003	<2.0	NA	NA	NA	NA	NA	NA
GW-3		12/22/2003	<2.0	NA	NA	NA	NA	NA	NA
		10/27/2004	<2.0	NA	NA	NA	NA	NA	NA
		5/11/2006	3.01	<1.00	<1.00	<10.0	<1.00	NA	NA
HMW-4		3/28/2003	<2.0	NA	NA	NA	NA	NA	NA
GW-3									

TABLE 5

SUMMARY OF GROUNDWATER ANALYTICAL DATA
LEAD AND OXYGENATES

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Concentrations in micrograms per liter (ug/L) equivalent to parts per billion (ppb)

Well ID *(GW Category)*	Data Usability Assessment	Date	MTBE	DIPE	TAME	TBA	ETBE	Lead	Ethanol
GW-2			50,000	NA	NA	NA	NA	NA	NA
GW-3			50,000	NA	NA	NA	NA	10	NA
TRIP BLANK	None	12/3/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	7/19/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/14/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	11/27/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/6/2013	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	5/15/2014	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
FIELD BLANK	None	12/3/2010	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	6/9/2011	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/14/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	11/27/2012	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	None	5/6/2013	<1.0	<2.0	<2.0	<20	<2.0	NA	<200
	Low[1]	5/15/2014	<1.0	<2.0	<2.0	<20	<2.0	NA	<200

Notes:
"<" - compound not detected above method detection limit
(GW-3) - groundwater category applicable to monitoring well
NA - not applicable or not available
MTBE - methyl tert-butyl ether
DIPE - diisopropyl ether
TAME - tert-Amyl methyl ether
TBA - tert-Butyl alcohol
ETBE - tert-Butyl ethyl ether
Method 1 Standards referenced from 310 CMR 40.0974 of the Massachusetts Contingency Plan, effective April 2014
Bold-type is concentration detected above laboratory reporting limit
Bold-type is concentration above applicable Policy Guidance Values

For the Data Usability Assessment, the following qualifiers are utilized:
None - no potential bias exists
Low - potential low bias exists
High - potential high bias exists
NC - data is not-CAM compliant

Low[1] - indicates bias low for ethanol

Analytical data presented through May 11, 2006 was provided by GSC/Kleinfelder.

TABLE 6

SUMMARY OF SOIL DATA - VPH

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

	Method 1 Standards	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	MTBE (mg/kg)	Napthalene (mg/kg)	C5-C8 Aliphatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C10 Aromatics (mg/kg)
	S-1/GW-2	40	500	500	100	100	20	100	1,000	100
	S-1/GW-3	40	500	500	500	100	500	100	1,000	100
	S-3/GW-2	400	2,000	1,000	100	100	20	500	5,000	500
	S-3/GW-3	1,000	3,000	3,000	3,000	500	3,000	500	5,000	500
	UCLs	10,000	10,000	10,000	10,000	5,000	10,000	5,000	20,000	5,000
Sample Identification	Date Sampled	Depth (ft)	Data Usability Assessment Bias								
Shallow Soils											
MW-6	5/19/1996	10-12	NC	<0.0054	<0.0054	<0.0054	<0.0108	<0.0054	--	--	--
B-1	4/21/1998	8-10	NC	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	< 0.62	0.396
B-2	4/21/1998	6-8	NC	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	< 0.62	0.853
B-3	4/21/1998	8-10	NC	< 0.13	0.15	< 0.13	0.57	< 0.13	1.98	24.3	116
B-4	4/21/1998	8-10	NC	<0.12	<0.12	<0.12	0.542	<0.12	1.18	23.5	55.3
B-5	4/21/1998	6-8	NC	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.66	< 0.66
B-6	4/21/1998	6-8	NC	<0.13	<0.13	<0.13	<0.13	<0.13	2.04	<0.64	1.27
MW-10	4/28/1998	8-10	NC	<0.13	<0.13	<0.13	<0.26	<0.13	<0.13	<0.65	<0.65
MW-15	6/21/2001	10-12	NC	<0.24	<0.24	<0.24	<0.48	<0.24	<0.24	<4.8	<4.8
MW-16	6/21/2001	10-12	NC	<0.29	<0.29	<0.29	0.342	<0.29	<0.29	<5.8	<5.8
UST-ESW	1/9/2002	8	None	<0.28	<0.28	<0.28	<0.56	<0.28	<0.28	<5.7	<5.7
UST-NSW	1/10/2002	8-10	None	<0.23	<0.23	<0.23	<0.46	<0.23	<0.23	<4.5	<4.5
HO-BOT	1/10/2002	6-8	None	<0.23	<0.23	<0.23	<0.46	0.347	<0.23	<4.6	<4.6
HO-ESW	1/10/2002	4-5	High (aliphatics ranges)	<0.25	<0.25	<0.25	<0.50	<0.25	<0.25	5.06	<5.0
HO-SSW	1/10/2002	4-5	High (aliphatics ranges)	<0.27	<0.27	<0.27	<0.54	<0.27	<0.27	<5.4	<5.4
UST-SSW	1/10/2002	8-10	None	<0.21	<0.21	<0.21	0.314	<0.21	<0.21	7.98	7.41	9.75
DISP-1	1/11/2002	4	None	<0.28	<0.28	<0.28	<0.56	<0.28	<0.28	<5.5	<5.5	<5.5
DISP-2	1/11/2002	4	None	<0.49	<0.49	<0.49	<0.98	<0.49	<0.49	<9.7	<9.7	<9.7
MW-11-OEXC-NWSW	1/17/2002	0-9	None	<0.23	<0.23	<0.23	<0.46	<0.23	<0.23	<4.7	<4.7	<4.7
MW-11-OEXC-NWSW	1/17/2002	10-15	None	<0.18	<0.18	<0.18	<0.36	<0.18	<0.18	<3.5	<3.5	<3.5
MW-11-OEXC-SWSW	1/17/2002	0-9	None	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<4.1	<4.1	<4.1
MW-11-OEXC-SWSW	1/17/2002	10-15	None	<0.16	<0.16	2.79	2.86	1.46	1.8	50.1	32.7	45.3
MW-11-OEXC-NESW	1/17/2002	0-9	None	<0.18	<0.18	<0.18	<0.36	0.228	<0.18	<3.7	<3.7	<3.7
MW-11-OEXC-NESW	1/17/2002	10-15	None	<0.14	<0.14	<0.14	0.292	0.826	0.15	<2.8	<2.8	<2.8
UST-SSW	2/1/2002	15	None	<0.21	<0.21	<0.21	<0.42	2.75	<0.21	5.95	9.29	16.1
OWS-WSW	2/5/2002	0-5	None	<0.19	<0.19	<0.19	<0.38	<0.19	<0.19	<3.8	<3.8	<3.8
OWS-WSW	2/5/2002	11-13	None	<0.3	<0.3	<0.3	<0.6	<0.3	<0.3	<6.0	14.3	26.2
OWS-ESW	2/5/2002	0-5	None	<0.37	0.614	7.22	21.97	<0.37	14.1	327	282	670
OWS-ESW	2/5/2002	11-13	None	<0.45	<0.45	2.19	1.66	<0.45	2.56	82.8	75.6	138
OWS-NSW	2/5/2002	0-5	None	<0.26	<0.26	<0.26	0.322	<0.26	0.262	<5.1	<5.1	<5.1
OWS-NSW	2/5/2002	11-13	None	<0.26	12.4	18.9	57.4	0.464	8.54	270	127	292
OWS-BOTT	2/5/2002	14	None	<0.22	2.49	6.04	21.82	<0.22	6.13	97.7	66.2	163
TEST PIT #1	2/7/2002	4-6	None	<0.17	0.274	0.821	3.493	<0.17	2.42	35.2	21.8	38.2
TEST PIT #1	2/7/2002	13-15	None	<0.16	<0.16	1.9	1.706	<0.16	1.0	85.7	76.1	111

TABLE 6

SUMMARY OF SOIL DATA - VPH

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

			Method 1 Standards	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	MTBE (mg/kg)	Naphthalene (mg/kg)	C5-C8 Aliphatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C10 Aromatics (mg/kg)
			S-1/GW-2	40	500	500	100	100	20	100	1,000	100
			S-1/GW-3	40	500	500	500	100	500	100	1,000	100
			S-3/GW-2	400	2,000	1,000	100	100	20	500	5,000	500
			S-3/GW-3	1,000	3,000	3,000	3,000	500	3,000	500	5,000	500
			UCLs	10,000	10,000	10,000	10,000	5,000	10,000	5,000	20,000	5,000
Sample Identification	Date Sampled	Depth (ft)	Data Usability Assessment Bias									
TEST PIT #2	2/7/2002	3-5	None	<0.18	<0.18	<0.18	0.222	<0.18	<0.18	4.33	<3.7	5.56
TEST PIT #2	2/7/2002	12-14	None	<0.15	<0.15	<0.15	0.297	<0.15	<0.15	6.57	4.15	3.83
OWS-SSW	2/7/2002	0-5	High (aliphatic ranges)	<2.5	<2.5	20.9	31.2	<2.5	73.4	156	982	1,140
OWS-SSW	2/7/2002	12-14	None	<0.23	<0.23	1.03	5.22	<0.23	1.68	12.9	16.4	28.4
MW-17	2/13/2002	10-12	None	<0.15	<0.15	<0.15	<0.30	<0.15	0.637	8.09	4.42	5.08
MW-18	2/20/2002	10-12	None	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<4.0	<4.0	<4.0
MW-19D	3/7/2002	10-12	None	<0.16	<0.16	<0.16	<0.32	<0.16	<0.16	4.26	<3.1	<3.1
MW-21D	7/26/2002	8-10	None	<0.29	<0.29	<0.29	<0.58	<0.12	<0.29	<5.8	<5.8	<5.8
MW13D	7/29/2002	8-10	None	<0.3	3.39	12.2	35.44	1.88	3.76	297	94.5	117
CF-1	11/18/2002	5-7	None	<0.5	<0.5	<0.5	0.523	<0.2	<0.5	<10.0	<10.0	<10.0
CF-2	11/18/2002	5-7	None	<0.5	<0.5	<0.5	<10.0	<0.2	<0.5	<10.0	<10.0	<10.0
CF-3	11/19/2002	5-7	None	<0.57	<0.57	<0.57	1.15	<0.23	<0.57	<11.0	<11.0	13.2
SB-101	1/30/2013	10-12.5	None	<0.33	<0.33	<0.33	<0.66	<0.067	<0.33	<6.7	<6.7	<6.7
SB-102	1/17/2013	2-4	High	<0.42	0.581	<0.42	1.06	<0.084	<0.42	<8.4	<8.4	<8.4
SB-102 DUP	1/17/2013	2-4	None	<0.34	0.548	<0.34	1.01	<0.067	0.604	<6.7	<6.7	10.3
SB-102	1/17/2013	6-10	High	<0.38	2.23	18.9	69.6	<0.075	16.7	237	271	843
SB-102	1/30/2013	10-12.5	Low	<0.34	39.2	30.1	105.4	<0.069	5.29	699	171	295
SB-102	1/30/2013	12.5-15	None	<0.33	13.6	17.4	61.0	<0.065	3.73	439	113	183
SB-105	1/14/2013	2-4	High	<0.49	<0.49	<0.49	<0.49	<0.099	<0.49	<9.9	<9.9	<9.9
SB-105	1/30/2013	12.5-14	None	<0.36	0.737	12.4	11.75	<0.072	3.24	377	107	146
SB-105	1/30/2013	14-17	None	<0.35	<0.35	2.07	1.64	<0.069	0.752	111	29.0	47.2
SB-106	4/24/2013	10-12	None	<0.34	<0.34	0.506	0.438	<0.069	<0.34	51.5	13.0	20.5
SB-106	4/24/2013	13-15	None	<0.31	<0.31	20.3	22.96	<0.061	4.70	413	94.7	164
SB-107	1/15/2013	8-10	None	<0.41	<0.41	<0.41	<0.41	<0.083	<0.41	<8.3	<8.3	<8.3
SB-107	1/30/2013	10-12.5	High	<0.40	<0.40	<0.40	<0.80	<0.081	<0.40	15.3	<8.1	<8.1
SB-200 (1-3 FT)	4/8/2014	1-3	None	<0.37	<0.37	<0.37	<0.74	<0.074	<0.37	<7.4	<7.4	<7.4
SB-201 (1-3 FT)	4/8/2014	1-3	None	<0.33	<0.33	<0.33	<0.66	<0.067	<0.33	<6.7	<6.7	<6.7
SB-202 (1-3 FT)	4/8/2014	1-3	None	<0.36	<0.36	<0.36	<0.72	<0.073	<0.36	<7.3	<7.3	<7.3
SB-203 (1-3 FT)	4/8/2014	1-3	Low	<0.47	<0.47	<0.47	<0.94	<0.47	<0.47	<9.4	<9.4	<9.4
Trip Blank	1/14/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.50	<0.25	<5.0	<5.0	<5.0
Trip Blank 1-17	1/17/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Trip Blank-7	1/30/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0

TABLE 6

SUMMARY OF SOIL DATA - VPH

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

				Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	MTBE (mg/kg)	Napthalene (mg/kg)	C5-C8 Aliphatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C10 Aromatics (mg/kg)
		Method 1 Standards										
		S-1/GW-2		40	500	500	100	100	20	100	1,000	100
		S-1/GW-3		40	500	500	500	100	500	100	1,000	100
		S-3/GW-2		400	2,000	1,000	100	100	20	500	5,000	500
		S-3/GW-3		1,000	3,000	3,000	3,000	500	3,000	500	5,000	500
		UCLs		10,000	10,000	10,000	10,000	5,000	10,000	5,000	20,000	5,000
Sample Identification	**Date Sampled**	**Depth (ft)**	**Data Usability Assessment Bias**									
Trip Blank	4/8/2014	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Solvent Blank 8	2/27/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Solvent Blank 10	4/24/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Field Blank 4	1/14/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Field Blank 5	1/15/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Field Blank 6	1/17/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Field Blank 7	1/30/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Field Blank 8	2/27/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Field Blank 9	2/28/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Field Blank 10	4/24/2013	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Field Blank	4/8/2014	NA	None	<0.25	<0.25	<0.25	<0.25	<0.050	<0.25	<5.0	<5.0	<5.0
Max EPCs (0-15')				0.00	39.20	30.10	105.40	2.75	73.40	699.00	982.00	1,140.00
Deep Soils												
MW-11	1/23/2001	15-17	None	17.2	138	126	391.8	<3.3	40.9	4,450	1,310	2,030
MW-12	1/23/2001	15-17	None	<0.33	0.4	3.3	3.843	<0.33	1.27	159	40.8	60.8
MW-13	1/23/2001	15-17	None	<0.42	<0.42	<0.42	<0.84	<0.42	<0.42	<8.3	<8.3	<8.3
MW-11-OEXC-BOT	1/21/2002	17	High (exposure ranges)	<1.5	5.27	56.6	147.2	3.82	15.9	1,070	395	608
UST-NSW	1/28/2002	15-16	None	<0.23	<0.23	<0.23	<0.46	0.478	1.27	183	42	108
UST-ESW	1/28/2002	15-16	None	<0.25	0.459	2.67	7.32	2.89	2.0	66.3	42.4	84.8
UST-BOTT1	1/28/2002	18	None	<0.2	<0.2	0.618	0.264	0.406	0.614	81.5	21.5	31.2
UST-BOTT2	1/28/2002	18	None	<0.21	<0.21	0.299	1.048	0.229	0.89	23.5	23.7	38.3
SB-101	1/30/2013	15-17	None	<0.36	<0.36	4.21	2.87	<0.072	1.09	94.9	22.4	29.1
SB-101	4/24/2013	19-21	None	<0.30	<0.30	<0.30	<0.30	<0.060	<0.30	<6.0	<6.0	<6.0
SB-102	1/30/2013	15-18	None	2.02	1.92	9.51	28.38	<0.065	2.62	265	68.2	107
SB-104	2/27/2013	15-17	None	1.75	1.80	7.99	17.53	<0.068	1.96	457	97.1	149
SB-104	2/27/2013	17-19	None	0.975	1.87	6.89	24.30	<0.066	1.79	208	47.7	80.7
SB-104	2/27/2013	27-29	None	0.922	<0.38	<0.38	<0.76	<0.075	<0.38	<7.5	<7.5	<7.5
SB-104 DUP	2/27/2013	27-29	None	<0.36	<0.36	0.439	0.538	<0.071	<0.36	10.3	<7.1	<7.1
SB-105	2/28/2013	17-19	None	<0.31	<0.31	0.36	0.330	<0.062	<0.31	17.5	<6.2	<6.2
SB-105	2/28/2013	19-21	None	<0.31	<0.31	<0.31	<0.62	<0.062	<0.31	<6.2	<6.2	<6.2
SB-106	4/24/2013	15-17	None	<0.28	0.529	5.77	5.66	<0.055	1.99	303	43.6	87.1
SB-106	4/24/2013	17-19	None	<0.32	<0.32	<0.32	<0.32	<0.063	<0.32	<6.3	<6.3	<6.3
SB-106	4/24/2013	19-21	None	<0.31	<0.31	<0.31	<0.31	<0.062	<0.31	<6.2	<6.2	<6.2

TABLE 6

SUMMARY OF SOIL DATA - VPH

Former Shell-Branded Service Station No. 13784?
620 Broadway
Somerville, Massachusetts

	Method 1 Standards	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	MTBE (mg/kg)	Napthalene (mg/kg)	C5-C8 Aliphatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C10 Aromatics (mg/kg)
	S-1/GW-2	40	500	500	100	100	20	100	1,000	100
	S-1/GW-3	40	500	500	500	100	500	100	1,000	100
	S-3/GW-2	400	2,000	1,000	100	100	20	500	5,000	500
	S-3/GW-3	1,000	3,000	3,000	3,000	500	3,000	500	5,000	500
	UCLs	10,000	10,000	10,000	10,000	5,000	10,000	5,000	20,000	5,000
Sample Identification	Date Sampled	Depth (ft)	Data Usability Assessment Bias							
SB-106	4/24/2013	21-23	None	<0.30	<0.30	<0.30	<0.30	<0.061	<0.30	<6.1	<6.1	<6.1
SB-106 DUP	4/24/2013	17-19	None	<0.29	<0.29	<0.29	<0.29	<0.058	<0.29	<5.8	<5.8	<5.8
SB-108	1/30/2013	15-17.5	None	<0.34	<0.34	2.05	4.58	<0.067	1.17	56.4	26.2	37.3
SB-108	4/24/2013	18-20	None	0.901	4.74	1.73	6.28	<0.063	0.514	47.9	<6.3	18.8
SB-108	4/24/2013	22-24	None	0.683	<0.30	<0.30	<0.30	<0.060	<0.30	<6.0	<6.0	<6.0
SB-109	1/30/2013	15-17.5	None	<0.34	<0.34	<0.34	<0.68	<0.069	<0.34	<6.9	<6.9	<6.9
SB-109 DUP	1/30/2013	15-17.5	None	<0.34	<0.34	<0.34	<0.68	<0.068	<0.34	<6.8	<6.8	<6.8
SB-109	2/27/2013	20-22	None	<0.31	<0.31	<0.31	1.253	<0.062	<0.31	16.1	8.66	16.2
SB-109	2/27/2013	24-26	None	<0.35	<0.35	<0.35	<0.70	<0.071	<0.35	7.89	<7.1	<7.1
SB-110	1/30/2013	15-17	Low	<0.33	0.348	3.23	0.599	<0.065	0.915	446	118	128
SB-110	1/30/2013	17-18	Low	<0.30	<0.30	13.1	20.90	<0.059	3.70	396	115	174
SB-110	2/27/2013	19-21	None	<0.35	1.21	6.32	14.25	<0.071	2.96	225	74.8	113
SB-110	2/27/2013	27-29	High	3.30	37.4	28.4	93.1	<0.063	6.90	873	188	323
SB-110	2/27/2013	33-35	None	<0.34	<0.34	0.632	0.885	<0.068	<0.34	14.2	<6.8	<6.8
SB-112	2/28/2013	15-17	High	<0.34	<0.34	21.0	20.86	<0.068	4.72	478	151	199
SB-112	2/28/2013	17-19	None	<0.31	<0.31	4.95	8.24	<0.062	1.19	113	32.7	48.4
SB-112	2/28/2013	23-25	None	<0.34	0.467	0.957	2.436	<0.068	<0.34	28.7	<6.8	<6.8
SB-112	2/28/2013	31-33	None	<0.37	<0.37	<0.37	<0.74	<0.075	<0.37	<7.5	<7.5	<7.5
Max EPCs (>15')				17.20	138.00	126.00	391.80	3.82	40.90	4,450.00	1,310.00	2,030.00

Notes:
(mg/kg) - milligrams per kilogram (parts per million (ppm))
- - not analyzed
ND - not detected above method detection limit
VPH - volatile petroleum hydrocarbons
S-1 - Massachusetts Contingency Plan (MCP) Method 1 Soil Standard for category S-1 soil (with GW-2/GW-3 Groundwater Standard).
Method 1 Standards referenced from 310 CMR 40.0975 of the Massachusetts Contingency Plan, effective April 2014
** - Sample ID's that do no appear on site plan
Bold-type is concentration detected above laboratory reporting limits
Bold type is concentration above applicable Standards
EPC - Exposure Point Concentration

Data Usability Assessment- the following qualifiers are utilized:
None - no potential bias exists
Low - potential low bias exists
High - potential high bias exists
NC - data is not-CAM compliant (may be due attributed to Pre-CAM data if QC cannot be confirmed)

TABLE 7

SUMMARY OF SOIL DATA - EPH

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

	Method 1 Soil Standards	C9-C18 Aliphatics	C19-C36 Aliphatics	C11-C22 Aromatics	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	2-Methyl-Naphthalene	Naphthalene	Phenanthrene	Pyrene
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
	S-1/GW-2	1,000	3,000	1,000	1,000	600	1,000	7	2	7	1,000	70	70	0.7	1,000	1,000	7	300	500	500	1,000
	S-1/GW-3	1,000	3,000	1,000	1,000	10	1,000	7	2	7	1,000	70	70	0.7	1,000	1,000	7	300	500	500	1,000
	S-3/GW-2	5,000	5,000	5,000	5,000	600	5,000	300	30	300	5,000	3,000	3,000	30.0	5,000	5,000	300	30	20	3,000	5,000
	S3/GW-3	5,000	5,000	5,000	5,000	10	5,000	300	30	300	5,000	3,000	3,000	30.0	5,000	5,000	300	500	3,000	3,000	5,000
	Background Natural Soil	NE	NE	NE	0.5	0.5	1	2	2	1	1	1	2	0.5	4	1	1	NE	0.5	3	4
	Background Urban Fill	NE	NE	NE	2	1	4	9	7	4	3	4	7	1	10	2	3	NE	1	20	20
	UCLs	20,000	20,000	10,000	10,000	10,000	10,000	3,000	300	3,000	10,000	10,000	10,000	300	10,000	10,000	3,000	5,000	10,000	10,000	10,000

Sample Identification	Date Sampled	Depth (ft)	Data Usability Assessment Bias																		
				Soil Borings																	
B-3	4/21/1998	8-8	NC	676	559	152	< 0.6	< 0.6	< 0.6	1.36	0.843	2.71	30.2	0.94	2.56	< 0.6	2.62	< 0.6	2.24	< 0.6	< 0.6	1.45	2.25
B-4	4/21/1998	8-10	NC	<0.55	<0.55	186	1.37	1.87	6.07	4.71	1.59	4.56	7.73	6.38	9.86	1.82	18.6	1.9	6.45	<0.55	0.823	25.8	14
B-5	4/21/1998	6-8	NC	< 0.52	< 0.52	< 0.52	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
B-6	4/21/1998	6-8	NC	<0.57	7.51	939	9.95	8.035	25.8	25.3	26.9	29.7	19.9	16.8	36.6	2.58	56.9	8.81	37.9	3.36	3.56	58.4	52.9
UST-ESW	1/9/2002	8	None	66.3	113	60.3	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61
UST-NSW	1/10/2002	8-10	None	<8.4	<8.5	<18	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53
HO-BOT	1/10/2002	6-8	None	17.6	366	318	<0.56	8.836	1.59	4.71	5.46	4.46	3.4	4.52	4.55	0.813	8.54	<0.56	3.84	<0.56	<0.56	4.6	7.69
HO-ESW	1/10/2002	4-5	None	<7.9	<9.3	37.5	<0.58	<0.58	<0.58	<0.58	<0.58	<0.58	<0.58	<0.58	<0.58	<0.58	0.602	<0.58	<0.58	<0.58	<0.58	<0.58	<0.58
HO-SSW	1/10/2002	4-5	None	7.59	12.8	28.3	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61
UST-SSW	1/10/2002	8-10	None	9.38	<8.8	28.6	<0.55	<0.55	<0.55	0.62	0.685	0.627	<0.55	0.613	0.557	<0.55	0.960	<0.55	<0.55	<0.55	<0.55	<0.55	0.953
DISP-1	1/11/2002	4	None	8.69	<8.9	23.3	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56
DISP-2	1/11/2002	4	None	<8.4	<8.5	<18	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53
MW-11-OEXC-NWSW	1/17/2002	8-9	None	<8.8	<8.8	<19	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.56	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55
MW-11-OEXC-NWSW	1/17/2002	10-15	None	<8.3	<8.4	<18	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52
MW-11-OEXC-SWSW	1/17/2002	8-9	None	8.75	86.2	94.4	<0.55	0.578	1.45	2.96	3.44	2.97	3.08	2.84	2.57	0.787	6.59	<0.55	3.47	<0.55	<0.55	5.03	5.81
MW-11-OEXC-SWSW	1/17/2002	10-15	None	64.6	<8.8	24	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	1.81	0.622	<0.55	<0.55
MW-11-OEXC-NESW	1/17/2002	8-9	None	<8.5	<8.7	<19	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55
MW-11-OEXC-NESW	1/17/2002	10-15	None	<8.5	<8.7	<18	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54
OWS-WSW	2/5/2002	8-8	None	<8.8	11.8	73.6	<0.57	<0.57	0.796	2.04	2.6	2.34	<0.57	2.26	2.68	<0.57	5.4	<0.57	<0.57	<0.57	<0.57	3.33	4.94
OWS-WSW	2/5/2002	11-13	None	23.2	<9.8	<21	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61
OWS-ESW	2/5/2002	8-8	None	207	23.1	88.9	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	<0.56	12.2	4.65	0.576	8.791
OWS-ESW	2/5/2002	11-13	None	23.9	<9.8	<21	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	1.14	<0.61	<0.61	<0.61
OWS-NSW	2/5/2002	8-8	High (aromatics ranges)	14.8	387	751	0.894	4.25	6.21	14.3	17.2	14.9	10.8	10	21.5	2.2	39.5	1.42	11.8	<0.54	<0.54	20.3	31
OWS-NSW	2/5/2002	11-13	None	74.3	<8.6	51.9	<0.54	<0.54	<0.54	0.658	0.947	0.774	<0.54	0.742	0.721	<0.54	1.57	<0.54	<0.54	4.61	2.58	8.607	1.34
OWS-BOTT	2/5/2002	14	None	44.7	14.8	24.8	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	3.17	1.36	<0.54	<0.54
TEST PIT #1	2/7/2002	4-6	None	11.5	566	167	<0.55	<0.55	<0.55	1.25	1.51	1.3	1.38	1.38	1.56	<0.55	2.74	<0.55	<0.55	<0.55	<0.55	1.46	2.33
TEST PIT #1	2/7/2002	13-15	None	24.8	15.5	27.3	<0.55	<0.55	<0.55	<0.55	<0.53	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	0.607	<0.55	<0.55	<0.55
TEST PIT #2	2/7/2002	3-5	Low (aliphatics ranges)	<7.3	<9.6	<21	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61	<0.61
TEST PIT #2	2/7/2002	12-14	None	<8.5	<8.6	<18	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54
OWS-SSW	2/7/2002	8-8	High (aliphatics ranges)	614	925	1,420	<2.6	<2.6	3.39	11.4	10.3	13.7	10.4	13.3	14.5	<2.6	27.8	4.02	30.8	76.9	22.6	16.8	24
OWS-SSW	2/7/2002	12-14	None	7.65	37.7	57.4	<0.57	<0.57	<0.57	1.21	1.18	1.03	<0.57	1.06	1.44	<0.57	2.75	<0.57	<0.57	2.33	1.14	2.12	2.27

TABLE 7

SUMMARY OF SOIL DATA - EPH

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Method 1 Soil Standards	C9-C18 Aliphatics	C19-C36 Aliphatics	C11-C22 Aromatics	Acenaph-thene	Acenaph-thylene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i)per ylene	Benzo(k) fluoranthene	Chrysene	Dibenzo(a,h)ant hracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	2-Methyl-Naphthalene	Naphthalene	Phenanthrene	Pyrene
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
S-1/GW-2	1,000	3,000	1,000	1,000	600	1,000	7	2	7	1,000	70	70	0.7	1,000	1,000	7	30	20	500	1,000
S-1/GW-3	1,000	3,000	1,000	1,000	10	1,000	7	2	7	1,000	70	70	0.7	1,000	1,000	7	300	500	500	1,000
S-3/GW-2	5,000	5,000	5,000	5,000	600	5,000	300	30	300	5,000	3,000	3,000	30.0	5,000	5,000	300	30	20	3,000	5,000
S3/GW-3	5,000	5,000	5,000	5,000	10	5,000	300	30	300	5,000	3,000	3,000	30.0	5,000	5,000	300	500	3,000	3,000	5,000
Background Natural Soil	NE	NE	NE	0.5	0.5	1	2	2	1	1	1	2	0.5	4	1	1	NE	0.5	3	4
Background Urban Fill	NE	NE	NE	2	1	4	9	7	4	3	4	7	1	10	2	3	NE	1	20	20
UCLs	20,000	20,000	10,000	10,000	10,000	10,000	3,000	300	3,000	10,000	10,000	10,000	300	10,000	10,000	3,000	5,000	10,000	10,000	10,000

Sample Identification	Date Sampled	Depth (ft)	Data Usability Assessment Bias																		
MW-17	2/13/2002	10-12	None	<6.5	<8.7	24.3	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	0.983	<0.54	<0.54	<0.54	1.16	0.78
CF-1	11/18/2002	5-7	None	11	13.9	83.8	<0.55	<0.55	0.827	3	3.64	3.43	<0.55	2.47	3.27	<0.55	5.9	<0.55	2.19	<0.55	<0.55	1.65	4.96
CF-2	11/18/2002	5-7	None	12.5	13.1	27.4	<0.59	<0.59	<0.59	<0.59	0.668	<0.59	<0.59	<0.59	<0.59	<0.59	0.93	<0.59	<0.59	<0.59	<0.59	<0.59	856
CF-3	11/19/2002	5-7	None	9.67	<9.5	<20	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	0.832	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59	<0.59
SB-101	1/15/2013	8-10	None	<9.4	<9.4	<19	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47
SB-102	1/17/2013	2-4	High	20.9	72.1	72.7	<0.51	<0.51	<0.51	0.787	0.979	0.735	1.83	0.583	0.661	<0.51	0.718	<0.51	1.35	0.609	0.856	<0.51	0.725
SB-102 DUP	1/17/2013	2-4	High	15.7	117	115	<0.52	0.707	0.524	1.35	1.57	1.23	2.90	1.21	1.14	<0.52	1.31	<0.52	2.21	1.26	1.56	1.04	1.19
SB-103	1/17/2013	2-4	High	<9.5	172	256	<0.46	1.56	1.83	8.80	9.24	7.78	6.92	7.69	8.62	1.37	13.2	<0.46	7.56	<0.46	<0.46	5.88	12.7
SB-105	1/14/2013	6-8	None	<11	<11	<21	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53	<0.53
SB-106	1/14/2013	6-8	None	<12	<12	<24	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60
SB-109	1/14/2013	2-4	None	<9.3	<9.3	<19	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47
SB-110	1/18/2013	2-4	High	<9.0	<9.0	<18	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45
SB-112	2/25/2013	2-4	None	<9.6	32.8	76.6	<0.48	<0.48	<0.48	1.27	1.03	2.23	1.51	2.77	2.99	0.924	4.05	<0.48	1.99	<0.48	<0.48	1.32	3.49
SB-200 (3-4 FT)	4/8/2014	3-4	None	<11	<11	69.9	0.586	<0.53	1.18	1.75	<0.53	<0.53	<0.53	<0.53	1.99	<0.53	3.55	<0.53	<0.53	<0.53	<0.53	1.06	2.88
SB-200 (6-7 FT)	4/8/2014	6-7	None	<10	81.6	81.2	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51
SB-201 (1-4 FT)	4/8/2014	1-4	None	11.3	228	334	0.886	0.504	3.39	8.03	8.79	6.45	4.72	6.79	7.83	1.97	15.1	0.915	5.42	<0.45	<0.45	9.59	13.6
SB-201 (4-6 FT)	4/8/2014	4-6	None	<11	<11	173	0.583	<0.56	2.03	5.00	5.01	4.13	2.82	3.82	4.95	0.773	8.70	<0.56	2.66	<0.56	<0.56	5.77	7.79
SB-202 (1-3 FT)	4/8/2014	1-3	None	<9.9	66.2	65.6	<0.49	<0.49	<0.49	1.25	1.27	1.23	0.964	1.08	1.38	<0.49	2.04	<0.49	0.877	<0.49	<0.49	0.929	1.75
SB-203 (1-3 FT)	4/8/2014	1-4	None	19.8	262	251	1.07	2.44	6.02	15.4	<0.49	<0.49	<0.49	<0.49	19.3	<0.49	33.5	1.46	<0.49	<0.49	<0.49	15.1	<0.49
SB-203 (4-9 FT)	4/8/2014	4-9	None	11.5	242	374	1.85	5.26	12.6	23.4	12.6	18.0	<0.44	12.9	22.4	<0.44	<0.44	4.58	<0.44	0.837	0.652	<0.44	<0.44
MW-11-DEXC-EOT	1/21/2002	17	None	28.6	<8.7	<18	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54	<0.54
UST-NSW	1/28/2002	15-16	None	18.1	<8.3	<18	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52
UST-ESW	1/28/2002	15-16	None	161	71.3	59.2	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	1.68	0.685	<0.52	<0.52
UST-SOTT1	1/28/2002	18	None	19.3	<8.8	19.6	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	0.971	<0.55	<0.55	<0.55
UST-SOTT2	1/28/2002	18	None	53.8	41.1	44.6	<0.53	<0.53	0.565	1.63	1.17	1.15	0.61	1.12	1.38	<0.53	3.96	<0.53	0.778	<0.53	<0.53	3.5	2.98

Notes:
(mg/kg) -Milligrams per kilogram (parts per million (ppm))
- not analyzed
ND - not detected above method detection limit
Method 1 Standards referenced from 310 CMR 40.0975 of the Massachusetts Contingency Plan, effective April 2014
Bold-type is concentration detected above laboratory reporting limits
Bold type is concentration above applicable Standards
EPH - extractable petroleum hydrocarbons

Data Usability Assessment- the following qualifiers are utilized:
None - no potential bias exists
Low - potential low bias exists
High - potential high bias exists
NC - data is not-CAM compliant (may be due attributed to Pre-CAM data if QC cannot be confirmed)

TABLE 8

SUMMARY OF SOIL DATA - RCRA 8 METALS

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, MA

			Method 1 Standards	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
			S-1/GW-2	20	1,000	70	100	200	20	400	100
			S-1/GW-3	20	1,000	70	100	200	20	400	100
			S-3/GW-2	20	5,000	100	200	600	30	800	200
			S-3/GW-3	20	5,000	100	200	600	30	800	200
			Background Natural Soil	20	50	2	30	100	0.3	0.5	0.6
			Background Urban Fill	20	50	3	40	600	1	1	5
			UCL Standards	200	10,000	300	2,000	3,000	300	8,000	2,000
Sample Identification	**Sample Date**	**Depth (ft)**	**Data Usability Assessment Bias**								
UST-ESW	1/9/2002	8	None	--	--	--	--	20.3	--	--	--
UST-NSW	1/10/2002	8-10	None	--	--	--	--	18.1	--	--	--
MW-11-OEXC-SWSW	1/17/2002	0-9	None	--	--	--	--	101	--	--	--
MW-11-OEXC-SWSW	1/17/2002	10-15	None	--	--	--	--	4.1	--	--	--
UST-BOTT1	1/28/2002	18	None	--	--	--	--	11.9	--	--	--
UST-BOTT2	1/28/2002	18	None	--	--	--	--	32.8	--	--	--
OWS-WSW	2/5/2002	0-5	None	5.1	45.7	<0.45	15.7	128	0.17	<1.1	<0.56
OWS-WSW	2/5/2002	11-13	None	9.5	107	<0.79	50.1	13.7	<0.037	<2.0	<0.49
OWS-ESW	2/5/2002	0-5	None	4.3	51.8	<0.44	1.3	115	0.12	<1.1	<0.56
OWS-ESW	2/5/2002	11-13	None	9.9	104	<0.78	45.9	10.1	<0.040	<1.9	<0.49
OWS-NSW	2/5/2002	0-5	None	7.2	95.8	<0.39	12.4	574	0.33	<0.97	<0.48
OWS-NSW	2/5/2002	11-13	None	3.1	32.6	<0.39	14.4	29.1	<0.036	<0.97	<0.49
OWS-BOTT	2/5/2002	14	None	3.8	37.5	<0.43	14.9	12.1	<0.036	<1.1	<0.53
CF-1	11/18/2002	5-7	None	--	--	--	--	50.2	--	--	--
CF-2	11/18/2002	5-7	None	--	--	--	--	74.2	--	--	--
CF-3	11/19/2002	5-7	None	--	--	--	--	565	--	--	--
Max EPCs				BB	107	BB	50.1	BB	BB	BB	BB

Notes:
mg/kg - milligrams per kilogram (parts per million (ppm))
S-1 - Massachusetts Contingency Plan (MCP) Method 1 Soil Standard for category S-1 soil (with GW-1, GW-2 & GW-3 Groundwater Standards)
S-3 - MCP Method 1 Soil Standard for Categorey S-3 soil (with GW-1, GW-2 & GW-3 Groundwater Standards)
-- - not analyzed
ft - feet
<5.0 - Not detected above method detection limit (MDL). MDL included.
Method 1 Standards referenced from 310 CMR 40.0975 of the Massachusetts Contingency Plan, effective April 2014
UCL - upper concentration limits
Bold-type is concentration detected above laboratory reporting limits
Bold-type is concentration above applicable Standards
EPC - Exposure Point Concentration

Data Usability Assessment- the following qualifiers are utilized:
None - no potential bias exists
Low - potential low bias exists
High - potential high bias exists
NC - data is not-CAM compliant (may be due attributed to Pre-CAM data if QC cannot be confirmed)
BB - Below Background

TABLE 9

SUMMARY OF SOIL DATA - TRIVALENT AND HEXAVALENT CHROMIUM

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, MA

Method 1 Standards	Chromium (mg/kg)	Hexavalent Chromium (mg/kg)	Trivalent Chromium (mg/kg)	Redox Potential Vs H2 (mv)	pH
S-1/GW-2	100	100	1,000	NA	NA
S-1/GW-3	100	100	1,000	NA	NA
S-3/GW-2	200	200	5,000	NA	NA
S-3/GW-3	200	200	5,000	NA	NA
Background Natural Soil	30	30	30	NA	NA
Background Urban Fill	40	40	40	NA	NA
UCL Standards	2,000	2,000	10,000	NA	NA

Sample Identification	Sample Date	Depth (ft)	Data Usability Assessment Bias					
SB-102	1/17/2013	6-10'	Low	**15.2**	<0.47	**15.2**	454	7.5
SB-102	1/30/2013	10-12.5'	None	**17.2**	<0.43	**16.8**	552	7.4
SB-102	1/30/2013	15-18'	None	**22.1**	<0.44	**21.7**	564	7.7
SB-104	1/30/2013	10-11.5	None	**14.9**	<0.44	**14.9**	519	10.2
SB-105	1/30/2013	10-12.5	None	**23.4**	0.50	**22.9**	581	7.6

Notes:
mg/kg - milligrams per kilogram (parts per million (ppm))
mv - millivolts
S-1 - Massachusetts Contingency Plan (MCP) Method 1 Soil Standard for category S-1 soil (with GW-1, GW-2 & GW-3 Groundwater Standards)
S-3 - MCP Method 1 Soil Standard for Categorey S-3 soil (with GW-1, GW-2 & GW-3 Groundwater Standards)
- - not analyzed
ft - feet
<5.0 - Not detected above method detection limit (MDL). MDL included.
Method 1 Standards referenced from 310 CMR 40.0975 of the Massachusetts Contingency Plan, effective April 2014
UCL - upper concentration limits
Bold-type is concentration detected above laboratory reporting limits
Bold type is concentration above applicable Standards

Data Usability Assessment- the following qualifiers are utilized:
None - no potential bias exists
Low - potential low bias exists
High - potential high bias exists
NC - data is not-CAM compliant (may be due attributed to Pre-CAM data if

TABLE 10

SUMMARY OF SOIL DATA - VOCs

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, MA

	Method 1 Standards	Benzene (mg/kg)	Sec-butylbenzene (mg/kg)	Ethylbenzene (mg/kg)	Isopropylbenzene (mg/kg)	p-Isopropyltoluene (mg/kg)	Naphthalene (mg/kg)	n-Propylbenzene (mg/kg)	Toluene (mg/kg)	1,3,5-Trimethylbenzene (mg/kg)	1,2,4-Trimethylbenzene (mg/kg)	Xylenes (mg/kg)	Other VOCs
	S-1/GW-2	40	NA	500	NA	NA	20	NA	300	NA	NA	100	NA
	S-1/GW-3	40	NA	500	NA	NA	500	NA	500	NA	NA	500	NA
	S-3/GW-2	400	NA	1,000	NA	NA	20	NA	2,000	NA	NA	100	NA
	S-3/GW-3	1,000	NA	3,000	NA	NA	3,000	NA	3,000	NA	NA	3,000	NA
Sample Identification	Sample Date	Depth (ft)	Data Usability Assessment Bias										
OWS-WSW	2/5/2002	11-13	None	<0.110	<0.270	<0.110	<0.270	<0.270	<0.270	<0.270	<0.110	<0.270	<0.270	<0.110	ND
OWS-WSW	2/5/2002	0-5	None	<0.083	<0.210	<0.083	<0.210	<0.210	<0.210	<0.210	<0.083	<0.210	<0.210	<0.083	ND
OWS-ESW	2/5/2002	11-13	None	<0.150	0.39	0.71	<0.370	0.62	1.62	1.39	<0.150	26.90	83.50	<0.150	ND
OWS-ESW	2/5/2002	0-5	None	<0.110	2.51	5.31	2.82	5.86	12.20	10.40	0.85	21.90	71.50	19.10	ND
OWS-NSW	2/5/2002	11-13	None	0.14	1.79	12.60	2.37	2.78	8.78	7.53	14.10	12.40	36.90	60.30	ND
OWS-NSW	2/5/2002	0-5	None	<0.083	<0.210	<0.083	<0.210	<0.210	<0.210	<0.210	0.102	<0.210	<0.210	0.27	ND
OWS-BOTT	2/5/2002	14	None	<0.085	0.860	4.730	1.150	1.710	5.710	3.770	2.600	6.21	17.80	20.90	ND
OWS-SSW	2/7/2002	0-5	None	0.13	27.5	36.4	97.2	75.9	84.2	52.5	0.99	125	437	722	ND
OWS-SSW	2/7/2002	12-14	None	<0.092	<0.230	0.33	<0.230	<0.092	0.55	0.32	<0.092	0.54	1.88	1.84	ND

Notes:
mg/kg - milligrams per kilogram (parts per million (ppm))
S-1 - Massachusetts Contingency Plan (MCP) Method 1 Soil Standard for category S-1 soil (with GW-1, GW-2 & GW-3 Groundwater Standards)
S-3 - MCP Method 1 Soil Standard for Categorey S-3 soil (with GW-1, GW-2 & GW-3 Groundwater Standards)
ft - feet
<5.0 - Not detected above method detection limit (MDL). MDL included.
Method 1 Standards referenced from 310 CMR 40.0975 of the Massachusetts Contingency Plan, effective April 2014
UCL - upper concentration limits
mg/kg - milligrams per kilogram (parts per million (ppm))
NA - not applicable
Bold-type is concentration detected above laboratory reporting limits
Bold type is concentration above applicable Standards
VOCs indicates volatile organic compounds

Data Usability Assessment- the following qualifiers are utilized:
None - no potential bias exists
Low - potential low bias exists
High - potential high bias exists
NC - data is not-CAM compliant (may be due attributed to Pre-CAM data if QC cannot be confirmed)

TABLE 11

SUMMARY OF SOIL GAS DATA - APH

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

			Policy Guidance Values	Benzene ug/m^3	1,3-Butadiene ug/m^3	Ethyl-benzene ug/m^3	MTBE ug/m^3	Naphthalene ug/m^3	Toluene ug/m^3	Total Xylenes ug/m^3	C_5-C_8 Aliphatics ug/m^3	C_9-C_{12} Aliphatics ug/m^3	C_9-C_{10} Aromatics ug/m^3
Residential Subslab				160	NE	520	2,700	43	3,800	1,400	4,100	4,800	700
Industrial/Commercial Subslab				770	NE	20,000	62,000	190	100,000	2,000	23,000	15,000	3,100
Sample Identification	Data Usability Assessment Bias	Sample Date	PID (ppmv)										
SVP-102	None	2/4/2014	0.2	<1.3	<0.88	<1.7	<1.4	<2.1	<1.5	<1.7	75.2	<18	<10

Notes:

APH is Air petroleum hydrocarbons and reported in (ug/m^3) micrograms per cubic meter

NE - not established

Bold-type is concentration detected above laboratory reporting limits

Bold type is concentration above applicable Policy Guidance Values

PID - photoionization detector

ppmv - parts per million per volume

Data Usability Assessment- the following qualifiers are utilized:

None - no potential bias exists

Low - potential low bias exists

High - potential high bias exists

NC - data is not-CAM compliant

TABLE 12

DATA SUMMARY TABLE: RISK ASSESSMENT DATA USABILITY EVALUATION

Former Shell-branded Service Station No. 137847
620 Broadway
Somerville, MA

Sample ID or Series	Parameters	Collection Date	Soil	Groundwater	Surface Water	Sediment	Air	Site Characterization	Background	EPCs	Hazard Elimination	CAM Compliant (Y, N, NA)	Data Qualifications, if any
M4389-1 through M4389-6	MassDEP VPH and EPH	4/21/1998	X					X				N	Pre-CAM data. Not compliant.
M4437-1	MassDEP VPH and EPH	4/28/1998	X					X				N	Pre-CAM data. Not compliant.
M22885-1 through M22885-9	MassDEP VPH, MassDEP EPH and Total Lead	1/9-1/11/2002	X					X		X		NA	Pre-CAM data. VPH samples HO-ESW 4-5' and HO-SSW 4-5' are biased high due to surrogate recoveries. Data will be used for closure.
M22982-1 through M22982-6	MassDEP VPH, MassDEP EPH and Total Lead	1/17/2002	X					X		X		NA	Pre-CAM data. All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
M23210-1 through M23210-5	MassDEP VPH, MassDEP EPH and Total Lead	1/21-1/29/2002	X					X		X		NA	Pre-CAM data. VPH sample MW-11-OEXC-BOT 17' is biased high due to surrogate recoveries. Data will be used for closure.
M23325-1 through M23325-8	MassDEP VPH, MassDEP EPH, VOCs by 8260 and RCRA 8 Metals	2/1-2/5/2002	X					X	X	X		NA	Pre-CAM data. All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
M23376-1 through M23376-6	MassDEP VPH, MassDEP EPH and VOCs by 8260	2/7/2002	X					X		X		NA	Pre-CAM data. VPH and EPH sample OWS-SSW 0-5' is biased high due to surrogate recoveries. Data will be used for closure.

TABLE 12

DATA SUMMARY TABLE: RISK ASSESSMENT DATA USABILITY EVALUATION

Former Shell-branded Service Station No. 137847
620 Broadway
Somerville, MA

Sample ID or Series	Parameters	Collection Date	Soil	Groundwater	Surface Water	Sediment	Air		Site Characterization	Background	EPCs	Hazard Elimination	CAM Compliant (Y, N, NA)	Data Qualifications, if any
M23507-1	MassDEP VPH and EPH	2/13/2002	X						X		X		NA	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
M23619-1	MassDEP VPH	2/20/2002	X						X		X		NA	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
M23870-1	MassDEP VPH	3/7/2002	X						X		X		NA	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
M26736-1 and M26736-2	MassDEP VPH	7/26/2002	X						X		X		NA	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
M28930-1 through M28930-3	MassDEP VPH and Total Lead	11/18/2002	X						X		X		NA	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
M28931-1 through M28931-3	MassDEP EPH	11/18/2002	X						X		X		NA	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.

TABLE 12

DATA SUMMARY TABLE: RISK ASSESSMENT DATA USABILITY EVALUATION

Former Shell-branded Service Station No. 137847
620 Broadway
Somerville, MA

Sample ID or Series	Parameters	Collection Date	Soil	Groundwater	Surface Water	Sediment	Air	Site Characterization	Background	EPCs	Hazard Elimination	CAM Compliant (Y, N, NA)	Data Qualifications, if any
MC17612-1 through MC17612-4	MassDEP EPH	1/14-1/15/2013	X					X		X		Y	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
MC17614-1 and MC17612-2	MassDEP VPH	1/14-1/15/2013	X					X		X		Y	VPH sample SB-105 2-4' is biased high due to surrogate recoveries. Data will be used for closure.
MC17687-1 through MC17687-5	MassDEP EPH, Hexavalent Chromium, Trivalent Chromium	1/17-1/18/2013	X					X	X	X		Y	EPH samples SB-102 2-4', Duplicate, SB-103 2-4' and SB-110 2-4' were biased high due to matrix spike and matrix spike duplicate recoveries. Data will be used for closure.
MC17688-1 through MC17688-3	MassDEP VPH	1/17/2013	X					X		X		Y	VPH samples SB-102 2-4' and SB-102 6-10' are biased high due to surrogate recoveries. Data will be used for closure.
MC17877-1 through MC17877-4	Hexavalent Chromium and Trivalent Chromium	1/30/2013	X					X	X			Y	Data are within acceptable limits. No bias.
MC17882-1 through MC17882-13	MassDEP VPH	1/30/2013	X					X		X		Y	VPH samples SB-102 10-12.5', SB-110 15-17', and SB-110 17-18' are biased low due to surrogate recoveries. VPH sample SB-107 10-12.5' is biased high due to surrogate recoveries. Data will be used for closure.

TABLE 12

DATA SUMMARY TABLE: RISK ASSESSMENT DATA USABILITY EVALUATION

Former Shell-branded Service Station No. 137847
620 Broadway
Somerville, MA

Sample ID or Series	Parameters	Collection Date	Soil	Groundwater	Surface Water	Sediment	Air	Site Characterization	Background	EPCs	Hazard Elimination	CAM Compliant (Y, N, NA)	Data Qualifications, if any
MC18571-1 and MC18571-2	MassDEP VPH	2/27/2013	X					X		X		Y	VPH sample SB-110 27-29' is biased high due to surrogate recoveries. Data will be used for closure.
MC18572-1 through MC18572-18	MassDEP VPH	2/27-2/28/2013	X					X		X		Y	VPH sample SB-112 15-17' is biased high due to surrogate recoveries. Data will be used for closure.
MC18585-1	MassDEP EPH	2/28/2013	X					X	X	X		Y	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
MC20215-1 through MC20215-13	MassDEP VPH	4/24/2013	X					X		X		Y	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
MC29608-1 through MC29608-4	MassDEP VPH	4/8/2014	X					X		X		Y	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
MC29609-1 through MC29609-7	MassDEP EPH	4/8/2014	X					X	X	X		Y	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.

TABLE 12

DATA SUMMARY TABLE: RISK ASSESSMENT DATA USABILITY EVALUATION

Former Shell-branded Service Station No. 137847
620 Broadway
Somerville, MA

Sample ID or Series	Parameters	Collection Date	Soil	Groundwater	Surface Water	Sediment	Air	Site Characterization	Background	EPCs	Hazard Elimination	CAM Compliant (Y, N, NA)	Data Qualifications, if any
MC28109-1	MassDEP APH	2/4/2014					X	X				Y	Data are within acceptable limits. No bias.
M31068-1 through M31068-9	MassDEP EPH	3/28/2003		X				X		X		NA	EPH sample MW-103 was biased low due to low surrogate recoveries from sample forming an emulsion on the extraction.
NPE2134-01, 02, 05, 06 and 10	MassDEP EPH	5/11/2006		X				X		X		Y	EPH sample MW-16 was biased low due to low surrogate recoveries from sample dilution.
NQK0934-01 through NQK0934-04	MassDEP EPH	11/6/2007		X				X		X		Y	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
M78946-1 through M78946-4	MassDEP EPH	11/20/2008		X				X		X		Y	EPH samples MW-105 and MW-106 are biased low due to surrogate recoveries. Data will be used for closure.
M82669-1 through M82669-4	MassDEP EPH	5/7/2009		X				X		X		Y	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.

TABLE 12

DATA SUMMARY TABLE: RISK ASSESSMENT DATA USABILITY EVALUATION

Former Shell-branded Service Station No. 137847
620 Broadway
Somerville, MA

Sample ID or Series	Parameters	Collection Date	Soil	Groundwater	Surface Water	Sediment	Air	Site Characterization	Background	EPCs	Hazard Elimination	CAM Compliant (Y, N, NA)	Data Qualifications, If any
MC16301-1 through MC16301-13	MassDEP VPH, Oxygenates and Ethanol	11/27/2012		X				X		X		Y	VPH Sample MW-105 is biased high due to surrogate recoveries. Data will be used for closure.
MC20527-1 through MC20527-13	MassDEP VPH, Oxygenates and Ethanol	5/6/2013		X				X		X		Y	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
MC27045-1 through MC27045-12	MassDEP VPH	12/6/2013		X				X		X		Y	All surrogate recoveries, holding time and temperature are within acceptable limits. No bias.
MC30689-1 through MC30689-11	MassDEP VPH, Oxygenates and Ethanol	5/15/2014		X				X		X		Y	All samples analyzed for ethanol were low biased due to low matrix spike/matrix spike duplicate recoveries. Data will be used for closure.

TABLE 13A
SOIL CONTAMINANTS OF CONCERN
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Compounds Detected During Subsurface Sampling Activities Master Listing	MassDEP Background Natural Soil	MassDEP Background Coal Ash Fill	Frequency of Detection	Highest Concentration Detected	Avg. Method Detection Limit (MDL)	% Above MDL	Contaminant of Concern?	Justification For Removal From COC List	Location	Depth (ft)
	mg/kg	mg/kg	#/#	mg/kg	mg/kg	%				
MA-VPH										
C5-C8 Aliphatics	N/A	N/A	50/86	4450.00	6.5	68462%	YES	COC	MW-11	15-17
C9-C12 Aliphatics	N/A	N/A	42/86	1310.00	6.5	20154%	YES	COC	MW-11	15-17'
C9-C10 Aromatics	N/A	N/A	37/86	2030.00	6.5	31231%	YES	COC	MW-11	15-17
Benzene	N/A	N/A	8/86	3.30	0.30	1100%	YES	COC	SB-110	27-29'
Toluene	N/A	N/A	22/86	37.40	0.30	12467%	YES	COC	SB-110	27-29'
Ethylbenzene	N/A	N/A	39/86	56.60	0.30	18867%	YES	COC	MW-11-OEXC-BOT	17'
Xylenes (m,p,o)	N/A	N/A	52/86	147.20	0.30	49067%	YES	COC	MW-11-OEXC-BOT	17'
MTBE	N/A	N/A	11/86	3.82	0.30	N/A	YES	COC	MW-11-OEXC-BOT	17'
Naphthalene	0.5	1.0	38/86	73.40	0.30	24467%	YES	COC	OWS-SSW	0-5'
1,2-Dibromoethane (Ethylene Dibromide)	N/A	N/A	N/A			N/A	No	Not a COC		
MA-EPH										
C9-C18 Aliphatics	N/A	N/A	29/52	614.00	8.20	7488%	YES	COC	OWS-SSW	0-5'
C19-C36 Aliphatics	N/A	N/A	25/52	929.00	8.20	11329%	YES	COC	OWS-SSW	0-5'
C11-C22 Aromatics	N/A	N/A	33/52	1420.00	8.20	17317%	YES	COC	OWS-SSW	0-5'
2-Methylnaphthalene	N/A	N/A	N/A			N/A	No	Related to Urban Fill, Not a COC		
PAH										
Acenaphthene	20	20	N/A			N/A	No	Related to Urban Fill, Not a COC		
Acenaphthylene	0.5	1	N/A			N/A	No	Related to Urban Fill, Not a COC		
Anthracene	0.5	1	N/A			N/A	No	Related to Urban Fill, Not a COC		
Benzo(a)anthracene	0.5	2	N/A			N/A	No	Related to Urban Fill, Not a COC		
Benzo(a)pyrene	0.5	2	N/A			N/A	No	Related to Urban Fill, Not a COC		
Benzo(b)fluoranthene	0.5	2	N/A			N/A	No	Related to Urban Fill, Not a COC		
Benzo(g,h,i)perylene	0.5	2	N/A			N/A	No	Related to Urban Fill, Not a COC		
Benzo(k)fluoranthene	0.5	2	N/A			N/A	No	Related to Urban Fill, Not a COC		
Chrysene	0.5	2	N/A			N/A	No	Related to Urban Fill, Not a COC		
Dibenz(a,h)anthracene	0.5	2	N/A			N/A	No	Related to Urban Fill, Not a COC		
Fluoranthene	0.5	10	N/A			N/A	No	Related to Urban Fill, Not a COC		
Fluorene	0.5	20	N/A			N/A	No	Related to Urban Fill, Not a COC		
Indeno(1,2,3-cd)pyrene	0.5	2	N/A			N/A	No	Related to Urban Fill, Not a COC		
Phenanthrene	0.5	20	N/A			N/A	No	Related to Urban Fill, Not a COC		
Pyrene	0.5	20	N/A			N/A	No	Related to Urban Fill, Not a COC		
Metals										
Arsenic	20	20	7/7	9.90		N/A	No	Below Background		
Barium	50	50	7/7	107.00	20.00	535%	YES	Below Background	OWS-WSW	11-13'
Cadmium	2	3	0/7		N/A	N/A	No	Below Background		
Chromium	30	40	7/7	50.10	0.98	5112%	YES	Below Background	OWS-WSW	11-13'
Lead	200	400	6/6	574.00		N/A	No	Below Background		
Mercury	0.3	1	3/7	0.10	0.03	N/A	No	Below Background		
Selenium	0.5	1	0/7		N/A	N/A	No	Not a COC		
Silver	0.6	5	0/7		N/A	N/A	No	Not a COC		

COC - Contaminant of Concern
N/A - Not applicable

TABLE 13B
GROUNDWATER CONTAMINANTS OF CONCERN
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Compounds Detected During Subsurface Sampling Activities Master Listing	Frequency of Detection	Highest EPC	Avg. Method Detection Limit (MDL)	% Above MDL	Contaminant of Concern?	Justification For Removal From COC List	Location
	#/#	mg/kg	mg/kg	%			
MA-VPH							
C5-C8 Aliphatics	26/35	4000.00	50	8000%	YES	COC	MW-105
C9-C12 Aliphatics	13/35	883.67	50	1767%	YES	COC	MW-105
C9-C10 Aromatics	23/35	3020.00	50	6040%	YES	COC	MW-105
Benzene	18/35	412.83	1	41283%	YES	COC	MW-106
Toluene	22/35	33.03	2	1652%	YES	COC	MW-106
Ethylbenzene	26/35	955.25	2	47763%	YES	COC	MW-105
Xylenes (m,p,o)	24/35	1507.53	2	75377%	YES	COC	MW-105
MTBE	9/35	42.48	1	4248%	YES	COC	MW-103D
Naphthalene	20/35	204.35	3	6812%	YES	COC	MW-16
Ethylene Dibromide	[illegible]	[illegible]		N/A	No	Not a COC	
MA-EPH							
C9-C18 Aliphatics	14/27	48800.00	109.00	44771%	Yes	COC	
C19-C36 Aliphatics	3/27	1140.00	109.00	1046%	No	Infrequent detection, Not a COC	
C11-C22 Aromatics	20/27	6730.00	109.00	6174%	Yes	COC	
2-methylnapthalene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Naphthalene	N/A			N/A	No	Related to Urban Fill, Not a COC	
PAH							
Acenapthene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Acenaphthylene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Anthracene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Benzo(a)anthracene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Benzo(a)pyrene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Benzo(b)fluoranthene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Benzo(g,h,i)perylene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Benzo(k)fluoranthene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Chrysene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Dibenz(a,h)anthracene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Fluoranthene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Fluorene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Indeno(1,2,3-cd)pyrene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Phenanthrene	N/A			N/A	No	Related to Urban Fill, Not a COC	
Pyrene	N/A			N/A	No	Related to Urban Fill, Not a COC	
VOCs 8260B							
sec-butylbenzene	N/A			N/A	No	Not analyzed	
Isopropylbenzene	N/A			N/A	No	Not analyzed	
n-Propylbenzene	N/A			N/A	No	Not analyzed	
p-Isopropyltoluene	N/A			N/A	No	Not analyzed	
1,2,4-Trimethylbenzene	N/A			N/A	No	Not analyzed	
1,3,5-Trimethylbenzene	N/A			N/A	No	Not analyzed	
Oxygenates							
TAME	0/25			N/A	No	Not Detected above MDLs	
ETBE	1/25			N/A	No	Infrequent detection, Not a COC	MW-103D
TBA	4/25			N/A	No	Infrequent detection, Not a COC	MW-103D
DIPE	0/25			N/A	No	Not Detected above MDLs	
Ethanol	0/25			N/A	No	Not Detected above MDLs	
Metals							
Arsenic	N/A			N/A	No	Not a COC	
Barium	N/A			N/A	No	Not a COC	
Cadmium	N/A			N/A	No	Not a COC	
Chromium	N/A			N/A	No	Not a COC	
Lead	N/A			N/A	No	Related to Urban Fill, Not a COC	
Mercury	N/A			N/A	No	Not a COC	
Selenium	N/A			N/A	No	Not a COC	
Silver	N/A			N/A	No	Not a COC	

COC - Contaminant of Concern
N/A - Not applicable

TABLE 14
POTENTIAL EXPOSURE PATHWAYS
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Receptor/Potential Receptor	Exposure Route	Media	Exposure Pathway	Pathway Evaluated	Explanation
Facility Worker and Visitors (Adults and Children)	Inhalation	Groundwater off-gas to indoor air	Unlikely	Yes	**Tables 18 & 19**
Exposures to impacted soil are unlikely during current site use	Dermal Absorption	Soil	Unlikely	No	Residential is more conservative and protective of this receptor
	Incidental Ingestion	Soil	Unlikely	No	Residential is more conservative and protective of this receptor
	Ingestion	Groundwater	Not Present	No	Municipal Water Services to site and surrounding properties
	Dermal Absorption	Groundwater	Not Present	No	Municipal Water Services to site and surrounding properties
					Evaluated through other receptor scenarios, with exception of groundwater to indoor air
Facility Tresspasses and Future Tresspassers	Inhalation	Groundwater off-gas to indoor air	Unlikely	No	No impacts were identified in site groundwater related to this RTN
(Adults and Children)	Dermal Absorption	Soil	Unlikely	No	Residential is more conservative and protective of this receptor
	Incidental Ingestion	Soil	Unlikely	No	Residential is more conservative and protective of this receptor
	Ingestion	Groundwater	Not Present	No	Municipal Water Services to site and surrounding properties
	Dermal Absorption	Groundwater	Not Present	No	Municipal Water Services to site and surrounding properties
					Evaluated through other receptor scenarios, with exception of groundwater to indoor air
Potential Future Residents (Facility)	Inhalation	Groundwater off-gas to indoor air	Unlikely	No	**Tables 16 & 17**
(Adults and Children)	Dermal Absorption	Soil	Likely	Yes	**Tables 15 & 17**
	Incidental Ingestion	Soil	Likely	Yes	**Tables 15 & 17**
	Ingestion	Groundwater	Not Present	No	Municipal Water services to site and surrounding properties
	Dermal Absorption	Groundwater	Not Present	No	Municipal Water services to site and surrounding properties
	Home Grown Produce	Soil	Unlikely	No	Lack of bioaccumulation compounds. Residential ingestion exposure greater.
					Predominance of Exposure exists in pathways evaluated
Utility Worker (Facility)	Dermal Absorption	Soil	Likely	No	Construction Worker exposure is greater and is used for both Construction and Utility Worker
(Adults)	Incidental Ingestion	Soil	Likely	No	Construction Worker exposure is greater and is used for both Construction and Utility Worker
	Particle Inhalation	Soil	Likely	No	Construction Worker exposure is greater and is used for both Construction and Utility Worker
	Particle Inhalation Gastro-Intestinal (swallowed mucus)	Soil	Likely	No	Construction Worker exposure is greater and is used for both Construction and Utility Worker
	Inhalation	Groundwater off-gas to Ambient Air	Limited	No	Construction Worker exposure is greater and is used for both Construction and Utility Worker
	Incidental Ingestion	Groundwater	Unlikely	No	Construction Worker exposure is greater and is used for both Construction and Utility Worker
	Dermal Absorption	Groundwater	Unlikely	No	Construction Worker exposure is greater and is used for both Construction and Utility Worker
					Evaluated through other receptor scenarios
Construction Worker (Facility)	Dermal Absorption	Soil	Likely	Yes	**Tables 20 through 23**
(Adults)	Incidental Ingestion	Soil	Likely	Yes	**Tables 20 through 23**
	Particle Inhalation	Soil	Likely	Yes	**Tables 20 through 23**
	Particle Inhalation Gastro-Intestinal (swallowed mucus)	Soil	Likely	Yes	**Tables 20 through 23**
	Inhalation	Groundwater off-gas to Ambient Air	Unlikely	No	No impacts were identified in groundwater.
	Incidental Ingestion	Groundwater	Unlikely	No	Soil EPCs represent saturated soil concentrations, dermal exposure to soil will likely dominate exposure
	Dermal Absorption	Groundwater	Unlikely	No	Soil EPCs represent saturated soil concentrations, dermal exposure to soil will likely dominate exposure
					Predominance of Exposure exists in pathways evaluated

TABLE 15
EXPOSURE TO SOIL (0-15') - POTENTIAL FUTURE RESIDENTS
Former Shell-Branded Service Station No. 137847
628 Broadway
Somerville, Massachusetts

COHC Constituent of Concern	EPC Soil (mg/kg)	DERMAL RAF dermal	RAF ref	ADD	LADD	RfD	CSF	Hazard Index	ELCR	INCIDENTAL INGESTION RAF ingestion	RAF ref	Incidental Ingestion ADD	LADD	RfD	CSF	CXcarc/HI	ELCR
MA-VPH																	
Aliphatics C5 to C8	699.00	0.20	NC	2.9E-03		4.0E-02		7.2E-02		1.00	NC	1.7E-03		4.0E-02		4.2E-02	
Aliphatics C9 to C12	982.00	0.20	NC	4.0E-03		1.0E-01		4.0E-02		1.00	NC	2.4E-03		1.0E-01		2.4E-02	
Aromatics C9 to C10	1140.00	0.20	NC	4.7E-03		3.0E-02		1.6E-01		1.00	NC	2.8E-03		3.0E-02		9.2E-02	
Benzene																	
Ethylbenzene	30.10	0.03	NC	1.9E-05		5.0E-02		3.7E-04		1.00	NC	7.3E-05		5.0E-02		1.5E-03	
Toluene	39.20	0.03	NC	2.4E-05		8.0E-02		3.0E-04		1.00	NC	9.5E-05		8.0E-02		1.2E-03	
Xylenes (mixed isomers)	105.40	0.03	NC	6.5E-05		2.0E-01		3.3E-04		1.00	NC	2.6E-04		2.0E-01		1.3E-03	
Methyl tert butyl ether	2.75	0.03	NC	1.7E-06		1.0E-01		1.7E-05		1.00	NC	6.7E-06		1.0E-01		6.7E-05	
Naphthalene	73.40	0.10	NC	1.5E-04		2.0E-02		7.6E-03		0.30	NC	5.3E-05		2.0E-02		2.7E-03	
MA-EPH																	
Aliphatics C9 to C18	614.00	0.20	NC	2.5E-03		1.0E-01		2.5E-02		1.00	NC	1.5E-03		1.0E-01		1.5E-02	
Aliphatics C19 to C36	929.00	0.20	NC	3.8E-03		2.0E+00		1.9E-03		1.00	NC	2.3E-03		2.0E+00		1.1E-03	
Aromatics C11 to C22	1420.00	0.10	NC	2.9E-03		3.0E-02		9.8E-02		0.30	NC	1.0E-03		3.0E-02		3.4E-02	
Metals																	
Barium	107.00	0.10	NC	2.2E-04		2.0E-01		1.1E-03		1.00	NC	2.6E-04		2.0E-01		1.3E-03	
Chromium (total)	50.10	0.10	NC	1.0E-04		3.0E-03		3.4E-02		1.00	NC	1.2E-04		3.0E-03		4.0E-02	
								SUMMATIONS								SUMMATIONS	

RISK SUMMARY - FUTURE RESIDENTIAL SOIL

	Hazard Index	Scientific	Decimal
	HI	7E-01	0.70
	ELCR	8E-06	0.000

TABLE 15 (Continued)
EXPOSURE TO SOIL (0-15') - POTENTIAL FUTURE RESIDENTS
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Calculation Formulas - Source: MassDEP Short Forms

Resident - Soil: Table RS-2
Equations to Calculate Cancer Risk for Resident (Age 1-31 years)

Cancer Risk from Ingestion

$$ELCR_{ing} = LADD_{ing(1-31)} * CSF$$

$$LADD_{ing(1-31)} = LADD_{ing(1-8)} + LADD_{ing(8-15)} + LADD_{ing(15-31)}$$

$$LADD_{ing(age\ group\ x)} = \frac{[OHM]_{soil} * IR_x * RAF_{c\text{-}ing} * EF_{ing} * ED * EP_x * C}{BW_x * AP_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR_{derm} = LADD_{derm} * CSF$$

$$LADD_{derm(1-31)} = LADD_{derm(1-8)} + LADD_{derm(8-15)} + LADD_{derm(15-31)}$$

$$LADD_{derm(age\ group\ x)} = \frac{[OHM]_{soil} * SA_x * RAF_{c\text{-}derm} * SAF_x * EF_{derm} * ED * EP_x * C}{BW_x * AP_{lifetime}}$$

Cancer Risk from Homegrown Produce

$$ELCR_{produce} = LADD_{produce(1-31)} * CSF$$

$$LADD_{produce(1-31)} = LADD_{produce(1-8)} + LADD_{produce(8-15)} + LADD_{produce(15-31)}$$

$$LADD_{produce(age\ x)} = \frac{[OHM_{soil}] * PUF * PIR_x * RAF_{produce} * EF_{produce} * ED * EP_x * C}{BW_x * AP_{lifetime}}$$

Vlookup Version V0414

Parameter	Value	Units
CSF	OHM specific	(mg/kg-day)-1
LADD	age/OHM specific	mg/kg-day
[OHM]soil	OHM specific	mg/kg
IR(1-8)	100	mg/day
IR(8-15)	50	mg/day
IR(15-31)	50	mg/day
PIR(1-8)	12,197	mg/day
PIR(8-15)	17,809	mg/day
PIR(15-31)	24,421	mg/day
RAFc-ing	OHM specific	dimensionless
RAFc-derm	OHM specific	dimensionless
RAFc-produce	OHM specific	dimensionless
EF ing, derm	0.412	event/day
EF produce	1.00	event/day
ED	1	day/event
EP(1-8)	7	years
EP(8-15)	7	years
EP(15-31)	16	years
C	0.000001	kg/mg
BW(1-8)	[illegible]	kg
BW(8-15)	39.9	kg
BW(15-31)	58.7	kg
AP(lifetime)	70	years
SA(1-8)	2430	cm2/day
SA(8-15)	4427	cm2/day
SA(15-31)	5653	cm2/day
SAF(1-8)	0.35	mg/cm2
SAF(8-15)	0.14	mg/cm2
SAF(15-31)	0.13	mg/cm2
PUF	OHM specific	(mg/mg)/(mg/mg)

Resident - Soil: Table RS-3
Equations to Calculate Chronic Noncancer Risk for Resident Child (Age 1-8 years)

Chronic Noncancer Risk from Ingestion

$$HQ_{ing} = \frac{ADD_{ing}}{RfD}$$

$$ADD_{ing} = \frac{[OHM]_{soil} * IR * RAF_{nc\text{-}ing} * EF_{ing} * ED * EP * C}{BW * AP}$$

Chronic Noncancer Risk from Dermal Absorption

$$HQ_{derm} = \frac{ADD_{ing\text{-}derm}}{RfD}$$

$$ADD_{derm} = \frac{[OHM]_{soil} * SA * RAF_{nc\text{-}derm} * SAF * EF_{derm} * ED * EP * C}{BW * AP}$$

Chronic Noncancer Risk from Homegrown Produce

$$HQ_{produce} = \frac{ADD_{produce}}{RfD}$$

$$ADD_{produce} = \frac{[OHM_{soil}] * PUF * PIR * RAF_{produce} * EF_{produce} * ED * EP * C}{BW * AP}$$

Vlookup Version V0414

Parameter	Value	Units
RfD ing	OHM specific	mg/kg-day
ADD	OHM specific	mg/kg-day
[OHM]soil	OHM specific	mg/kg
IR	100	mg/day
PIR	12,097	mg/day
RAFnc-ing	OHM specific	dimensionless
RAFnc-derm	OHM specific	dimensionless
RAFnc-produce	OHM specific	dimensionless
EFing	0.412	event/day
EFderm	1.00	event/day
EFproduce	1.00	event/day
ED	1	day/event
EP	7	years
EPproduce	[illegible]	day
C	0.000001	kg/mg
BW	17.0	kg
AP	7	year
APproduce	[illegible]	day
SA	2430	cm2/day
SAF	0.35	mg/cm2
PUF	OHM specific	(mg/mg)/(mg/mg)

TABLE 15 (Continued)
EXPOSURE TO SOIL (0-15') - POTENTIAL FUTURE RESIDENTS
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Calculation Formulas - Source: MassDEP Short Forms

Resident - Soil: Table RS-4
Equations to Calculate Subchronic Noncancer Risk for Resident Child (Age 1-2 years)

Subchronic Noncancer Risk from Ingestion

$$HQ_{ing} = \frac{ADD_{ing}}{RfD_{subchronic}}$$

$$ADD_{ing} = \frac{[OHM]_{soil} * IR * RAF_{oral-ing} * EF_{ing} * ED * EP * C}{BW * AP}$$

Subchronic Noncancer Risk from Dermal Absorption

$$HQ_{derm} = \frac{ADD_{derm}}{RfD_{subchronic}}$$

$$ADD_{derm} = \frac{[OHM]_{soil} * SA * RAF_{dermal} * SAF * EF_{derm} * ED * EP * C}{BW * AP}$$

Subchronic Noncancer Risk from Homegrown Produce

$$HQ_{produce} = \frac{ADD_{produce}}{RfD_{subchronic}}$$

$$ADD_{produce} = \frac{[OHM_{soil}] * PUF * PIR * RAF_{produce} * EF_{produce} * ED * EP * C}{BW * AP}$$

Vlookup Version V0414

Parameter	Value	Units
RfD	OHM specific	mg/kg-day
ADD	OHM specific	mg/kg-day
$[OHM]_{soil}$	OHM specific	mg/kg
IR	100	mg/day
PIR	[illegible]	mg/day
RAF	OHM specific	dimensionless
RAF	OHM specific	dimensionless
RAF	OHM specific	dimensionless
EF	[illegible]	event/day
EF	1.00	event/day
EF	1.00	event/day
ED	1	day/event
EP	[illegible]	day
EP	[illegible]	year
C	0.000001	kg/mg
BW	[illegible]	kg
AP	[illegible]	year
AP	[illegible]	day
SA	1670	cm^2/day
SAF	[illegible]	mg/cm^2
PUF	OHM specific	[illegible]

TABLE 15 (Continued)
EXPOSURE TO SOIL (0-15') - POTENTIAL FUTURE RESIDENTS
Former Shell-Branded Service Station No. 137847
520 Broadway
Somerville, Massachusetts

Calculation Formulas - Source: MassDEP Short Forms

Resident - Soil: Table RS-5
Definitions and Exposure Factors

Vlookup Version: V0414

Parameter	Value	Units	Notes
ELCR - Excess Lifetime Cancer Risk	chemical specific	dimensionless	Pathway specific (ing =ingestion, derm=dermal, inh=inhalation)
CSF - Cancer Slope Factor	chemical specific	(mg/kg-day)$^{-1}$	see Table RS-7
LADD - Lifetime Average Daily Dose	chemical specific	mg/kg-day	Pathway specific
LADE - Lifetime Average Daily Exposure	chemical specific	mg/m^3	
HQ - Hazard Quotient	chemical specific	dimensionless	Pathway specific (ing.=ingestion, derm=dermal, inh=inhalation)
RfD - Reference Dose	chemical specific	mg/kg-day	see Table RS-7
ADD - Average Daily Dose	chemical specific	mg/kg-day	Pathway specific
ADE - Average Daily Exposure	chemical specific	mg/m^3	
EPC - Exposure Point Concentration	chemical specific	mg/kg	
PUF - Plant Uptake Factor	chemical specific	(mg/mg)/(mg/kg)	See Table RS-7; (mg$_{chem}$/mg$_{veg,dw}$)/(mg$_{chem}$/mg$_{soil}$)^3
$IR_{S,1-2}$ - Soil Ingestion Rate for age group 1-2	100	mg/day	MADEP, 2002. Technical Update: Calculation of an Enhanced Soil Ingestion Rate. (http://www.mass.gov/dep/cleanup/dispsoil.htm)
$IR_{S,1-8}$ - Soil Ingestion Rate for age group 1-8	100	mg/day	Ibid
$IR_{S,9-15}$ - Soil Ingestion Rate for age group 9-15	50	mg/day	Ibid
$IR_{S,15-31}$ - Soil Ingestion Rate for age group 15-31	50	mg/day	Ibid
$PIR_{S,1-2}$ = Produce Ingestion Rate for age group 1-2	10,900	mg/day	see Table RS-6
$PIR_{S,1-8}$ = Produce Ingestion Rate for age group 1-8	12,099	mg/day	see Table RS-6
$PIR_{S,9-15}$ = Produce Ingestion Rate for age group 9-15	17,909	mg/day	Ibid
$PIR_{S,15-31}$ = Produce Ingestion Rate for age group 15-31	24,420	mg/day	Ibid
RAF$_i$ - Relative Absorption Factor for Cancer Effects	chemical specific	dimensionless	
$EF_{subchronic}$ - Exposure Frequency for subchronic ingestion or dermal exposure	0.714	event/day	5 days/week
$EF_{chronic}$ - Exposure Frequency for chronic ingestion or dermal exposure	0.412	event/day	5 days/week, 30 weeks/year
EF_{cancer} - Exposure Frequency for cancer, ingestion or dermal exposure	0.412	event/day	5 days/week, 30 weeks/year
$EF_{produce}$ - Exposure Frequency for produce ingestion, cancer and noncancer	1.00	event/day	
$EF_{cyanide}$ - Exposure Frequency for subchronic and chronic non-cancer cyanide	1.00	event/day	
ED - Exposure Duration		day/event	
$ED_{S,1-2}$ - Exposure Period for age group 1-2	0.577	years	30 weeks
$ED_{S,1-8}$ - Exposure Period for age group 1-8	7	years	
$ED_{S,9-15}$ - Exposure Period for age group 9-15	7	years	
$ED_{S,15-31}$ - Exposure Period for age group 15-31	16	years	
$EP_{cyanide}$ - Exposure period for Cyanide exposure	1	day	MADEP, 1995, Guidance for Disposal Site Risk Characterization. Page 5-5
$BW_{S,1-2}$ - Body Weight for age group 1-2	10.7	kg	U.S. EPA. 1997. Exposure Factors Handbook. Table 7-2, females
$BW_{S,1-8}$ - Body Weight for age group 1-8	17.0	kg	Ibid
$BW_{S,9-15}$ - Body Weight for age group 9-15	39.9	kg	Ibid
$BW_{S,15-31}$ - Body Weight for age group 15-31	58.7	kg	Ibid
$AP_{subchronic}$ - Averaging Period for subchronic exposure	0.577	years	30 weeks
$AP_{chronic}$ - Averaging Period for Chronic exposure	7	years	
AP_{cancer} - Averaging Period for Cancer	70	years	
$AP_{cyanide}$ - Averaging period for assessing cyanide exposure	1	day	MADEP, 1995, Guidance for Disposal Site Risk Characterization. Page 5-5
$SA_{S,1-2}$ - Surface Area for age group 1-2	1570	cm^2 / day	50th percentile of face (1/3 head), forearms, hands, lower legs, and feet for females MADEP, 1995, Guidance for Disposal Site Risk Characterization. Appendix Table B-2.
$SA_{S,1-8}$ - Surface Area for age group 1-8	2431	cm^2 / day	Ibid
$SA_{S,9-15}$ - Surface Area for age group 9-15	4427	cm^2 / day	Ibid
$SA_{S,15-31}$ - Surface Area for age group 15-31	5653	cm^2 / day	Ibid
$SAF_{S,1-2}$ - Surface Adherence Factor for age group 1-2	0.35	mg/cm^2	AF1/AF2 developed for short form according to procedure outlined in MA DEP Technical Update
$SAF_{S,1-8}$ - Surface Adherence Factor for age group 1-8	0.56	mg/cm^2	Weighted Skin-Soil Adherence Factor, April 2002
$SAF_{S,9-15}$ - Surface Adherence Factor for age group 9-15	0.14	mg/cm^2	
$SAF_{S,15-31}$ - Surface Adherence Factor for age group 15-31	0.13	mg/cm^2	

TABLE 16
CALCULATED EXPOSURE TO INDOOR AIR FROM GROUNDWATER - POTENTIAL FUTURE RESIDENTS
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

OHM Contaminant of Concern	EPC ug/L	Henry's Law Constant (H)	a	n	Conversion (C) L/m³	Calculated Indoor Air Conc. (OHM_{ia}) ug/m³	RfC mg/m³	RfC ug/m³	(OHM_{ia}/RfC) Hazard Index	Unit Risk	ELCR
MA-VPH											
Aliphatics C5 to C8	4000.00	1.30E+00	7.56E-04	0.01	1000	3.9.E+01	2.0.E-01	2.0.E+02	2.0.E-01		
Aliphatics C9 to C12	883.67	1.56E+00	7.19E-04	0.01	1000	9.9.E+00	2.0.E-01	2.0.E+02	5.0.E-02		
Aromatics C9 to C10	3020.00	7.92E-03	7.20E-04	0.01	1000	1.7.E-01	5.0.E-02	5.0.E+01	3.4.E-03		
Benzene	313.03	5.55E-03	7.81E-04	0.01	1000	1.4.E-02	1.0.E-02	1.0.E+01	1.4.E-03	7.8.E-06	1.1.E-07
Ethylbenzene	955.25	7.88E-03	7.39E-04	0.1	1000	5.6.E-01	1.0.E+00	1.0.E+03	5.6.E-04		
Toluene	26.95	6.64E-03	7.78E-04	0.1	1000	1.4.E-02	5.0.E+00	5.0.E+03	2.8.E-06		
Xylenes (mixed isomers)	1507.53	6.63E-03	7.46E-04	0.1	1000	7.5.E-01	1.0.E-01	1.0.E+02	7.5.E-03		
Methyl tert butyl ether	42.48	5.87E-04	1.07E-04	0.1	1000	2.7.E-04	3.0.E+00	3.0.E+03	8.9.E-08		
Naphthalene	204.35	4.40E-04	6.90E-04	0.1	1000	6.2.E-03	3.0.E-03	3.0.E+00	2.1.E-03		
MA-EPH											
Aliphatics C9 to C18	207.00	1.66E+00	7.19E-04	0.01	1000	2.5.E+00	2.0.E-01	2.0.E+02	1.2.E-02		
Aromatics C11 to C22	239.00	7.20E-04	6.77E-04	0.01	1000	1.2.E-03	5.0.E-02	5.0.E+01	2.3.E-05		
								SUMMATIONS:	3.E-01		1.E-07

RISK SUMMARY - FUTURE RESIDENTIAL GW TO AIR	Scientific	Decimal
Hazard Index	3E-01	0.27
ELCR	1E-07	0.00

TABLE 16 (Continued)
CALCULATED EXPOSURE TO INDOOR AIR FROM GROUNDWATER - POTENTIAL FUTURE RESIDENTS
Former Shell-Branded Service Station No. 137847
628 Broadway
Somerville, Massachusetts

[OHM]w = EPC x a x d x H x C

H Henry's Law Constant (dimensionless)
a Attenuation Factor for transfer of soil gas to indoor air
d Dilution Factor accounting for Biodegradation in the soil gas
C Units conversion factors

Hazard Index (HI) = [OHM]w / RfC

ELCR = [OHM]w x Unit Risk Factor

RfC Reference Concentration
ELCR Excess Lifetime Cancer Risk
Cancer Unit Risk See Toxicity Table
N/A Not Applicable

Sources

Refer to Toxicity Summary Spreadsheets for Toxicity References

1 MassDEP Characterizing Risks Posed by Petroleum Contaminated Sites: Implementation of the MADEP VPH/EPH Approach, Final Policy, October 31,2002, #WSC-02-411
2 EPA Office of USTs Oxygen Identification www.epa.gov/OUST/oxygenat/oxytable.htm
3 MassDEP v1012 Risk Assessment Short Forms
4 MassDEP Background Documentation for the Development of the MCP Numerical Standards April 1994
5 Nancy Fitzpatrick and John Fitzgerald of MADEP: An Evaluation of Vapor Intrusion Into Buildings Through a Study of Field Data, October 1992
6 MassDEP Updated Petroleum Hydrocarbon Fraction Toxicity Values for VPH/EPH/APH Methodology, May 2003
7 Proposed Changes to the MCP Numerical Standards, GW-2 Groundwater Standards, Discussion of Significant Changes Since the December 2001 Draft, April 24, 2002, MADEP Office of Research and Standards
8 Correction of Henrys Law Constant for Average Groundwater Temperature was based on a reduction by 50%. The reduction is consistent with the MADEP Draft reduction of VPH/EPH by roughly 52%, and the Michigan DEQ reduction of 50%.
9 MCP Numerical Standards Development Spreadsheets
10 U.S. EPA On-line Tools for Site Assessment Calculations. Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with Two Variable/Uncertain Parameters (Source Depth, Moisture Content). See: http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.html
11 MassDEP Interim Final Vapor Intrusion Guidance, December 2011, WSC#-11-435

TABLE 17
SUMMATION OF RISK TO POTENTIAL FUTURE RESIDENTS
Sum of Soil Exposure Risk and Groundwater to Indoor Air Risk
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Exposure Pathways	Hazard Index	Excess Lifetime Cancer Risk
Soil Exposures		
Dermal	4.E-01	0.E+00
Incidental Ingestion	3.E-01	0.E+00
Groundwater Exposures		
Inhalation from Groundwater to Indoor Air	3.E-01	1.E-07
Sum of Exposures	1.E+00	1.E-07
MCP Limits	1.E+00	1.E-05
Significant Risk	NO	NO

TABLE 18

CALCULATED EXPOSURE TO INDOOR AIR FROM GROUNDWATER - CURRENT WORKER

Former Shell-Branded Service Station No. 137847

620 Broadway

Somerville, Massachusetts

OHM Contaminant of Concern	EPC ug/L	Henry's Law Constant (H)	a	d	Conversion (C) L/m³	Calculated Indoor Air Concentration ug/m³	ADE_{air} ug/m³	RfC mg/m³	RfC ug/m³	(ADE_{air}/RfC) Hazard Index	Unit Risk	ELCR
MA-VPH												
Aliphatics C5 to C8	4000.00	1.30E+00	7.56E-04	0.01	1000	3.9.E+01	8.9.E+00	2.0.E-01	2.0.E+02	4.5.E-02		
Aliphatics C9 to C12	883.67	1.56E+00	7.19E-04	0.01	1000	9.9.E+00	2.3.E+00	2.0.E-01	2.0.E+02	1.1.E-02		
Aromatics C9 to C10	3020.00	7.92E-03	7.20E-04	0.01	1000	1.7.E-01	3.9.E-02	5.0.E-02	5.0.E+01	7.9.E-04		
Benzene	313.03	5.55E-03	7.81E-04	0.01	1000	1.4.E-02	3.1.E-03	1.0.E-02	1.0.E+01	3.1.E-04	7.8.E-06	2.4.E-08
Ethylbenzene	955.25	7.88E-03	7.39E-04	0.10	1000	5.6.E-01	1.3.E-01	1.0.E+00	1.0.E+03	1.3.E-04		
Toluene	26.95	6.64E-03	7.78E-04	0.10	1000	1.4.E-02	3.2.E-03	5.0.E+00	5.0.E+03	6.4.E-07		
Xylenes (mixed isomers)	1507.53	6.63E-03	7.46E-04	0.10	1000	7.5.E-01	1.7.E-01	1.0.E-01	1.0.E+02	1.7.E-03		
Methyl tert butyl ether	42.48	5.87E-04	1.07E-04	0.10	1000	2.7.E-04	6.1.E-05	3.0.E+00	3.0.E+03	2.0.E-08		
Naphthalene	204.35	4.40E-04	6.90E-04	0.10	1000	6.2.E-03	1.4.E-03	3.0.E-03	3.0.E+00	4.7.E-04		
MA-EPH												
Aliphatics C9 to C18	207.00	1.66E+00	7.19E-04	0.01	1000	2.5.E+00	5.6.E-01	2.0.E-01	2.0.E+02	2.8.E-03		
Aromatics C11 to C22	239.00	7.20E-04	6.77E-04	0.01	1000	1.2.E-03	2.7.E-04	5.0.E-02	5.0.E+01	5.3.E-06		
									SUMMATIONS	6.E-02		2.4.E-08

RISK SUMMARY - CURRENT WORKER GW TO AIR	Scientific	Decimal
Hazard Index	6E-02	0.0623
ELCR	2E-08	0.000000

TABLE 18 (Continued)
CALCULATED EXPOSURE TO INDOOR AIR FROM GROUNDWATER - CURRENT WORKER
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

[OHM]air = EPC * a * d * H * C

H Henry's Law Constant (dimensionless)
a Attenuation Factor for transfer of soil gas to indoor air
d Dilution Factor accounting for Biodegradation in the soil gas
C Units conversion factors

Hazard Index (HI) = ADE / RfC

ELCR [ADE] = Unit Risk Inhalation

RfC Reference Concentration
ELCR Excess Lifetime Cancer Risk
Cancer Unit Risk See Toxicity Table
N/A Not Applicable
[OHM]air Calculated indoor air concentration

Average Daily Exposure (ADE) = [OHM]air * EF * ED * EP / AP

EF - Exposure Frequency	40 Hours/Week
ED - Exposure Duration	50 Weeks/Year
EP - Exposure Period	7 Years
AP - Averaging Period	61,320 Hours or (7 years* 365 days*24 hours)

An HI was not developed for VPH C9-C12 in order to remove the double counting resulting from assessing risk for VPH C9-C12 and EPH C9-C18. The range with the higher calculated HI was used and the lower was removed

Sources

Refer to Toxicity Summary Spreadsheets for Toxicity References

1 MassDEP Characterizing Risks Posed by Petroleum Contaminated Sites: Implementation of the MADEP VPH/EPH Approach, Final Policy, October 31,2002, #WSC-02-411
2 EPA Office of USTs Oxygen Identification www.epa.gov/OUST/oxygenat/oxytable.htm
3 MassDEP v0808 Risk Assessment Short Forms
4 MassDEP Background Documentation for the Development of the MCP Numerical Standards April 1994
5 Nancy Fitzpatrick and John Fitzgerald of MADEP: An Evaluation of Vapor Intrusion Into Buildings Through a Study of Field Data, October 1992
6 MassDEP Updated Petroleum Hydrocarbon Fraction Toxicity Values for VPH/EPH/APH Methodology, May 2002 p60
7 Proposed Changes to the MCP Numerical Standards, GW-2 Groundwater Standards, Discussion of Significant Changes Since the December 2001 Draft, April 24, 2002, MADEP Office of Research and Standards
8 Correction of Henrys Law Constant for Average Groundwater Temperature was based on a reduction by 50%. The reduction is consistent with the MADEP Draft reduction of VPH/EPH by roughly 52%, and the Michigan DEQ reduction of 50%.
9 ADE formula: INDOOR AIR SAMPLING AND EVALUATION GUIDE WSC POLICY #02-430, April 2002
10 U.S. EPA On-line Tools for Site Assessment Calculations. Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with Two Variable/Uncertain Parameters (Source Depth, Moisture Content). See: http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.html

TABLE 19

CALCULATED RISK EXPOSURE TO INDOOR AIR FOR CURRENT WORKERS FROM GROUNDWATER OFF-GAS

Groundwater Exposure Point Location = Most Impacted Well at the Facility (Highest EPC)

Former Shell-Branded Service Station No. 137847

620 Broadway

Somerville, Massachusetts

Exposure Pathways	Hazard Index	Excess Lifetime Cancer Risk
Groundwater Exposures		
Inhalation from Groundwater to Indoor Air	6.E-02	2.E-08
Sum of Exposures	6.E-02	2.E-08
MCP Limits	1.E+00	1.E-05
Significant Risk	NO	NO

TABLE 20
RISK CALCULATIONS FOR CONSTRUCTION WORKERS (0-15')
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

DERMAL

OHM Contaminant of Concern	EPC Soil (mg/kg)	RAF derm	RAF derm	ADD	LADD	RfD	CSF	Hazard Index	ELCR
MA-VPH									
Aliphatics C5 to C8	699.00	0.20	NC	1.7E-03		4.0E-01		4.3E-03	
Aliphatics C9 to C12	962.00	0.20	NC	2.4E-03		1.0E+00		2.4E-03	
Aromatics C9 to C10	1140.00	0.20	NC	2.8E-03		3.0E-01		9.4E-03	
Benzene									
Ethylbenzene	30.10	0.03	NC	1.1E-05		5.0E-02		2.2E-04	
Toluene	39.20	0.03	NC	1.5E-05		8.0E-01		1.8E-05	
Xylenes (Mixed Isomers)	105.40	0.03	NC	3.9E-05		4.0E-01		9.8E-05	
Methyl tert butyl ether	2.75	0.03	NC	1.0E-06		1.0E+00		1.0E-06	
Naphthalene	73.40	0.10	NC	9.1E-05		2.0E-01		4.6E-04	
MA-EPH									
Aliphatics C9 to C18	614.00	0.20	NC	1.5E-03		1.0E+00		1.5E-03	
Aliphatics C19 to C36	929.00	0.20	NC	2.3E-03		6.0E+00		3.8E-04	
Aromatics C11 to C22	1420.00	0.10	NC	1.8E-03		3.0E-01		5.9E-03	
Metals									
Barium	107.00	0.10	NC	1.3E-04		7.0E-02		1.9E-03	
Chromium (total)	50.10	0.10	NC	6.2E-05		2.0E-02		3.1E-03	
							DERMAL SUMMATIONS	3.0E-02	0.0E+00

INCIDENTAL INGESTION

OHM Contaminant of Concern	RAF ing	RAF ing	Incidental Ingestion ADD	LADD	RfD	CSF	Hazard Index	ELCR
Aliphatics C5 to C8	1.00	NC	8.6E-04		4.0E-01		2.2E-03	
Aliphatics C9 to C12	1.00	NC	1.2E-03		1.0E+00		1.2E-03	
Aromatics C9 to C10	1.00	NC	1.4E-03		3.0E-01		4.7E-03	
Benzene								
Ethylbenzene	1.00	NC	3.7E-05		5.0E-02		7.4E-04	
Toluene	1.00	NC	4.8E-05		8.0E-01		6.0E-05	
Xylenes (Mixed Isomers)	1.00	NC	1.3E-04		4.0E-01		3.2E-04	
Methyl tert butyl ether	1.00	NC	3.4E-06		1.0E+00		3.4E-06	
Naphthalene	0.30	NC	2.7E-05		2.0E-01		1.4E-04	
Aliphatics C9 to C18	1.00	NC	7.6E-04		1.0E+00		7.6E-04	
Aliphatics C19 to C36	1.00	NC	1.1E-03		6.0E+00		1.9E-04	
Aromatics C11 to C22	0.30	NC	5.2E-04		3.0E-01		1.7E-03	
Barium	1.00	NC	1.3E-04		7.0E-02		1.9E-03	
Chromium (total)	1.00	NC	6.2E-05		2.0E-02		3.1E-03	
						INCIDENTAL INGESTION SUMMATIONS	1.7E-02	0.0E+00

PARTICLE INHALATION - GI

OHM Contaminant of Concern	RAF ing	RAF ing	Inhalation - GI ADD	LADD	RfD	CSF	Hazard Index	ELCR
Aliphatics C5 to C8	1	NC	2.2E-05		4.0E-01		5.6E-05	
Aliphatics C9 to C12	1	NC	3.1E-05		1.0E+00		3.1E-05	
Aromatics C9 to C10	1	NC	3.6E-05		3.0E-01		1.2E-04	
Benzene					1.0E-02			
Ethylbenzene	1	NC	9.6E-07		5.0E-02		1.9E-05	
Toluene	1	NC	1.3E-06		8.0E-01		1.6E-06	
Xylenes (Mixed Isomers)	1	NC	3.4E-06		4.0E-01		8.4E-06	
Methyl tert butyl ether	1	NC	8.8E-08		1.0E+00		8.8E-08	
Naphthalene	0.3	NC	7.0E-07		2.0E-01		3.5E-06	
Aliphatics C9 to C18	1	NC	2.0E-05		1.0E+00		2.0E-05	
Aliphatics C19 to C36	1	NC	3.0E-05		6.0E+00		4.9E-06	
Aromatics C11 to C22	0.3	NC	1.4E-05		3.0E-01		4.5E-05	
Barium	1	NC	3.4E-06		7.0E-02		4.9E-05	
Chromium (total)	1	NC	1.6E-06		2.0E-02		8.0E-05	
						PARTICLE INHALATION - GI SUMMATIONS	1.4E-04	0.0E+00

PARTICLE INHALATION - PA

OHM Contaminant of Concern	RAF inh	RAF inh	Inhalation - PA ADD	LADD	RfD	CSF	Hazard Index	ELCR
Aliphatics C5 to C8	1.00		7.4E-06		5.7E-02	0.0E+00	1.3E-04	
Aliphatics C9 to C12	1.00		1.0E-05		1.7E-01	0.0E+00	6.1E-05	
Aromatics C9 to C10	1.00		1.2E-05		1.4E-01	0.0E+00	8.5E-05	
Benzene								
Ethylbenzene	1.00		3.2E-07		2.6E+00	0.0E+00	1.2E-07	
Toluene	1.00		4.2E-07		1.4E+00	0.0E+00	2.9E-07	
Xylenes (Mixed Isomers)	1.00		1.1E-06		1.1E-01	0.0E+00	9.9E-06	
Methyl tert butyl ether	1.00		2.9E-08		8.6E-01	0.0E+00	3.4E-08	
Naphthalene	1.00		7.6E-07		8.6E-04	0.0E+00	9.1E-04	
Aliphatics C9 to C18	1.00		6.5E-06		1.7E-01	0.0E+00	3.8E-05	
Aliphatics C19 to C36					0.0E+00	0.0E+00		
Aromatics C11 to C22	1.00		1.5E-05		1.4E-01	0.0E+00	1.1E-04	
Barium	1.00		1.1E-06		1.4E-03	0.0E+00	8.0E-04	
Chromium (total)	1.00	1.00	5.3E-07	3.8E-09	8.6E-05	4.2E+01	6.2E-03	1.6E-07
						PARTICLE INHALATION SUMMATIONS	8.4E-03	1.6E-07

RISK SUMMARY - SOIL-CONSTRUCTION WORKER	Scientific	Decimal
Hazard Index	6E-02	0.06555
ELCR	2E-07	0.00000

TABLE 20 (Continued)
RISK CALCULATIONS FOR CONSTRUCTION WORKERS (0-15')
Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts

Construction Worker - Soil: Table CW-2
Equations to Calculate Cancer Risk for Construction Worker

Cancer Risk from Ingestion

$ELCR_{ing} = LADD_{ing} * CSF_{oral}$

$LADD_{ing} = \frac{EPC * IR * RAF_{c,ing} * EF * ED_{ing} * EP * C1}{BW * AP_{lifetime}}$

Cancer Risk from Dermal Absorption

$ELCR_{derm} = LADD_{derm} * CSF_{oral}$

$LADD_{derm} = \frac{EPC * SA * AF * RAF_{c,derm} * EF * ED_{derm} * EP * C1}{BW * AP_{lifetime}}$

Cancer Risk from Particulate Inhalation - Gastrointestinal Absorption

$ELCR_{ing,GI} = LADD_{ing,GI} * CSF_{oral}$

$LADD_{inh,GI} = \frac{EPC * RCAF_{ing} * PM_{10} * VR_{work} * RAF_{c,ing} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{lifetime}}$

Cancer Risk from Particulate Inhalation - Pulmonary Absorption

$ELCR_{inh} = LADD_{inh} * CSF_{inhalation}$

$LADD = \frac{EPC * RCAF_{inh} * PM_{10} * VR_{work} * RAF_{c,inh} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{lifetime}}$

Construction Worker - Soil: Table CW-3
Equations to Calculate Noncancer Risk for Construction Worker

Noncancer Risk from Ingestion

$HQ_{ing} = \frac{ADD_{ing}}{RfD_{subchronic}}$

$ADD_{ing} = \frac{EPC * IR * RAF_{nc,ing} * EF * ED_{ing} * EP * C1}{BW * AP_{noncancer}}$

Noncancer Risk from Dermal Absorption

$HQ_{derm} = \frac{ADD_{derm}}{RfD_{subchronic}}$

$ADD_{derm} = \frac{EPC * SA * AF * RAF_{nc,derm} * EF * ED_{derm} * EP * C1}{BW * AP_{noncancer}}$

Noncancer Risk from Particulate Inhalation - Gastrointestinal Absorption

$HQ_{ing,GI} = \frac{ADD_{ing,GI}}{RfD_{subchronic}}$

$ADD_{inh,GI} = \frac{EPC * RCAF_{ing} * PM_{10} * VR_{work} * RAF_{nc,ing} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{noncancer}}$

Noncancer Risk from Particulate Inhalation - Pulmonary Absorption

$HQ_{inh} = \frac{ADD}{RfD_{subchronic}}$

$ADD_{inh} = \frac{EPC_{soil} * RCAF_{inh} * PM_{10} * VR_{work} * RAF_{nc,inh} * EF * ED_{inh} * EP * C2 * C3 * C4}{BW * AP_{noncancer}}$

Construction Worker - Soil: Table CW-4
Definitions and Exposure Factors

Vlookup Version V0414

Parameter	Value	Units	Notes
ELCR - Excess Lifetime Cancer Risk	chemical specific	dimensionless	Pathway specific (ing=ingestion, derm=dermal, inh=inhalation)
HI - Hazard Index	chemical specific	dimensionless	Pathway specific (ing=ingestion, derm=dermal, inh=inhalation)
CSF - Cancer Slope Factor	chemical specific	(mg/kg-day)$^{-1}$	see Table CW-3.
RfD - Reference Dose	chemical specific	mg/kg-day	see Table CW-3.
LADD - Lifetime Average Daily Dose	chemical specific	mg/kg-day	Pathway specific. See Table CW-2.
ADD - Average Daily Dose	chemical specific	mg/kg-day	Pathway specific. See Table CW-3.
EPC - Exposure Point Concentration	chemical specific	mg/kg	see Table CW-1.
IR - Soil Ingestion Rate	100	mg/day	MADEP, 2002. Technical Update: Calculation of an Enhanced Soil Ingestion Rate. (http://www.mass.gov/dep/ors/orspubs.htm)
RAF_c - Relative Absorption Factor for Cancer Effects	chemical specific	dimensionless	Pathway specific, see Table CW-3.
RAF_{nc} - Relative Absorption Factor for Noncancer Effects	chemical specific	dimensionless	Pathway specific - see Table CW-3.
EF - Exposure Frequency	0.714	event/day	5 events (days) / 7 events (days) in a week; MADEP 1995 Guidance for Disposal Site Risk Characterization pg B-38
$EF_{cyanide}$ - Exposure Frequency for Cyanide Exposures	1.00	event/day	MADEP, 1995. Guidance for Disposal Site Risk Characterization. Page B-5.
$ED_{ing/derm}$ - Exposure Duration for ingestion or dermal exposure	1	day/event	
ED_{inh} - Exposure Duration for inhalation exposure	0.333	day/event	Represents 8 hours / event.
EP - Exposure Period	182	days	6 months; MADEP 1995 Guidance for Disposal Site Risk Characterization.
$EP_{cyanide}$ - Exposure period for cyanide exposure	1	day	MADEP, 1995. Guidance for Disposal Site Risk Characterization. Page B-5.
BW - Body Weight	58.0	kg	U.S. EPA, 1997. Exposure Factors Handbook. Table 7.7. - Females ages 18 - 25.
$AP_{lifetime}$ - Averaging Period for lifetime	25,550	days	Represents 70 years.
$AP_{noncancer}$ - Averaging Period for noncancer	182	days	6 months; MADEP 1995 Guidance for Disposal Site Risk Characterization.
$AP_{cyanide}$ - Averaging period for assessing cyanide exposure	1	day	MADEP, 1995. Guidance for Disposal Site Risk Characterization. Page B-5.
AF - Adherence Factor	0.29	mg/cm^2	MA DEP, 2002 Technical Update: Weighted Skin-Soil Adherence Factors. (http://www.mass.gov/dep/ors/orspubs.htm)
VR_{work} - Ventilation Rate during work (heavy exertion)	60	L/min	Table B-4 MADEP 1995 Guidance for Disposal Site Risk Characterization.
SA - Surface Area	3473	cm^2/day	MADEP, 1995. Guidance for Disposal Site Risk Characterization. 50th percentile for females. Appendix Table B-2.
$RCAF_{ing}$ - Relative Concentration Adjustment Factor, gastrointestinal	1.5	dimensionless	MADEP 2007. Characterization of Risks Due to Inhalation of Particulates by Construction Workers.
$RCAF_{inh}$ - Relative Concentration Adjustment Factor, inhalation	0.5	dimensionless	MADEP 2002. Characterization of Risks Due to Inhalation of Particulates by Construction Workers.
PM_{10} - Concentration of PM_{10}	60	µg/m^3	MADEP 1995 Guidance for Disposal Site Risk Characterization pg B-11

- There are no other degradation/daughter COCs of concern for this release.

8.7 Receptors

8.7.1 Human Receptors and Exposure Potential

Potential human receptors at the disposal site include facility workers, customers, pedestrians and trespassers of the current retail gasoline station and convenience store. Current facility workers are adults and future workers at the facility are assumed to be adults. Customers and pedestrians are assumed to be adults who may normally be accompanied by children. Trespassers are assumed to be both children and adults. Normal operations at the facility may include an average of two to three employees working eight to 12 hour shifts five days per week. Customers of the facility would be present only for short durations (10 minutes to an hour). Construction workers could also be present at the disposal site. The current use does not include residential receptors, however, the future use of this disposal site is unrestricted. Therefore, current and future potential human receptors include residential receptors (adults and children) who could be present at the property for up to 24 hour days.

Soil impacts at the site range from zero to 29 feet bgs and are located beneath concrete/asphalt throughout the entire site. COC concentrations in groundwater above the Method 1 GW-2 Standards are limited to monitoring well MW-105. Soil gas sampling at SVP-102 documented APH concentrations below the VI Guidance Residential and Industrial/Commercial Soil Gas Screening Values and additional historic TOV data collected from soil gas points at the site document vapor migration is an incomplete pathway. These results indicate that dermal, ingestion, and inhalation exposures to current and future human receptors are not expected. In addition, there are no private drinking water wells within 500 feet of the disposal site as detailed in **Section 2.3**.

8.7.2 Ecological

Although there are shallow soil impacts at the site, wildlife exposures are unlikely because impacted soil is located beneath asphalt and concrete. As discussed in **Section 2.3**, there are no estimated habitats of rare wildlife, certified vernal pools, priority sites of rare species habitats or exemplary natural communities within 500 feet of the disposal site. An area of Protected Open Space is located approximately 500 feet to the southeast of the site. The closest surface water body is the Mystic River, which is located approximately 4,000 feet east of the facility. No other surface water bodies are located within one mile of the facility.

8.8 Exposure Point Concentration Calculations

Exposure point calculations (EPCs) were performed on groundwater and soil analytical data sets. In each case, EPC calculations were conducted in accordance with guidance set forth in the MCP per 310 CMR 40.0926.

8.8.1 Soil EPCs

Construction workers, utility workers, and landscapers are the only current receptors likely to be exposed to petroleum-impacted soil. Potential future use of the facility as residential may

include exposures to petroleum-impacted soil. As a conservative approach, the maximum concentration for each COC was utilized as the EPC and includes soil data collected from soil boring and monitoring well installation activities and excavation activities. Refer to **Tables 6** and **8** for the maximum concentrations of VPH and EPH COCs utilized as EPCs. Since it is unlikely any receptors other than construction or utility workers will be exposed to soil at depths greater than 15 feet bgs, two sets of EPCs were identified for soil:

- A shallow set (zero to 15 feet bgs) used to assess current receptors (current facility and construction workers) and future residential receptors; and,
- A deep set (greater than 15 feet bgs) used to assess current receptors (construction workers).

Several soil samples with laboratory results showing COCs above applicable soil standards are Pre-CAM (collected prior to June 2003). These samples document some of the higher concentrations at the site and were included in the evaluation of EPCs for this risk assessment. Duplicate samples were collected as a component of Quality Assurance (QA) and Quality Control (QC); therefore, duplicates were not included as part of the EPC evaluation.

The calculated EPCs for soil were used to evaluate soil risks for construction workers and future residents, and for comparison to Method 3 UCLs. All EPC concentrations for impacted soil are below UCLs.

8.8.2 Groundwater EPCs

Groundwater EPCs for VPH were generated by calculating the arithmetic average of the analytical results from the four temporal sampling events per well. Where analytical data results were below the laboratory method detection limits (MDLs), one-half of the MDL was used to calculate the EPC. If four data sets were not available as many data sets as available were used to calculate the EPC concentration. For EPH EPCs, the maximum concentration for each COC during the most recent EPH sampling event (May 2009) was utilized as the EPC due to a limited sample set. All EPC concentrations for impacted groundwater are below UCLs. EPC concentrations for groundwater are located in **Tables 3 and 4.**

8.8.3 Hot Spot Evaluation

No "Hot Spots" as defined in 310 CMR 40.0006 have been identified in the subsurface soils or groundwater at the disposal site.

9.0 METHOD 3 RISK CHARACTERIZATION

A M3RC may be used to characterize the risk at a disposal site by relying upon detailed information about the disposal site, the OHM, and potential exposures to Human and Environmental receptors under all current and reasonably foreseeable Site Activities and Uses. Since concentrations of COCs in disposal site groundwater and soil exceed Method 1 standards, a M3RC was required to evaluate risk posed by the disposal site. This risk characterization is intended to evaluate risk to the most likely receptors and relies on published toxicological, chemical, human behavior, and modeling information as well as several assumptions in order

to assess potential risk to receptors. Where necessary, sources and assumptions are outlined in the characterization. Uncertainties are also outlines in this section.

9.1 Toxicity Profile

The toxicity of a chemical is based on the nature of the effect-caused and the dose, or concentration over time, required to cause effects. The route of entry into the body also affects the toxicity of many compounds introduced to the human body. Toxic effects may occur immediately or over long periods of time. For the purpose of risk assessment, health effects are divided into two categories, carcinogenic (cancer causing) and non-carcinogenic. Carcinogenic effects are evaluated for compounds that are known to cause cancer as outlined by the United States Environmental Protection Agency (EPA) and MassDEP, currently listed as known carcinogens.

Many chemicals have some level of toxicity; therefore, non-carcinogenic or systemic health effects were evaluated for all COCs at the disposal site. The majority of toxicological information on chemicals is extrapolated from animal testing. In addition, long-term studies of human populations and correlations between exposure and increased (higher than average) illnesses are also used to establish toxicity values. Human populations are constantly exposed to chemicals in the workplace, homes, and during recreational activities as a result of human use of chemicals and compounds that are present in the environment. This exposure includes petroleum products used in vehicle fuels, heating fuels, cleaning solvents, and lubricants. Exposures also include air pollutants from vehicle exhaust, industrial emissions, tobacco smoke, and household cleaning products. All of these exposures create some toxic effect. The purpose of this risk assessment is to evaluate the additional risk of toxic affect on receptors as a result of the disposal site RTN 3-1322.

Toxicity data used in this risk assessment originates from a variety of sources including the MassDEP Office of Research and Standards, the EPA Integrated Risk Information System (IRIS) and the Agency for Toxic Substances and Disease Registry (ATSDR). These agencies provide detailed summaries of health effects of toxic chemicals and supporting scientific research. Due to the former use of the property as a Shell-branded service station, groundwater samples were analyzed for the presence of the gasoline oxygenate additives TBA, ethyl tert-butyl ether (ETBE), di-isopropyl ether (DIPE), and tert-amyl methyl ether (TAME). To date, there is limited published toxicological data pertaining to these compounds. A handful of state agencies (e.g., the Michigan Department of Environmental Quality) have established toxicological benchmark standards for these compounds and toxicity data for these compounds was obtained from these sources. Toxicological information on specific COCs is included in **Attachment C** including source references.

9.2 Environmental Fate and Transport

The behavior of COCs in the environment is dependent on numerous factors. These factors include the physical properties of the compound itself and the physical, chemical and biological properties of the media to which they are released. The exact source, magnitude and date of the release or releases are not known; however, the site was first listed with the MassDEP as an LTBI under RTN 3-1322 on January 15, 1990 following the discovery of petroleum impacted soil

during UST removal activities in June 1987. Since the initial RTN, four more releases were discovered and reported to the MassDEP between 1996 and 2001 and these releases were likely associated with the historic use of the facility as a retail gasoline station and automotive repair facility. If gasoline is released to the soil it may migrate to the groundwater table, however, COCs in groundwater at the site above the Method 1 GW-2 Standards are limited to monitoring well MW-105 and COC concentrations in downgradient monitoring wells are below the Method 1 Method 1 GW-2 and/or GW-3 standards.

Volatile organic compounds (VOCs), such as BTEX and MTBE, have high vapor pressures and tend to migrate to the vapor phase. When compounds at concentrations detected at this disposal site reach the atmosphere, they are generally diluted to non-detectable concentrations by wind dispersion. These compounds also photo-degrade in sunlight. At disposal sites where VOCs are detected in groundwater at shallow depths (less than 15 feet), the potential for VOCs to migrate into indoor air is a concern as the mechanical and photochemical processes of the atmosphere are limited by the structure. Semi volatile compounds (SVOCs) generally bind to soil and other organic matter in the soil. Generally, heavier compounds tend to be less mobile in the environment. Many of these compounds are soluble in water. The VOCs detected at the disposal site are soluble in water and potentially migrate with groundwater, while the SVOCs are less soluble and less likely to migrate with groundwater. Generally SVOCs decrease in solubility and mobility in the environment with increasing molecular weight.

The main forces acting on the COCs at the disposal site are advection, dispersion, diffusion, sorption, volatilization, and biodegradation. The mechanical forces of groundwater flow and infiltration account for a large portion of the contaminant migration in the subsurface. At this site, infiltration and volatilization are limited by the asphalt, concrete and buildings. As documented by analytical data from soil and groundwater at the disposal site, COCs are bound to soil and are dissolved in groundwater. Petroleum compounds are known to biodegrade in the environment. Based on groundwater sampling results, concentrations of COCs in groundwater are subject to biodegradation, thus reducing COC concentrations. Additional compound specific fate and transport data is included in **Attachment C**.

9.3 Potential Receptors and Exposure Potential

Potential receptors were evaluated with the assumption that potential future use of the disposal site was unrestricted. Once risk to potential receptors was evaluated without restrictions, modifications and restrictions were evaluated and added where necessary to more precisely represent current and foreseeable risk at the disposal site. Risk calculations are presented for all pathways assuming no AUL or other access restrictions are placed on the disposal site.

9.4 Current Use

Current use was evaluated based on each of the properties in the disposal site, impacted media at those properties and the receptors currently at those properties. Vertical and horizontal extents of COC soil impacts have been defined through subsurface investigations conducted at the disposal site and are limited to the former OWS area, the area to the south of the on-site building and the current and former gasoline UST area at depths ranging from zero to 29 feet bgs. Based on

groundwater analytical data, COC concentrations above the Method 1 GW-2 Standards are limited to monitoring well MW-105.

The facility is currently used as a retail gasoline station and convenience store. The property is primarily covered with asphalt, concrete and a building. Workers at the property are adults and are likely present for a period of approximately eight hours. Customers at the facility may include children and adults for short periods of time (less than one hour). A small percentage of visitors are likely to be present at the disposal site for short periods of time repeatedly over long time periods (several years). The disposal site is located in a mixed commercial and residential area and is zoned as Neighborhood Business. Since groundwater is not utilized at the facility and impacted soil is covered by pavement and concrete, the workers and visitors do not come in contact with impacted soil or groundwater. Due to duration of exposure (many hours per day for several years), on-site workers are considered to have a higher exposure potential than visitors for current use. On-site worker risks were used to evaluate potential risk to visitors and visitor exposure was not specifically quantified.

Under current use, construction and utility workers are likely to work at the disposal site periodically to upgrade features or repair utilities. Construction and utility workers are likely to be exposed to soil or groundwater at the disposal site for eight hours per day for several months; however, they are not likely to revisit the disposal site with regularity. Construction workers are generally assumed to have greater exposure to COCs than utility workers due to the duration of construction projects; therefore, risk to construction workers was evaluated and is considered more conservative than utility workers. Landscapers are also expected to work at the disposal site under current disposal site use. However, due to the type of work conducted, the construction worker is expected to have greater potential contact with subsurface soil and groundwater and therefore greater exposure potential. The construction worker exposure scenario is used throughout this risk characterization to approximate risk to utility workers and landscapers.

9.5 Potential Future Use

Current MassDEP guidance requires that risk be characterized with regard to unrestricted future use unless an AUL is used to restrict future disposal site uses. Unrestricted future use includes the assumption that the facility will be used for residential use. Residents would include adults and children at the facility for long durations over long periods of time. Since the groundwater is not classified as GW-1 and municipal water is provided to the facility, drinking water exposures are not evaluated for future use of the facility. Potential exposures to indoor air and exposure to soil were initially evaluated for the potential future use of the property as residential, assuming residential receptors and exposures. The potential future use of the property for residential purposes also does not account for additional degradation over time of COC concentrations at the disposal site, which would decrease risk.

9.6 Ecological

Although there are shallow soil impacts at the site, the disposal site is not expected to provide significant habitat for wildlife since the site is located in an urban setting and the majority of the site is paved or covered with concrete and vehicle/pedestrian traffic are likely to restrict

wildlife presence. Potential future habitats for wildlife are also unlikely due to the urban nature of the location. As discussed in **Section 2.3**, there are no estimated habitats of rare wildlife, certified vernal pools, priority sites of rare species habitats or exemplary natural communities within 500 feet of the disposal site. An area of Protected Open Space is located approximately 500 feet to the southeast of the site. The closest surface water body is the Mystic River, which is located approximately 4,000 feet east of the facility. No other surface water bodies are located within one mile of the facility.

9.7 Potential Exposure Routes

The following is a list of potential routes of exposure evaluated for current disposal site use. **Table 14** presents a detailed review of exposure pathways. Potential exposure routes are outlined for the disposal site.

9.7.1 Current

The subsections below detail current exposure pathways at the disposal site based on the current use of the facility. Additionally, potential future residential use is more conservative.

9.7.1.1 Facility – Workers and Site Visitors

On-site Workers (adults):

- Potential inhalation of vapors from groundwater migrating into the building. Based on the current distribution of COCs in groundwater and the results from the soil gas sampling, this pathway is incomplete. However, to be conservative, inhalation of vapors from groundwater migrating through soil into the facility building was evaluated.

Site Visitors (adults and children):

- Potential inhalation of vapors from groundwater migrating through soil gas into the building. The potential exposure to on-site workers is significantly higher than site visitors and was used to conservatively evaluate this exposure scenario.

9.7.1.2 Construction, Utility Workers and Landscapers (adults)

- Dermal exposure to soil due to direct contact with impacted soil;
- Incidental ingestion of impacted soil; and,
- Inhalation of particulate matter.

Exposure of utility workers or landscapers to COCs was not quantified. The potential exposure of construction workers to COCs is significantly higher than utility workers and landscapers and was used to conservatively evaluate exposures to utility workers and landscapers.

9.7.2 Potential Future Use

All of the exposures evaluated in consideration of current use are considered to also exist during future uses and are not repeated in this section. Potential exposure routes are outlined in this section for the assumption of unrestricted use of the facility as a residence.

9.7.2.1 Facility

Residents (If applicable) (adults and children):

- Inhalation of vapors from groundwater migrating through soil into a future residential structure;
- Dermal exposure due to direct contact with impacted soil;
- Incidental Ingestion of impacted soil; and,
- Home grown produce vegetable COC uptake, bioaccumulation and ingestion.

Exposure potential was evaluated for all future use scenarios in the risk characterization. These exposure routes were selected for initial screening since they represent the most likely for potential exposure of potential receptors to COCs. In addition, these exposure routes represent the predominance of risk posed by the disposal site to these potential receptors. A more specific evaluation of exposures would likely reduce the calculated risk posed by the disposal site.

9.8 Identification of Exposure Point Concentrations (EPCs)

EPCs for soil were determined by utilizing the maximum concentration for each COC. **Section 8.8.1** summarized the development of EPCs for COCs in soil. Maximum concentration EPCs in soil are depicted on **Tables 6** and 8. EPCs were generated for VPH in groundwater by calculating the arithmetic average of the analytical results from the last four temporal sampling events per well. For EPH EPCs, the maximum concentration was utilized as the EPC due to a limited sample set. EPC concentrations for groundwater are located in **Tables 3 and 4. Section 8.8.2** summarized the development of the EPC for COCs in groundwater. Soil and groundwater COCs are provided in **Tables 13A and 13B**, respectively.

9.8.1 Soil

Exposure to COCs in soil to on-site workers and visitors is unlikely due to the location of petroleum impacts beneath the asphalt-paved or concrete surface at depths ranging from zero to 29 feet bgs; therefore, these exposure pathways were not evaluated for current use. Construction workers, utility workers, and landscapers are the only receptors likely to be exposed to petroleum impacted soil. Potential future use of the facility as residential may include exposures to petroleum impacted soil. As a conservative approach, the maximum concentration for COCs in soil are utilized as EPCs. There were no hot spots as defined by 310 CMR 40.0006 with respect to soil data at this disposal site. Soil EPCs were discussed previously, in more detail, in **Section 8.8.1**.

9.8.2 Groundwater

EPCs for VPH were calculated for groundwater COCs at the disposal site using the arithmetic average of the analytical results from the last four temporal sampling events per well, where available. Due to a limited data set, the highest EPH value for each COC during the most recent groundwater sampling event for EPHs (May 2009) was used as the EPC. Refer to **Tables 3 and 4** for a summary of groundwater analytical data used in this risk characterization.

9.9 Dose Response Assessment

To evaluate the potential risk to the receptors and potential receptors at the disposal site, a relationship between the toxicity of COCs, exposure pathways and the receptors must be determined. In order to evaluate risk, a quantitative assessment of risk was performed. The quantitative risk was evaluated following the guidance presented in the MCP, MassDEP's *Guidance for Disposal Site Risk Characterization July 1995* (Risk Guidance), associated Technical Updates, MassDEP's *Background Documentation for the Development of the MCP Numerical Standards* (Background Documentation), the VPH/EPH Approach guidance document, and several other industry sources. COC toxicity factors were updated to include the most recent MassDEP 2012 updated values.

The basis for significant risk as defined by the MCP is a Hazard Index (HI) of greater than one (one significant figure), or an Excess Lifetime Cancer Risk (ELCR) of greater than one chance in 100,000 (10^{-5}) (one significant figure). As defined by the Risk Guidance, the HI is the ratio of the receptor's exposure level, or dose, to an acceptable, or allowable, level. The ELCR represents the incremental probability of a receptor developing cancer as a result of their exposure to a carcinogen related to the disposal site. The ELCR is similar to the HI as it is also a measure of a calculated dose verses an acceptable (not likely to increase the chance of developing cancer) dose. A dose is the amount of the contaminant that the receptor receives from exposure. The dose is a function of the quantity, or concentration, of the contaminant in the environment, the means by which the receptor is exposed, the uptake of the COC by the body, and the duration of the exposure.

For this and most risk assessments, many assumptions are required to limit the scope of the risk assessment and to format the intensity of the assessment to meet the potential risks associated with the disposal site. For this quantitative assessment, risk to three receptors was considered: on-site workers, on-site construction workers, and potential future residents. The risk to the potential residential receptor for a chronic exposure (seven years) represents the highest potential exposure for the disposal site. Chronic exposures represent the highest potential risk. An evaluation of acute (immediate) or sub chronic (up to seven years) exposures would present lower risks than those presented in the chronic assessment and were not evaluated for receptors. The risk to the construction worker was evaluated because of the intensity of exposure to a construction worker in comparison to residents, on-site workers, and visitors.

An HI and ELCR are established for each receptor for each exposure pathway. A cumulative HI and a cumulative ELCR for each exposure pathway is calculated to produce an HI and ELCR for each receptor. The methodologies for calculating HI and ELCR for each receptor and receptor pathway are outlined below.

9.10 Potential Future Use of the Facility as Residential - Dermal Exposure, Incidental Ingestion, and Home Grown Vegetable Uptake (Assuming Unrestricted Use)

In developing an HI for each compound, an Average Daily Dose (ADD) is calculated for dermal and ingestion routes of exposure. The ADD is a function of the concentration in soil, the exposure frequency (EF in events per day), the exposure duration (ED in hours per day), the exposure period (EP in years), a relative absorption factor (RAF, a function of how much is absorbed into the body), dermal contact or ingestion rates, receptor body weight (BW), exposure averaging period (AP), and appropriate unit conversion factors. RAF's used for the M3RC are included in **Attachment C** including source references.

The exposure to residential receptors at this disposal site is based on the exposure scenario outlined by MassDEP in the Draft Revisions to the MCP Numerical Standards, May 31, 2001 (2001 Draft Revisions). The exposure is based on a hypothetical receptor in contact with the soil five days per week, 30 weeks per year for eight years in calculating HI, or 30 years in calculating ELCR. These rates are effectively a time weighted average that accounts for a hypothetical receptor's age, body weight, soil contact rates, ingestion rates, body surface area, and seasonal variation (EF & ED). The Average Daily Soil Ingestion Rates (ADSIR) and the Average Daily Soil Dermal Contact Rate (ADSDCR) are based on a receptor age one through eight years of age when calculating the HI and age 1 to 30 when calculating the ELCR. The 2001 MassDEP Draft Revisions are consistent with the residential receptor as outlined in this risk assessment is based on MassDEP's Normalized Average Daily Soil Ingestion Rate (NADSIR) and the Normalized Average Daily Soil/Skin Contact Rate (NADSCR) presented in MassDEP's Background Documentation; however, the 2002 approach refines the exposure time and includes updated assumptions.

To develop the ELCR, a similar methodology was followed. A Lifetime Average Daily Dose (LADD) was developed for each COC. The LADD is based on an exposure period of 30 years and an averaging period of 70 years. While MassDEP guidance suggests the use of 75 years as an averaging period, the reference exposure and toxicity data for chemicals is normally developed using 70 years as outlined by the United States Environmental Protection Agency (EPA). In addition the 2001 Draft Revisions also use 70 years. This risk assessment utilizes an averaging period of 70 years in order to avoid errors created by the use of 75 years and to remain consistent with generally accepted practices. The additional five years outlined by MassDEP is unlikely to alter the conclusions of risk for this disposal site. An EP of 30 years is expected to be equivalent to the number of years the average person spends in one household. The Lifetime (L) LADSIR and LADSDCR are based on a weighted average of a hypothetical receptor age birth to 30 years. This method is useful for summarizing exposures to aging/growing receptors and limits the complexity/scope of the calculations required. The assumption that the same receptor will live in the same residence from birth to age 30 is conservative in today's society.

The potential future use of the facility for residential purposes includes the potential for COC bioaccumulation in home grown vegetables and the eventual ingestion of bio-accumulated COCs present in home grown vegetables. Vegetable bio-accumulation exists with many metals commonly present at gasoline service station disposal sites. For this RTN, barium and chromium were detected above background levels. Soil EPCs were input into the MassDEP

vegetable uptake Shortform (v0414) to evaluate vegetable uptake. Refer to **Attachment D** for the homegrown vegetable uptake table. Due to potential exposure to future residential receptors via vegetable uptake, gardening Best Management Practices (BMPs) have been provided with this submittal as **Attachment E**.

To calculate the HI for each COC for dermal and ingestion exposures, the ADD is divided by a dermal or oral reference dose (RFD). The RFD is a dose at which toxic affect is expected. The ELCR is calculated as the product of the LADD and the Cancer Slope Factor (CSF). The CSF is a measure of a chemicals ability to increase the incidence of cancer in a population (for comparison to a lifetime dose). The calculations, assumptions and references for dermal and incidental ingestion of soil at the facility by potential future residents are presented in **Table 15.** Chemical specific data used for the M3RC are included in **Attachment C** including source references.

9.11 Potential Future Use of the Facility as Residential - Inhalation Exposure (Assuming Unrestricted Use)

Potential inhalation exposures to vapors from impacted groundwater were evaluated by modeling the concentrations of each COC in groundwater to indoor air. Potential indoor air concentrations were calculated using an adaptation of the Johnson and Ettinger Heuristic Model outlined in the MassDEP Background Documentation used to develop the GW-2 Standards. This model was confirmed by Nancy Fitzpatrick and John Fitzgerald of MassDEP in their paper titled: An Evaluation of Vapor Intrusion into Buildings through a Study of Field Data, October 1992. The model uses factors including the Henry's Law Constant (H, dimensionless), a dilution factor (d) that calibrates the model to account for affects of biological degradation in the soil gas, an attenuation factor (α) that accounts for the attenuation of soil gas into the indoor air space, and an appropriate unit conversion factor. The result of this model is a calculated concentration of the COC in indoor air. It is important to note that this model simplifies the process of infiltration into the building. No indoor air concentrations are expected under current conditions based on sub-slab soil vapor analytical results. Any new construction is likely to be more restrictive to vapor migration than the model assumes. The model does not account for degradation of the groundwater concentrations over time, prior to building in the impacted area. Additionally, background concentrations were not deducted from indoor air EPCs estimated by the model. Reduction of calculated indoor air concentrations by published background data will reduce calculated risk.

Henry's Law constants (H) are typically reported at a reference temperature of 20 to 25 degrees Celsius. However, groundwater and soil temperatures, where the COCs are volatilizing, are at a lower temperature. In the Proposed Changes to the MCP Numerical Standards, GW-2 Standards, Discussion of Significant Changes Since the December 2001 Draft, (MassDEP, April 24, 2002), MassDEP includes an adjustment to the Henry's Law Constants to reflect an average groundwater temperature. For most chemicals, the Clausius-Clapeyron equation is used to estimate the Henry's law coefficient at groundwater temperatures. However, for VPH fractions, MassDEP has assumed the Henry's Law constants at typical groundwater temperatures are 50% of the values at the reference temperatures. This is consistent with the Michigan Department of Environmental Quality Part 201 Generic Groundwater and Soil Volatilization to Indoor Air Inhalation Criteria: Technical Support Document, (MDEQ, August 31, 1998) temperature

adjustment factor of 0.5 to correct the Henry's Law constant. Where available, the corrected Henry's Law values from MassDEP April 2002 draft standards discussion were used. When MassDEP values were unavailable, the Henry's Law constants were corrected by a factor of 0.5. While a more precise adjustment of the constant requires other input factors, the ratio that was used is appropriate. Henry's law constants are summarized in **Attachment C.**

The concentrations from the model are compared to Reference Concentrations (RFCs) and Unit Risk factors (UR). The RFC is a concentration in air that is likely to cause a toxic effect on the receptor and is used in calculating the HI. The UR is the concentration in air that is likely to increase the rate of cancer in a population over a lifetime. An HI is calculated by dividing the modeled indoor air concentration by the RFC, and the ELCR is calculated as the product of the modeled concentration and the UR. RFCs and URs are listed in **Attachment C** along with appropriate references. The calculations, assumptions, and references for inhalation exposures at the facility from groundwater are presented in **Table 16.** A summary of risk to potential future residents is provided in **Table 17.**

9.12 On-Site Workers Facility - Inhalation Exposure

Potential inhalation exposures for on-site workers were calculated following the same methodology as the residential inhalation exposure; however, a correction was included to account for a shorter exposure for on-site workers. The risk characterization assumes that on-site workers are present at the site 40 hours per week, 50 weeks per year, for seven years. The calculated indoor air concentration from the Johnson and Ettinger model described above is used in calculating an ADE. The ADE incorporates the exposure assumptions and is divided by the RFC to produce the HI. The ELCR is the product of the Lifetime (L) LADE and the UR. The groundwater EPCs selected for use in these calculations were EPCs calculated from groundwater COCs detected in MW-101, the most impacted groundwater monitoring well within 30 feet of the facility building. The calculations, assumptions, and references for on-site worker inhalation exposures from groundwater are presented in **Tables 18 and 19.**

9.13 Construction Workers (Facility)

The exposure to construction workers was calculated since this exposure is markedly different to that of other receptors as their work places workers in direct contact with impacted media. This approach is outlined in MassDEP's Technical Update: Characterization of Risks Due to Inhalation of Particulates by Construction Workers. Construction workers have a much greater exposure to soil and to construction derived dust then a utility worker. Since the construction worker's duration of exposure is longer than a utility worker, the construction worker exposure has been assumed to adequately characterize risk for both receptors. The inhalation of particulates by construction workers is broken into two parts. One part accounts for the amount of the particles that are swallowed (following coughing up of mucus) and the other accounts for the intake of the particle in the lung. The calculated risk assumes that all respirable particles are smaller than 30 microns in diameter and 40% of those are smaller than or equal to 10 microns. The calculation also assumes that all particles greater than 10 microns but less than or equal to 30 microns are swallowed. A total of 50% of particles, 10 microns or less, are swallowed and the remainder enters the lungs.

In accordance with the Risk Guidance, construction workers are exposed to the soil at the disposal site for eight hours per day, five days per week for six months (130 days). Due to the size (small) of the facility and the adjacent properties within the disposal site it is unlikely that construction, especially soil excavation, would last as long as six months. Construction workers were also assumed to be adult females with a body weight of 58 kilograms (kg). While construction workers are likely to be both men and women, use of a woman's approximate body weight results in a more conservative exposure scenario for this receptor. The exposure assessment of construction workers is a sub-chronic exposure and sub-chronic absorption and reference concentrations/doses were used, where available. In the event that sub-chronic values were unavailable, chronic values were used as a more conservative approach. It is important to note, however, that construction workers at service stations and many other commercial properties have an increased understanding of the risks posed by construction on similar disposal sites. Many of these workers are expected to have received contaminant-related Occupational Safety and Health Administration (OSHA) training and often pre-screen projects to limit exposure to workers and visitors. In addition, these skilled workers often institute engineering controls on their projects that further limit exposure.

The calculation for the ADD and LADD is similar to the one described above for the residential receptor; however, it removes the time weighted averages and replaces them with more specific factors. The calculations account for the surface area in contact with soil (SA); the soil adhered to the exposed skin area (AF), ingestion rates (IR), and body weight (BW). The calculations, assumptions, and references for construction workers are presented in **Tables 20** through **23.**

9.14 Risk to Receptors

As outlined above, a hazard index is calculated for each COC for each exposure pathway. For carcinogenic compounds, an ELCR is also calculated. The receptor's exposure to all of the COCs through all of the exposure routes is additive. The hazard index for each COC is added to the other hazard indices for each exposure pathway. The hazard index for each exposure pathway is added to the hazard indices for all of the exposure pathways for each receptor to determine the hazard index for that receptor. The ELCR for each receptor is calculated in the same manner. These calculations are presented in **Tables 15 through 23.** As outlined above, the pathways and receptors evaluated represent a conservative evaluation of risk at the disposal site. While additional receptors and exposure pathways can be calculated, the scope of this assessment is appropriate for the COCs detected and the potential receptors present. The potential risk to potential receptors is outlined below.

9.14.1 Potential Future Receptors

Potential future residents at the disposal site may include residential property owners including adults and children present at the facility 24 hours per day. Such future residents are expected to have high intensity uses of the property (including playground areas for children and growing and consumption of vegetable garden produce). In order to calculate the risk to potential future receptors, risk calculation spreadsheets were prepared and are included as **Tables 15** through **23. Table 9-1** below summarizes the risk calculated.

Table 9-1 Future Unrestricted Use, Residential Receptors – Soil Exposures

Exposure Pathways	Hazard Index	Excess Lifetime Cancer Risk
Soil Exposures		
Dermal	4.E-01	0.E+00
Incidental Ingestion	3.E-01	0.E+00
Groundwater Exposures		
Inhalation from Groundwater to Indoor Air	3.E-01	1.E-07
Sum of Exposures	1.E+00	1.E-07
MCP Limits	1.E+00	1.E-05
Significant Risk	NO	NO

9.14.2 Current Receptors

Current receptors at the disposal site (based upon current use) include site workers (workers at a commercial establishment) and site visitors and customers as well as construction and utility workers who may perform activities at the facility. All of the above-summarized receptors may be exposed to both soil and groundwater at the disposal site. As summarized in **Table 18**, site-specific risk for impacted soil exposure for current site workers was not calculated as the more conservative risk for future residential receptor exposure to impacted soil is considered more protective of human health. This potential exposure risk was calculated in **Section 9.14.1**.

However, specific risk was calculated for the potential indoor air exposure from groundwater off-gas to current facility workers. Current toxicological data from the MassDEP Short Forms v0414 was utilized to calculate the risk, as summarized below in **Table 9-2**. In order to calculate the risk to current receptors, risk calculation spreadsheets were prepared and are included as **Tables 18** and **19**.

Table 9-2 Current Facility Workers – Groundwater Off-Gas Exposures

Exposure Pathways	Hazard Index	Excess Lifetime Cancer Risk
Groundwater Exposures		
Inhalation from Groundwater to Indoor Air	6.E-02	2.E-08
Sum of Exposures	6.E-02	2.E-08
MCP Limits	1.E+00	1.E-05
Significant Risk	NO	NO

Site-specific risk to construction and utility workers was quantified as part of this Method 3 Risk Assessment as the intensity of potential exposure to impacted soil is expected to be greater

with construction and utility workers than visitors, with the potential exposure expected to be the greatest for construction workers. Therefore, construction workers were evaluated for potential current soil exposure. In order to calculate the risk to construction workers, risk calculation spreadsheets were prepared and are included as **Tables 20 through 23. Tables 9-3A and 9-3B** below summarizes the risk calculated.

Table 9-3A Construction Workers – Soil Exposures (0-15')

Exposure Pathways	Hazard Index	Excess Lifetime Cancer Risk
Incidental Ingestion	2.E-02	0.E+00
Dermal Exposure	3.E-02	0.E+00
Particulate Inhalation GI	4.E-04	0.E+00
Particulate Inhalation	8.E-03	2.E-07
Sum of Exposures	6.E-02	2.E-07
MCP Limits	1.E+00	1.E-05
Significant Risk	NO	NO

Table 9-3B Construction Workers – Soil Exposures (>15')

Exposure Pathways	Hazard Index	Excess Lifetime Cancer Risk
Incidental Ingestion	3.E-02	8.E-09
Dermal Exposure	5.E-02	3.E-09
Particulate Inhalation GI	8.E-04	2.E-10
Particulate Inhalation	2.E-03	4.E-11
Sum of Exposures	8.E-02	1.E-08
MCP Limits	1.E+00	1.E-05
Significant Risk	NO	NO

9.14.3 Visitors (adults and children)

Site-specific risk to visitors was not quantified as part of this M3RC. For screening purposes, the exposure to on-site workers was used to approximate potential risk to workers and visitors. To be conservative, the risk to visitors was assumed to be equal to the risk to the on-site worker receptor for inhalation exposures as visitors are expected to be present for shorter duration than workers and will use the facility less intensively. Exposures to soil are not expected.

Based upon the results of the quantitative assessment, a condition of "No Significant Risk" as defined by the MCP exists for current and unrestricted future uses of the disposal site. Use limitations are not required to maintain a condition of "No Significant Risk" for current or unrestrictive future use scenarios.

9.15 Stage I Environmental Screening

In accordance with 310 CMR 40.0995, a characterization of Risk or Harm to the environment must be evaluated for current and potential future uses for any disposal sites where M3RC is used. A review of disposal site information did not produce any evidence of current or potential exposure. No current or past visible evidence of physical impact to surface soil or wildlife was noted.

No analytical data was present that shows impacts to surface water or sediment. Current groundwater concentrations are below Method 1 GW-3 Standards; therefore, evaluation of risk to surface water bodies is not required. The majority of the facility is asphalt-paved or covered with concrete and is not likely to provide habitat for wildlife. Due to the urban nature of the site and surrounding properties, potential future use of the property is not likely to provide habitat for wildlife. Impacts to soil are located beneath asphalt-paved or concrete surfaces. Since no current or potential future exposure has been identified, a condition of "No Significant Risk" of Harm to the disposal site biota and habitats exists. A Stage II Environmental Risk Characterization is not required.

9.16 Suitably Analogous Standards

Concentrations of COCs at the disposal site were compared to MCP Method 3 UCLs listed in the MCP at 310 CMR 40.0996, and no COC concentrations exceed UCLs. COC concentrations and UCLs are presented in **Tables 3 through 5** for groundwater, and **Tables 6 through 10** for soil. Since the closest surface water body is the Mystic River, which is located approximately 4,000 feet east of the facility, further reduction in COC concentrations are expected prior to reaching the receptor, and dilution of groundwater will occur due to mixing with surface water. Concentrations of COCs in groundwater above the Method 1 GW-2 Standards are limited to monitoring well MW-105 and COCs do not appear to be migrating from the disposal site. A comparison with drinking water standards is not warranted since current or potential future uses are not likely to utilize the groundwater for drinking. COCs at the site have also been compared to Method 1 Groundwater Standards. While Method 1 Groundwater Standards are not considered suitably analogous, they provide some measure of the magnitude of impacts in relation to expected risk.

9.17 Substantial Release Migration, Imminent Hazards, and Critical Exposure Pathways

9.17.1 Critical Exposure Pathways (CEPs)

9.17.1.1 Vapor Phase Emissions

Subsurface structures within 1,000 feet of the facility include many half and full basements and utility conduits located along Broadway, Albion, and Winchester Streets. The closest residence with a basement is located approximately 75 feet east of the facility. The closest school or institution is Brown School, located approximately 1,300 feet southwest of the facility. However, potential vapor phase emissions creating CEPs are not anticipated at any of these locations based on the lack of a complete pathway at the disposal site documented by groundwater and soil gas analytical results and historic soil gas TOV readings when

K. CERTIFICATION OF PERSON MAKING SUBMITTAL:

1. I, ANNETTE DOKKEN, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

2. By:	ANNETTE DOKKEN (Signature)	3. Title:	PROGRAM MANAGER
4. For:	SHELL OIL PRODUCTS US (Name of person or entity recorded in Section H)	5. Date:	8/20/2014 (mm/dd/yyyy)

☐ 6. Check here if the address of the person providing certification is different from address recorded in Section H.

7. Street:

8. City/Town: 9. State: 10. ZIP Code:

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METHOD 3 RISK CHARACTERIZATION AND PERMANENT SOLUTION STATEMENT WITH CONDITIONS

Former Shell-Branded Service Station
620 Broadway
Somerville, Massachusetts
Location #137847

MassDEP RTN 3-1322

Prepared for:

SHELL OIL PRODUCTS US
20945 S. WILMINGTON AVENUE
CARSON, CA 90810
ATTENTION: ANNETTE DOKKEN
SHELL SAP#137847

Prepared by:

Sovereign Consulting Inc.
4 Open Square Way, Suite 307
Holyoke, MA 01040

August 29, 2014

Project Number: 2R759

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1.0 INTRODUCTION

Sovereign Consulting Inc. (Sovereign) prepared this combined Method 3 Risk Characterization (M3RC) and Permanent Solution Statement with Conditions (PSSC) Report on behalf of Motiva Enterprises LLC (Motiva). The report presents information related to environmental assessment and remediation activities for Massachusetts Department of Environmental Protection (MassDEP) Release Tracking Number (RTN) 3-1322 and that disposal site conditions demonstrate the achievement of a condition of "No Significant Risk" (NSR) as defined by the Massachusetts Contingency Plan (MCP).

For the purpose of this PSSC, the "facility" is defined as the area located within the legal property boundaries of 620 Broadway, Somerville, Massachusetts. The "disposal site" for RTN 3-1322 is defined as the facility and other properties where oil and/or hazardous material (OHM) has come to be located because of the release. Refer to **Figure 1** for the regional location of the disposal site and to **Figure 2** for relevant disposal site features.

In accordance with 310 CMR 40.1040, a Permanent Solution shall apply to disposal sites where a level of NSR exists or has been achieved, all sources of OHM have been eliminated or controlled, control of plumes of dissolved OHM in groundwater and vapor-phase OHM in the vadose zone has been achieved, non-aqueous phase liquids (NAPL), if present, has been addressed, all threats of release have been eliminated, and the level of OHM concentrations has been reduced to as close to background levels as feasible. In accordance with 310 CMR 40.1041(2), a Permanent Solution with Conditions shall apply to disposal sites where:

(a) The requirements of 310 CMR 40.1040(1) have been achieved;
(b) OHM concentrations do not exceed an applicable Upper Concentration Limits (UCLs) in soil or groundwater, unless such levels are consistent with Anthropogenic Background or OHM in soil is located at a depth of 15 feet from the ground surface or beneath an Engineered Barrier and an evaluation pursuant to 310 CMR 40.0860 indicates that it is not feasible to reduce the concentrations of OHM material in soil located at a depth greater than 15 feet from the ground surface or in the area beneath the Engineered Barrier to less than or equal to the applicable UCL in soil; and,
(c) A level of NSR exists and will be maintained for all current and foreseeable future use of the disposal site relying on one or more of the following:
    - Assumed limitations on future site activities or uses that require an Activity and Use Limitation (AUL); and,
    - Assumed limitations on current or future site activities, uses or conditions that do not require an AUL pursuant to 310 CMR 40.1013.

A M3RC was conducted in accordance with the MassDEP guidance *Characterizing Risks Posed by Petroleum Contaminated Sites: Implementation of the MassDEP VPH/EPH Approach, Final Policy,* October 2002 Policy #WSC-02-411 (VPH/EPH Approach). Concentrations of OHM have not been reduced to background for RTN 3-1322, and per CMR 40.1013(1)(b), an AUL is not required as the Permanent Solution is based on the concentrations of OHM at the disposal site being consistent with Anthropogenic Background levels. Therefore, this M3RC and PSSC was prepared to characterize the risk of harm to health, safety, public welfare and the environment for both current and future uses of the disposal site.

2.0 SITE DESCRIPTION, SENSITIVE RECEPTORS, REGULATORY STATUS

2.1 Site Description and Surrounding Properties

The facility consists of an approximately 12,000 square foot parcel situated on Broadway, just south of the intersection of Albion and Winchester Streets along the Somerville-Medford city line in Somerville, Massachusetts. The facility property is identified on the City of Somerville Assessor's Map 27, Block L, Lot 2 and is zoned as NB (neighborhood business). Motiva sold the facility in 2002 and it is currently owned and operated by Somerville Citgo. The facility currently operates under the name Somerville Citgo. Gasoline dispensers are located along the northeastern side of the facility, near Broadway, and underground storage tanks (USTs) are located west of the dispensers. Refer to **Figure 1** for the regional location of the facility and to **Figure 2** for the location of pertinent facility features.

This site is bordered by the following:

North: Broadway, followed by the Ball Square Medical Center

Northwest: An undeveloped lot owned by the Massachusetts Bay Transit Authority (MBTA)

Southeast: A lot owned by Despasquale Ltd

West and Southwest: The Boston and Maine Railroad Company (Southern Division)

East: Disabled American Veterans Hall

2.2 General Disposal Site Information

General site information to which this PSSC applies is presented below.

MassDEP Release Tracking Number(s):	RTN 3-1322
Potentially Responsible Party:	Shell Oil Products US 20945 S. Wilmington Avenue Carson, CA 90810 Contact: Ms. Annette Dokken (561) 433-2052
Facility Owner:	Somerville Citgo Inc. 239 Pleasant Street Arlington, MA 02474
Facility location and disposal site:	Former Shell-branded Service Station 620 Broadway Somerville, MA

Other properties comprising portions of disposal site:	Disabled American Veterans 616 Broadway Somerville, MA MBTA Map 27, Block L, Lot 1 Somerville, MA
LSP of Record:	Mr. Philip D. McBain License # 5121 Sovereign Consulting Inc. 16 Chestnut Street, Suite 520 Foxborough, MA 02035 (508) 339-3200
Operator of the Remedial Alternative:	Sovereign Consulting Inc. 16 Chestnut Street, Suite 520 Foxborough, MA 02035 (508) 339-3200
USGS Quadrangle:	Boston North, Massachusetts
Longitude, latitude:	71°06'36" W, 42°23'57"N (approximate)
UTM Coordinates:	326304 E, 4696020 N (approximate)
Zoning of facility:	Neighborhood Business
Zoning of Surrounding Properties:	Neighborhood Business
Facility SIC #:	5541 Gasoline Service Stations
County:	South Middlesex County
Assessor's Information:	Map 27, Block L, Lot 2

2.3 Sensitive Receptors

2.3.1 Drinking Water Receptors

The City of Somerville obtains its potable water from the Massachusetts Water Resource Authority (MWRA). The MWRA obtains its water through a series of surface water intakes on the Quabbin Reservoir, located more than 50 miles west of the facility. According to the Somerville Health Department, no private wells exist within 2,000 feet of the facility. The facility is not located within a potentially productive aquifer, a MassDEP-Approved Wellhead Protection Area (Zone II), or an Interim Wellhead Protection Area.

2.3.2 *School, Residential or Institutional Receptors*

Subsurface structures within 1,000 feet of the facility include many half and full basements and utility conduits located along Broadway, Albion, and Winchester Streets. The closest residence with a basement is located approximately 75 feet east of the facility. The closest school or institution is Brown School, located approximately 1,300 feet southwest of the facility. No other schools or institutions are known to exist within 1,500 feet of the facility.

2.3.3 *Ecological Receptors*

According to data obtained from the Massachusetts Geographic Information Systems (Mass GIS) there are no estimated habitats of rare wildlife, certified vernal pools, priority sites of rare species habitats or exemplary natural communities within 500 feet of the disposal site. An area of Protected Open Space is located approximately 500 feet to the southeast of the site. The closest surface water body is the Mystic River, which is located approximately 4,000 feet east of the facility. No other surface water bodies are located within one mile of the facility. A copy of the MassDEP BWSC Site Scoring Map is included as **Figure 4.**

2.4 Applicable Soil and Groundwater Categories

Applicable soil and groundwater categories for this disposal site include:

- GW-2 and GW-3: Depth to water is less than 15 feet below grade surface (bgs) in the monitoring wells located within 30 feet of the facility building (MW-105 and MW-106). The GW-3 standards apply to all groundwater within the Commonwealth of Massachusetts.

- S-1 and S-3: S-1 soil standards apply to this disposal site as the depth to soil impacts is less than 15 feet bgs and the future use of the disposal site is unrestricted. S-3 soil standards apply to the soils beneath and near the building foundation at a depth of 15 feet or deeper.

2.5 Facility Use History

Book/Page	Grantor	Grantee	Date	Land Use
4380/244	Motiva Enterprises LLC	Galal Ibrahim	10/20/02	Automobile Service Station
Unknown	Shell Oil Company	Motiva Enterprises LLC	6/22/98	Automobile Service Station
Unknown	Atlantic Richfield Company	Shell Oil Company	1985	Automobile Service Station
Unknown	Unknown	Atlantic Richfield Company	1934	Automobile Service Station

Available records indicated that the site has operated as a gasoline station since at least 1934.

2.6 Underground Storage Tank Systems

The following table summarizes the historical USTs of the facility according to records obtained from the MassDEP.

Gallons	Contents	Construction	Date Installed	Date Removed
500	Used Oil	Steel	Unknown	7/70
1,000	Gasoline	Steel	Unknown	7/70
1,000	Gasoline	Steel	Unknown	7/70
1,000	Gasoline	Steel	Unknown	7/70
500	Fuel Oil	Steel	7/70	6/87
4,000	Gasoline	Steel	7/70	6/87
5,000	Gasoline	Steel	7/70	6/87
5,000	Gasoline	Steel	7/70	6/87
1,000	Used Oil	Fiberglass	8/87	4/98
1,000	Fuel Oil	Fiberglass	8/87	1/02
12,000	Gasoline	Fiberglass	8/87	1/02
12,000	Gasoline	Fiberglass	8/87	1/02
12,000	Gasoline	Fiberglass	8/87	1/02
10,000	Gasoline	Fiberglass	1/03	In use
10,000	Gasoline/ Diesel	Fiberglass	1/03	In use

3.0 DETAILED SUMMARY OF COMPLETED RESPONSE ACTIONS

The site was first listed with the MassDEP as a Location to Be Investigated (LTBI) on January 15, 1990 following the discovery of petroleum impacted soil during UST removal activities in June 1987. RTN 3-1322 was assigned to the notification condition. On January 8, 1991 total benzene, toluene, ethylbenzene, and xylenes (BTEX) concentrations ranged from 190 micrograms per liter (µg/l) in the sample collected from GT-4, to 9,200 µg/l in the sample collected from GT-2. Groundwater flow at the site was documented to be in a northeasterly direction. A Preliminary Assessment and Phase I – Limited Site Assessment were completed for RTN 3-1322 in January 1992. During groundwater sampling activities conducted on May 21, 1996, dissolved lead was detected in a groundwater sample collected from MW-7 at a concentration in excess of the applicable Reportable Concentration (RC) GW-2 Standard. The MassDEP subsequently assigned RTN 3-13932 to this 120-day notification condition on June 24, 1996. A Phase I – Limited Site Investigation Report Addendum and Tier Classification were submitted to the MassDEP for RTNs 3-1322 and 3-13932 in August 1996. Groundwater samples collected from the site-related monitoring wells on May 21, 1996 also exhibited BTEX, methyl tertiary-butyl ether (MTBE), total petroleum hydrocarbons (TPH), and dissolved lead at concentrations of up to 109,800 µg/l, 5,900 µg/l, 113,900 µg/l, and 32 µg/l, respectively. The Phase I Report indicated groundwater flow in the site vicinity to be in a northeasterly direction. The Tier Classification submittal indicated Tier II Status for RTNs 3-1322 and 3-13932, effective August 5, 1996.

On April 13, 1998, a 1,000-gallon fiberglass used oil UST was removed from the site. Post excavation analytical results indicated the presence of polycyclic aromatic hydrocarbons (PAHs) in a soil sample at a concentration in excess of the applicable RC Standards. The MassDEP assigned RTN 3-17163 to this 120-day notification condition on August 7, 1998. According to the MassDEP database, RTN 3-17163 was linked to RTN 3-1322 on August 16, 1999. During groundwater gauging and sampling activities conducted on August 6, 1998, 0.16 feet of non-aqueous phase liquid (NAPL) was detected in monitoring well MW-7. The MassDEP subsequently assigned RTN 3-17125 to this 72-hour notification condition on August 6, 1998 and verbally approved passive NAPL recovery activities as an Immediate Response Action (IRA). Approximately 3.5 gallons of NAPL were hand bailed from MW-7 during the period of August 6 through September 4, 1998.

A Phase II – Comprehensive Site Assessment Report was submitted to the MassDEP in September 1998 for RTNs 3-1322 and RTN 3-13932. The Phase II report indicated that additional response actions were necessary to achieve a permanent solution and passive NAPL removal activities will continue as an IRA under RTN 3-17125. In October 1998, an IRA Completion Report was submitted to the MassDEP for RTN 3-17125 and detailed the linking of RTN 3-17125 to RTN 3-1322, effective October 14, 1998. Thus, additional site assessment activities were performed from 1998 through the present under RTN 3-1322 in order to aid in the completion of a Supplemental Site Investigation and Phase III – Remedial Action Plan.

In January 2001, three 2-inch diameter groundwater monitoring wells (MW-11, MW-12, and MW-13) were installed on-site to further delineate petroleum impact to soil and groundwater. During on-site gauging and sampling activities performed on February 14, 2001, approximately 0.90 feet of NAPL was detected in newly installed monitoring well MW-11. The MassDEP was verbally notified of the presence of greater than 0.5 inches NAPL on this date. MassDEP subsequently assigned RTN 3-20394 to this 72-hour release condition and verbally approved passive NAPL bailing activities as an IRA. An IRA Plan was submitted to the MassDEP on April 13, 2001. An IRA Addendum and Status Report outlining the gauging, sampling and bailing activities performed during the period of February through May 2001 was submitted in June 2001. The IRA Addendum also included a work plan to field screen manholes/underground utility conduits in the subject area in order to aid in determining if an imminent hazard, critical exposure pathway, and/or substantial release migration exists. Also, a Tier II Extension linking RTN 3-20394 to RTN 3-1322 was submitted to the MassDEP in June 2001 to allow for the continuation of response activities at the site.

On July 10, 2001, a Release Abatement Measure (RAM) Plan was submitted to the MassDEP in order to appropriately manage excavated soil during the removal of the gasoline dispensers and associated product lines. These activities were delayed pending a real estate transaction involving the site. In December 2001, an IRA Completion Report was submitted to the MassDEP detailing that an imminent hazard, critical exposure pathway, or substantial release migration does not exist at the site. NAPL bailing activities would continue at the site under a RAM. A RAM Plan Addendum was submitted to the MassDEP on January 7, 2002 in order to appropriately manage excavated soil during the removal of the gasoline/heating oil USTs, dispensers, and the oil/water separator (OWS). Approximately 1,220 cubic yards of impacted soil was generated during the course of these site construction activities. On January 15, 18, 22, 24, 28, and February 19, 2002, this petroleum impacted soil (approximately 1,846 tons as

measured by the receiving facility) was transported under Massachusetts Bills of Lading (BOLs) to an off-site disposal facility for recycling. On January 9 and January 18, 2002, dewatering activities were performed in the vicinity of the gasoline UST excavation area.

Approximately 3,700 gallons of petroleum impacted groundwater/NAPL mixture were pumped from the gasoline/heating oil UST excavation. Approximately 5 gallons of recovered fluid was determined to be NAPL. The recovered groundwater/NAPL mixture was subsequently transported to an off-site disposal facility under a Uniform Hazardous Waste Manifest. The RAM Completion Report for this work was submitted on April 4, 2002. A Tier II Extension was submitted on June 14, 2002 to allow for the continuation of response activities at the subject property under RTN 3-1322. On November 4, 2002 a RAM Plan was submitted to the MassDEP detailing the management of petroleum impacted soils encountered during the installation of new USTs. No remediation waste was generated for off-site disposal during the installation of the new USTs. The RAM Completion for the new UST installation activities was submitted to the MassDEP on February 5, 2003. During the site redevelopment activities conducted in the fall/winter of 2002 all on-site monitoring wells were destroyed during re-grading. A new monitoring well network was installed in February 2003. A Tier II Extension was submitted on June 6, 2003 to allow for the continuation of response activities at the site. A RAM Status Report was submitted to the MassDEP on June 20, 2003 detailing manual NAPL recovery activities.

A Phase II Comprehensive Site Assessment (CSA) Addendum and Phase III Remedial Action Plan (RAP) were submitted to the MassDEP on October 30, 2003. The RAP identified monitored natural attenuation (MNA), selective soil excavation, and passive NAPL recovery as the selected remedial alternatives for this site. A RAM Completion Report, detailing the completion of passive NAPL recovery activities, was submitted to the MassDEP on December 23, 2003. As noted in the RAM Completion Report, NAPL has not been detected in any on-site monitoring wells since 2002 and has not been detected in any off-site wells since 2004. In the event that NAPL reappears in site-related monitoring wells, passive recovery efforts would be performed as outlined in the Phase III-RAP submitted in October 2003. A Phase IV Remedy Implementation Plan (RIP) was submitted to the MassDEP in January 2004 and detailed the following activities: site assessment activities performed in November 2003 through January 2004; and, future plan/schedule for groundwater monitoring, soil vapor monitoring, passive NAPL recovery, and selective soil excavation. A Class C RAO Statement was submitted in July 2004 in conjunction with the Phase IV Final Inspection Report/Completion Statement. Temporary solution activities conducted at the site consisted of semi-annual groundwater monitoring during the months of May and November.

4.0 RECENT ASSESSMENT ACTIVITIES

4.1 Groundwater Sampling

On December 6, 2013 and May 15, 2014, groundwater samples were collected from select monitoring wells at the disposal site. During each event, depth to water (DTW) was measured from top of casing and a minimum of three well volumes were purged prior to collecting groundwater samples. Groundwater samples were submitted to Accutest Laboratories of

Marlborough, Massachusetts (Accutest) in accordance with chain of custody procedures for analysis of:

- Volatile Petroleum Hydrocarbons (VPH); and,
- Gasoline oxygenates and ethanol.

An electronic water level meter was used to measure DTW and/or NAPL with an accuracy of ± 0.01 feet. A YSI multi-meter was utilized to measure the following field parameters: conductivity, temperature, oxidation/reduction potential (ORP), dissolved oxygen (DO), and pH in each monitoring well. The results of groundwater sampling and field measurements are summarized in **Tables 1 through 5.**

4.2 Soil Assessment Program

On April 8, 2014, four soil borings (SB-200 through SB-203) were advanced to a maximum depth of 9.5 feet bgs using vacuum excavation to evaluate whether PAHs at the site are contaminants of concern (COCs) or are related to urban fill material. Soil samples were collected at select intervals and field-screened for the presence of total organic vapors (TOVs) using a photoionization detector (PID) and standard headspace screening techniques. Selected soil samples were submitted to Accutest for laboratory analysis of VPH and extractable petroleum hydrocarbons (EPH). Refer to **Tables 6 and 7** for a summary of soil analytical data. Refer to **Figure 3** for soil sample locations. Soil boring logs are included as **Attachment A.**

4.3 Soil Gas Sampling

Due to groundwater concentrations above GW-2 Standards in monitoring well MW-105, soil gas samples were collected on February 4, 2014 in accordance with MassDEP's *December 2011 Interim Final Vapor Intrusion Guidance* (VI Guidance). A soil gas grab sample was collected using a laboratory-certified summa canister from soil gas point SVP-102. The sample was submitted to Accutest for laboratory analysis of air-phase petroleum hydrocarbons (APH). Refer to **Table 11** for a summary of soil gas analytical data.

4.4 Data

Overall, COC concentrations measured in groundwater samples collected from on- and off-site monitoring wells during the December 2013 and May 2014 sampling events are stable or decreasing. Concentrations of C_5-C_8 aliphatic hydrocarbons in monitoring well MW-105 have increased and are currently above the Method 1 Standards; however, these results were still less than C_5-C_8 aliphatic hydrocarbon concentrations previously detected in MW-105 between 2004 and 2007.

Based upon the results from the soil assessment program conducted at the site, VPH concentrations in soil samples collected from borings SB-200 through SB-203 are either below the Method 1 S-1 Standards or below the laboratory reporting limit (BRL). EPH results from borings SB-200 through SB-203 documented PAH concentrations in samples SB-201 (1-4 FT), SB-201 (4-6 FT), SB-203 (1-4 FT) and SB-203 (4-9 FT) above the Method 1 S-1 Standards. The PAH exceedances detected in these samples on the southeastern and southwestern portions of the

site exhibit similar PAH concentrations to those detected in the former OWS area. These results indicate that the PAH concentrations detected at the site are not considered COCs and are related to background fill material. Refer to **Tables 6 and 7** for a summary of soil analytical data and **Figure 3** for soil sample locations.

APH concentrations are below the VI Guidance Residential and Industrial/Commercial Soil Gas Screening Values. Additionally, based upon a review of soil gas data collected between 2003 and 2005 from SVP-101 through SVP-103, TOV results from SVP-101 through SVP-103 were less than 1 parts per million per volume (ppmv) while COC concentrations in monitoring wells MW-105 and MW-106 were greater than current concentrations in these wells. These results indicated that there is an incomplete vapor migration pathway. Refer to **Table 11** for a summary of soil gas analytical data. Refer to **Attachment B** for a summary of historic soil gas data.

5.0 REMEDIATION WASTE

In January and February 2002, approximately 1,220 cubic yards of impacted soil related the removal of the gasoline and fuel oil USTs and the OWS was excavated and transported to Aggregate Industries of Stoughton, Massachusetts (Aggregate) under BOL procedures. Approximately 3,700 gallons of petroleum impacted groundwater and NAPL were removed during dewatering activities in January 2002. Recovered groundwater and NAPL were transported for off-site disposal to International Petroleum Corporation of Wilmington Delaware. In addition, in January 2002, prior to the removal of the OWS, approximately 217 gallons of an oil/water mixture was removed from the OWS and transported for off-site disposal.

During the 2013 drilling event, seven 55-gallon drums of soil were generated for off-site disposal. On April 30, 2013, EQ Northeast (EQNE) of Wrentham, Massachusetts transported the soil drums to Northland Environmental, Inc. of Providence, Rhode Island.

It should be noted that recovered NAPL that was collected at the site was temporarily stored in a drum on-site; however, on February 10, 2003, it was observed that the drum was stolen during redevelopment activities. Approximately nine gallons of recovered NAPL was contained in the drum at the time it was stolen.

6.0 DISPOSAL SITE CHARACTERIZATION

6.1 Limits of the Disposal Site

The disposal site (RTN 3-1322) consists of the former Shell-branded facility at 620 Broadway as well as portions of the MBTA property identified as Map 27, Block L, Lot 1 and the Disabled American Veterans property located at 616 Broadway.

The lateral and vertical boundaries of the disposal site include the following:

Known Extent of OHM Impacts		
Media	**Location**	**Estimated Volume**
Soil	Northern portion of site (current and former gasoline UST area) 45 x 40 x 29 feet Southern portion of site (former OWS and area to the south of on-site building) 60 x 40 x 15 feet	Northern area - approximately 1,925 cubic yards Southern area - approximately 1,333 cubic yards
Groundwater	MW-105 Depth of screened interval - 10-25 feet bgs, 10-foot radius	35,263 gallons
Surface Water	None currently known or expected.	None
Sediment	None currently known or expected.	None
Soil Vapor/Indoor Air	Based on sub-slab soil vapor analytical results, none currently known or expected.	None

Groundwater sampling data are summarized in **Tables 1** through **5**. Soil sampling data are summarized in **Tables 6** through **10.**

7.0 CONTAMINANTS OF CONCERN

All chemicals detected at a site are considered COCs, unless there is a specific, justifiable, rationale for eliminating the contaminant as a COC. Contaminants may be eliminated from the list of study compounds if they are: 1) detected at concentrations at or below background concentrations identified by the MassDEP or by site-specific data; 2) laboratory contaminants; or 3) detected infrequently at low concentrations with respect to the detection limit. COCs observed in soil and groundwater have been summarized in **Sections 7.2** and **7.3**, respectively.

7.1 COC Elimination Rationale

7.1.1 Definition of Background

As defined in the MCP, 310 CMR 40.0006, background concentrations are defined as those levels of oil and/or hazardous material that would exist in the absence of the disposal site of concern, including both Natural Background and Anthropogenic Background. Anthropogenic Background concentrations are defined as those levels of OHM that would exist in the absence of the disposal site of concern and which are attributable to atmospheric deposition of industrial process or engine emissions, ubiquitous and consistently present in the environment at and in the vicinity of the disposal site of concern, attributable to Historic Fill, associated with sources specifically exempt from the definitions of disposal site or release as those terms are defined in MGL c. 21E and 310 CMR 40.0006, releases to groundwater from a public water supply system, or petroleum residues that are incidental to the normal operation of motor vehicles.

Based upon elevated PAH concentrations detected in the former OWS area, additional soil sampling was conducted in April 2014 to determine whether the PAH compounds detected in the former OWS area are COCs or if the PAH compounds are related to background urban fill. Soil samples were collected from soil borings SB-200 through SB-203 at selected depths at the site for laboratory analysis. EPH results from borings SB-200 through SB-203 documented PAH concentrations in samples SB-201 (1-4 FT), SB-201 (4-6 FT), SB-203 (1-4 FT) and SB-203 (4-9 FT) above the Method 1 S-1 Standards. The PAH exceedances detected in these samples on the southeastern and southwestern portions of the site exhibit similar PAH concentrations to those detected in the former OWS area. These results indicate that the PAH concentrations detected at the site are not considered COCs and are related to background fill material. Additionally, previous investigations conducted at the site have documented PAH concentrations in soil samples B-3, B-4, B-6, HO-BOT, UST-SSW, MW-11-OEXC-SWSW, OWS-WSW, OWS-NSW, Test Pit #1, OWS-SSW, CF-1, SB-102, SB-103, SB-112, SB-200, SB-201, SB-202 and SB-203 at depths ranging from zero to 14 feet bgs.

Furthermore, Sovereign has determined that this soil meets the definition of Historic Fill. Historic Fill means Fill Material that based on the weight of evidence and consistent with the Conceptual Site Model:

(a) Was emplaced before January 1, 1983;
(b) May contain, but is not primarily composed of, construction and demolition debris, reworked soils, dredge spoils, coal ash, wood ash or other solid waste material;
(c) Was contaminated with metals, hydrocarbons, and/or polycyclic aromatic hydrocarbons prior to emplacement, at concentrations consistent with the pervasive use and release of such materials prior to 1983;
(d) Does not contain oil or hazardous materials originating from operations or activities at the location of emplacement;
(e) Is not and does not contain a generated hazardous waste, other than Oil or Waste Oil
(f) Does not contain chemical production waste, manufacturing waste, or waste from processing of metal or mineral ores, residues, slag or tailings; and,
(g) Does not contain waste material disposed in a municipal solid waste dump, burning dump, landfill, waste lagoon or other waste disposal location.

The facility originated as early as 1934. During historic subsurface investigations to date fill debris has been identified within disposal site soil. In order to confirm the detection of PAHs in soil was related to Historic Fill and not related to RTN 3-1322, confirmation soil samples (SB-200 through SB-203) were installed on the periphery of the disposal site in locations that were not near potential sources, nor near known impacted soil. These data confirmed that PAHs are attributable to Historic Fill, and not due to releases associated with RTN 3-1322. The following compounds, which are characteristic of Historic Fill, have been eliminated as COCs for the purpose of risk characterization related to RTN 3-1322:

- **PAH compounds:**
  - acenaphthene
  - acenaphthylene
  - anthracene
  - benzo(a)anthracene
  - benzo(a)pyrene
  - benzo(b)fluoranthene
  - benzo(g,h,i)perylene
  - benzo(k)fluoranthene
  - chrysene
  - dibenzo(a,h)anthracene
  - fluoranthene
  - fluorene
  - indeno(1,2,3-cd)pyrene
  - 2-Methylnaphthalene
  - naphthalene
  - phenanthrene
  - pyrene

- **Metals:**
  - arsenic
  - cadmium
  - lead
  - mercury
  - selenium
  - silver

The above compounds are not considered COCs related to RTN 3-1322. Per 310 CMR 40.1056(2)(j)(2), a map which depicts the location of PAH detections related to Historic Fill is provided as **Figure 7**.

7.2 COCs in Soil

The compounds detected within soil at the disposal site include the following:

VPH Fraction C_5-C_8 Aliphatics	**VPH Fraction C_9-C_{12} Aliphatics**
VPH Fraction C_9-C_{10} Aromatics	Benzene
Toluene	Ethylbenzene
Xylenes	MTBE
Naphthalene	Chromium
Barium	EPH Fraction C_9-C_{18} Aliphatics
EPH Fraction C_{19}-C_{36} Aliphatics	**EPH Fraction C_{11}-C_{22} Aromatics**

The compounds that are bold and underlined have been detected above the applicable Method 1 S-1 Standards. Soil analytical data is summarized in **Tables 6** through **10**. **Figure 3** provide site plans depicting sampling locations.

7.3 COCs in Groundwater

The compounds detected within groundwater at the disposal site include the following:

VPH Fraction C_5-C_8 Aliphatics	**VPH Fraction C_9-C_{12} Aliphatics**
VPH Fraction C_9-C_{10} Aromatics	Benzene
Toluene	Ethylbenzene
Xylenes	MTBE
Naphthalene	EPH Fraction C_9-C_{18} Aliphatics
EPH Fraction C_{11}-C_{22} Aromatics	

The compounds that are bold and underlined have been detected above the applicable Method 1 GW-2 and/or GW-3 Standard. Groundwater analytical data is summarized in **Tables 3 through 5**. **Figure 2** provide site plans depicting sampling locations.

7.4 Surface Water

The closest surface water body is the Mystic River, which is located approximately 4,000 feet east of the facility. No other surface water bodies are located within one mile of the facility. A copy of the MassDEP BWSC Site Scoring Map is included as **Figure 4.**

7.5 Sediment

Since COCs have not migrated to surface water, impacts to sediment are not anticipated at this disposal site.

7.6 Indoor Air

Due to groundwater concentrations above GW-2 Standards in monitoring well MW-105, soil gas samples were collected on February 4, 2014 in accordance with MassDEP's *December 2011 Interim Final Vapor Intrusion Guidance* (VI Guidance). A soil gas grab sample was collected using a laboratory-certified summa canister from soil gas point SVP-102. The sample was submitted to Accutest for laboratory analysis of APH. Refer to **Table 11** for a summary of soil gas analytical data.

APH concentrations are below the VI Guidance Residential and Industrial/Commercial Soil Gas Screening Values. Additionally, based upon a review of soil gas data (**Attachment B**) collected from SVP-101 through SVP-103 between 2003 and 2005, TOV results from SVP-101 through SVP-103 ranged from less than 0.1 ppmv to 0.8 ppmv, while COC concentrations in monitoring wells MW-105 and MW-106 (**Tables 3 and 4**) were greater than current concentrations in these wells. These results indicate that there is an incomplete vapor migration pathway.

8.0 SITE CONCEPTUAL MODEL

8.1 Geologic Setting

Materials encountered during previous and recent subsurface investigations generally consist of fine to coarse sand and gravel (fill material). Concrete and brick were also observed during investigation and excavation activities. Layers of silt were observed at depths ranging from 15 to 22 feet, 10 to 17 feet, and 32 to 34 feet bgs. Silt and clay layers were observed at depths ranging from 6 to 12 feet, 21 to 23 feet, and 32 to 34 feet bgs.

Based upon previous investigations at the site, bedrock was encountered at approximately 38 feet bgs in MW-21D, MW-103D and MW-107D. Bedrock outcrops were not observed near the site. Based on review of the Bedrock Geologic Map of Massachusetts (E-an Zen, 1983), bedrock underneath the disposal site consists of Cambridge Argillite. This bedrock, of Proterozoic to early Paleozoic age, includes gray argillite with rare sandstones and quartzites.

8.2 Hydrogeology

Depth to water measurements have been collected during groundwater monitoring events between 1987 and 2014. Based on current and historic gauging data, the depth to groundwater at the disposal site ranges from eight to 19 feet bgs. Refer to **Figures 5 and 6** for groundwater contour maps from data collected on December 6, 2013 and May 15, 2014, respectively. Data from the December 2013 event indicates groundwater flows in a north-northeasterly direction at an average horizontal gradient of 0.031 feet per foot. Data from the May 2014 event indicates groundwater flows to the north, west and southwest direction at an average horizontal gradient of 0.056 feet per foot.

Hydrogeological testing conducted as part of assessment activities in August 2002 at the disposal site indicates a site-specific potential groundwater flow velocity of approximately 71 feet per year.

8.3 Known and/or Likely Sources of Impact and Release Mass

The source of the soil and groundwater impacts is most likely due to the facility's historical use as a retail gasoline and automotive repair facility.

8.4 Release Timeframe

The site was first listed with the MassDEP as an LTBI under RTN 3-1322 on January 15, 1990 following the discovery of petroleum impacted soil during UST removal activities in June 1987. During groundwater sampling activities conducted on May 21, 1996, another reportable condition was discovered when dissolved lead was detected in a groundwater sample collected from MW-7 at a concentration in excess of the applicable RC GW-2 Standard and the MassDEP subsequently assigned RTN 3-13932 to this release.

On April 13, 1998, a 1,000-gallon fiberglass used oil UST was removed from the site. Post excavation analytical results from a used oil UST removal in April 1998 documented PAH concentrations above the applicable RC Standards. The MassDEP assigned RTN 3-17163 to this

this release. During groundwater gauging and sampling activities conducted on August 6, 1998, 0.16 feet of NAPL was detected in monitoring well MW-7 and MassDEP subsequently assigned RTN 3-17125 to this release. In addition, on February 14, 2001, approximately 0.90 feet of NAPL was detected in newly installed monitoring well MW-11 and . The MassDEP assigned RTN 3-20394 to this release. The timeframe for which these release have occurred at the disposal site has not been determined; however, all of these releases were likely associated with the historic use of the facility as a retail gasoline station and automotive repair facility.

8.5 Extent of Impacted Media

Vertical and horizontal extents of COC soil impacts have been defined through subsurface investigations conducted at the disposal site and are limited to the former OWS area, the area to the south of the on-site building and the current and former gasoline UST area at depths ranging from zero to 29 feet bgs. Based on groundwater analytical data, COC concentrations above the Method 1 GW-2 Standards are limited to monitoring well MW-105.

8.6 Release Fate and Transport

Migration pathways for this release include the following:

- *Vertical migration of COCs from soil in the vadose zone.* Pathway for COCs in soil to migrate to the water table ranging from 8 to 19 feet bgs. COCs in groundwater above the Method 1 GW-2 Standards are limited to monitoring well MW-105.
- *Vertical migration of COCs deeper into the aquifer.* Pathway is not likely based upon chemical properties of COCs and by the analytical results from groundwater sampling and analysis of monitoring wells MW-103D and MW107D.
- *Lateral migration of COCs at the water table.* Pathway is not likely. Groundwater flow direction has historically varied at the site. COCs in groundwater in all on- and off-site wells with the exception of monitoring well MW-105 are below the Method 1 GW-2 and/or GW-3 Standards.
- *Potential vapor impacts due to volatilization of petroleum in soil and groundwater into existing occupied structures.* It has been determined that vapor migration is an incomplete pathway based upon current soil gas data collected in February 2014 that is below the VI Guidance Residential and Industrial/Commercial Soil Gas Screening Values and historic TOV results collected between 2003 and 2005 when groundwater concentrations in monitoring wells MW-105 and MW-106 were greater than current concentrations concentrations in these wells.

Degradation considerations for this release include the following:

- The source of COCs in soil and groundwater is associated with the use of the facility as a retail gasoline station and automotive repair facility. The majority of gasoline-related COCs do not degrade into daughter COCs, but rather carbon dioxide and water. MTBE can degrade into tertiary butyl alcohol (TBA) under anaerobic subsurface conditions. MTBE has previously been detected at the disposal site. Groundwater is sampled for the presence of TBA and other gasoline oxygenates on an annual basis. TBA has been detected at low concentrations at the site.

O'DONOVAN LAW OFFICE

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September 24, 2014

City of Somerville
Office of the Planning Staff
93 Highland Avenue
Somerville, MA 02143

ATTN: Melissa Woods

RE: *620 Broadway*
Somerville, MA

Dear Melissa:

Enclosed please find the Environmental Report from Sovereign and the office seller's attorney Robert G. Cohen, Esq. Please contact if you have any questions or concerns.

Thank you.

Very truly yours,

Sean T. O'Donovan, Esq.

O'DONOVAN LAW OFFICE

STO/tmc
Encl.

ROBERT GERALD COHEN

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Paula Mackenzi
Paralegal/Administrative Assistant
Cell: (774) 249-3235

September 4, 2014

Sean T. O'Donovan, Esq.
741 Broadway
Somerville, MA 02143

RE: *620 Broadway*
Somerville, MA

Dear Counsel:

Enclosed please find Sovereign's "PERMANENT SOLUTION STATEMENT WITH CONDITIONS" dated August 29, 2014.

According to Ms. Hagie, the project manager, this is the document we are looking for at this stage of this transaction. Please feel free to speak directly with Ms. Hajie and/or Mr. McBain.

If you have any questions, please do not hesitate to call me.

Thank you.

Very truly yours,

Robert G. Cohen

RGC/pjm
Enc.

SOVEREIGN CONSULTING INC.

August 29, 2014

Mr. Galal F. Ibrahim
c/o Robert G. Cohen, Esq.
188 Oaks Road
Framingham, Massachusetts 01702

Re: **Informational Notice to Property Owner**
Former Shell-branded Station No. 137847
620 Broadway
Somerville, Massachusetts 02145
RTN 3-1322

Dear Mr. Ibrahim:

In accordance with 310 CMR 40.1406(3), this letter is to notify you that a portion of your property is included within the disposal site boundary for which a *Permanent Solution Statement with Conditions* (PSSC) has been submitted to the Massachusetts Department of Protection (MassDEP). The report documents the response activities associated with RTN 3-1322. This report concludes that a Condition of "No Significant Risk" to human health, safety, public welfare and the environment has been achieved for this site for current and future site use scenarios.

On behalf of Motiva Enterprises LLC (Motiva), Sovereign Consulting Inc. (Sovereign) has submitted MassDEP Form BWSC 122 *Informational Notice to Property Owners* (Notice) with regard to the above-referenced location. This Notice complies with public notification requirements for properties within the boundaries of a "disposal site." This Notice is being provided pursuant to 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP). Note that background information for the Notice requirements is summarized on the second page of the Notice.

Based upon the results of the M3RC and previous investigations, the requirements for a PSSC related to RTN 3-1322 have been achieved as outlined below:

1. The sources of the releases at the disposal site were adequately defined and appear to be related to the historic use of the facility as a retail gasoline station and automotive repair facility. The release was detected in 1987 during UST removal activities and the site was listed with the MassDEP as a LTBI on January 15, 1990.

2. According to data obtained from the Mass GIS there are no estimated habitats of rare wildlife, certified vernal pools, priority sites of rare species habitats or exemplary natural communities within 500 feet of the disposal site. An area of Protected Open Space is

located approximately 500 feet to the southeast of the site. The closest surface water body is the Mystic River, which is located approximately 4,000 feet east of the facility. No other surface water bodies are located within one mile of the facility. The City of Somerville obtains its potable water from the MWRA. The MWRA obtains its water through a series of surface water intakes on the Quabbin and Wachusett Reservoir, located more than 50 miles west of the facility. According to the Somerville Health Department, no private wells exist within 2,000 feet of the facility. The facility is not located within a potentially productive aquifer, a MassDEP-Approved Wellhead Protection Area (Zone II), or an Interim Wellhead Protection Area.

3. Subsurface structures within 1,000 feet of the facility include many half and full basements and utility conduits located along Broadway, Albion, and Winchester Streets. The closest residence with a basement is located approximately 75 feet east of the facility. The closest school or institution is Brown School, located approximately 1,300 feet southwest of the facility. No other schools or institutions are known to exist within 1,500 feet of the facility.

4. Groundwater beneath the disposal site is impacted with COCs (petroleum constituents) above Method 1 GW-2 Standards and is limited to monitoring well MW-105. The groundwater flow direction at the site has historically varied. Data from the December 2013 event indicates groundwater flows in a north-northeasterly direction. Data from the May 2014 event indicates groundwater flows to the north, west and southwest direction. The extent of impacted groundwater was adequately defined.

5. Vertical and horizontal extents of COC soil impacts have been defined through subsurface investigations conducted at the disposal site and are limited to the former OWS area, the area to the south of the on-site building and the current and former gasoline UST area at depths ranging from zero to 29 feet bgs. Impacted soil is located beneath paved surface. Since the future use of the disposal site is unrestricted, residential use was considered in the risk assessment.

6. APH concentrations detected in SVP-102 are below the VI Guidance Residential and Industrial/Commercial Soil Gas Screening Values. Additionally, based upon a review of soil gas data collected from SVP-101 through SVP-103 between 2003 and 2005, TOV results from SVP-101 through SVP-103 were less than 1 ppmv while COC concentrations in monitoring wells MW-105 and MW-106 were greater than current concentrations in these wells. These results indicated that there is an incomplete vapor migration pathway.

7. COC concentrations in soil and groundwater are below applicable UCLs.

8. Based on data collected at the site, SRM, CEP, and IH conditions do not exist at the disposal site. Response actions conducted at the site have eliminated all threats of release and no release of OHM to the environment has occurred.

9. The M3RC concludes that a Condition of "No Significant Risk" to human health, safety, public welfare and the environment exists for current and all future site use scenarios.

10. A permanent solution has been achieved, concentrations of COCs are approaching background, and an AUL is not required to maintain a level of "No Significant Risk."

If you have any questions please call the undersigned at (413) 540-0650.

Sincerely,
SOVEREIGN CONSULTING INC.

Tamara Hagie
Project Manager

Attachments: Disposal Site Map
BWSC-122 Transmittal Form

cc: Annette Dokken, Motiva Enterprises LLC (attached within report)
Sovereign File - 2R759

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC122

This notice is related to:
Release Tracking Number
3 - 1322

INFORMATIONAL NOTICE TO PROPERTY OWNERS

As Required by 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP)

A. DISPOSAL SITE ADDRESS: (associated with Release Tracking Number provided above)

1. Street Address: 620 Broadway
2. City/Town: Somerville 3. ZIP Code: 02145-0000
4. Assessor's Parcel ID: Map 27, Block L, Lot 2

B. THIS NOTICE IS BEING PROVIDED TO THE FOLLOWING PROPERTY OWNER:

1. Name of Property Owner: Galil Ibrahim, Somerville Citgo Inc.
2. Address of Property For Which This Notice is Being Provided: (property owned by person named in B1)
   a. Street Address: 620 Broadway
   b. City/Town: Somerville c. ZIP Code: 02145-0000
3. Assessor's Parcel ID: Map 27, Block L, Lot 2

C. THIS NOTICE IS BEING GIVEN : (check one)

- [ ] 1. Upon Completion of a Phase II Comprehensive Site Assessment.
- [x] 2. Upon Submittal of a Permanent or Temporary Solution Statement (i.e., Site Closure Report).
- [ ] 3. Upon Completion of Additional Investigation showing that Oil or Hazardous Material is not Present at the Property.

D. DESCRIPTION OF OIL AND/OR HAZARDOUS MATERIAL PRESENT OR LIKELY TO BE PRESENT AT THE PROPERTY : (check all that apply)

AFFECTED ENVIRONMENTAL MEDIA	PRINCIPAL CHEMICAL(S) PRESENT
[x] 1. Soil	petroleum compounds
[x] 2. Groundwater	petroleum compounds
[ ] 3. Surface Water	
[ ] 4. Sediment	
[ ] 5. Indoor Air	
[ ] 6. Soil Gas	
[ ] 7. Other: (specify)	

E. ATTACHMENTS PROVIDED WITH THIS NOTICE, AS REQUIRED BY 310 CMR 40.1406:

- [x] 1. A Copy of the Map Showing or a Description Describing the Area where the Oil and/or Hazardous Material is or is likely to be Present.
- [x] 2. A Copy of the Phase II Comprehensive Site Assessment or Permanent or Temporary Solution Statement Conclusions.
- [x] 3. Specify the category of Solution that applies to the Disposal Site.
  - [ ] 1. Permanent Solution with No Conditions.
  - [x] 2. Permanent Solution with Conditions.
    - [ ] i. An Activity and Use Limitation has been implemented.
    - [x] ii. An Activity and Use Limitation has not been implemented.
  - [ ] 3. Temporary Solution.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC122

This notice is related to:
Release Tracking Number

3 - 1322

INFORMATIONAL NOTICE TO PROPERTY OWNERS

As Required by 310 CMR 40.1406 of the Massachusetts Contingency Plan (MCP)

F. CONTACT INFORMATION RELATING TO THE PARTY PROVIDING THIS NOTICE:

1. Name of Organization: Sovereign Consulting Inc.
2. Contact First Name: Tammie
3. Last Name: Hagie
4. Street: 4 Open Square Way
5. Title: Project Manager
6. City/Town: Holyoke
7. State: MA
8. ZIP Code: 01040-0000
9. Telephone: (413) 540-0650
10. Email: thagie@sovcon.com

MASSACHUSETTS REGULATIONS THAT REQUIRE THIS NOTICE

This notice is being provided pursuant to the Massachusetts Contingency Plan and the notification requirement at 310 CMR 40.1406. The Massachusetts Contingency Plan is a state regulation that specifies requirements for parties who are taking actions to address releases of chemicals (oil or hazardous material) to the environment.

THE PERSON(S) PROVIDING THIS NOTICE

This notice has been sent to you by the party(ies) who is/are addressing a release of oil or hazardous material to the environment at the location listed in **Section A** on the reverse side of this form.

PURPOSE OF THIS NOTICE

Parties who are taking actions to respond to releases of oil or hazardous material to the environment are required by state regulations (referred to above) to notify the owners of property where the oil or hazardous material is or is likely to be present. These same parties are also required to notify property owners upon completion of actions to address the oil or hazardous material, or if additional investigations show that the oil or hazardous material is not present at a property. **Section C** on the reverse side of this form indicates the circumstance under which you are receiving this notice at this time.

INFORMATION RELATED TO YOUR PROPERTY

Section D on the reverse side of this form indicates the type(s) of oil or hazardous material that is or is likely to be present at your property, and the environmental medium (e.g., soil or groundwater) where it is or is likely to be present. **Please note** that when an investigation indicates that the oil or hazardous material is or is likely to be present at your property, this does not mean that the oil or hazardous material is posing a health risk to you. Parties who are taking actions to address oil and hazardous material releases are required by state regulations to adequately investigate these releases and take necessary actions to ensure that affected properties meet standards that are protective of human health and the environment.

ATTACHED MAP OR DESCRIPTION AND REPORT CONCLUSIONS

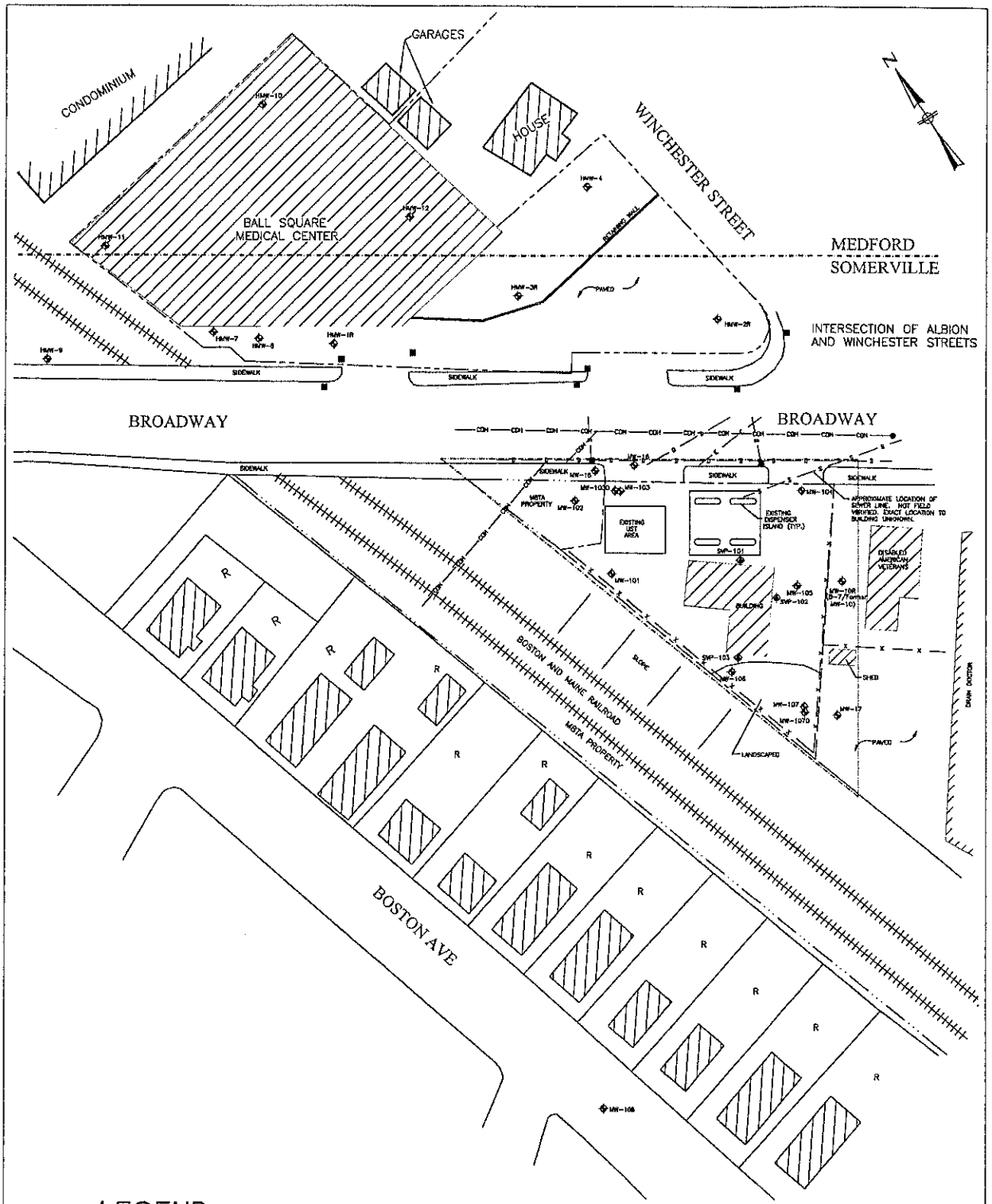
The party providing this notice to you is required to attach a map or description that indicates the boundaries of the area where the oil or hazardous material is or is likely to be present, and the conclusions of the site investigation or closure report **(Section E).** These attachments should give you additional information about the nature and location of the oil or hazardous material with respect to your property.

FOR MORE INFORMATION

Information about the general process for addressing releases of oil or hazardous material under the Massachusetts Contingency Plan and related public involvement opportunities may be found at http://www.mass.gov/eea/agencies/massdep/cleanup.

For more information regarding this notice, you may contact the party listed in **Section F** of this form. Information about the disposal site identified in **Section A** is also available in files at the Massachusetts Department of Environmental Protection.

See http://public.dep.state.ma.us/SearchableSites2/Search.aspx to view site-specific files on-line or http://mass.gov/eea/agencies/massdep/about/contacts/conduct-a-file-review.html if you would like to make an appointment to see these files in person. Please reference the **Release Tracking Number** listed in the upper right hand corner on the reverse side of this form when making file review appointments.



LEGEND

- MONITORING WELL
- SOIL VAPOR POINT
- PROPERTY BOUNDARY
- DISPOSAL SITE BOUNDARY
- FENCE LINE
- MBTA PROPERTY
- CATCH BASIN
- MANHOLE
- DRAIN LINE
- ELECTRIC LINE
- COMMUNICATION LINE
- SEWER LINE
- R RESIDENTIAL PROPERTY
- SOIL BORING (RAW)
- SOIL BORING (2013/14)
- DESTROYED MW/SVP
- SOIL SAMPLE
- EXCAVATION AREA
- FORMER SITE FEATURE

50 0 50 100

APPROXIMATE SCALE

FIGURE 2

SITE AREA MAP

FORMER SHELL-BRANDED SERVICE STATION
LOCATED AT
620 BROADWAY
SOMERVILLE, MA
PREPARED FOR
MOTIVA ENTERPRISES LLC

SOVEREIGN CONSULTING INC.
4 OPEN SQUARE WAY, SUITE 307
HOLYOKE, MA 01040
TEL:(413) 540-0650 FAX:(413) 540-0656

PREPARED	UPDATED	UPDATED	UPDATED	UPDATED
08/01/2001	05/20/2013			
BY: GSC/KLEIN	BY: PJV	BY:	BY:	BY:

SOVEREIGN CONSULTING INC.

August 29, 2014
Via eDEP Electronic Submittal

Commonwealth of Massachusetts
Department of Environmental Protection
Northeast Regional Office (NERO)
205B Lowell Street
Wilmington, Massachusetts 01887

Re: METHOD 3 RISK CHARACTERIZATION AND PERMANENT SOLUTION STATEMENT WITH CONDITIONS

Former Shell-Branded Service Station No. 137847
620 Broadway
Somerville, Massachusetts
Release Tracking Number (RTN) 3-1322

To Whom It May Concern:

On behalf of Motiva Enterprises LLC (Motiva), Sovereign Consulting Inc. (Sovereign) is submitting the attached Method 3 Risk Characterization (M3RC) and Permanent Solution Statement with Conditions (PSSC) for the above-referenced disposal site. The M3RC and PSSC were prepared in accordance with the Massachusetts Contingency Plan (MCP) and summarize response actions conducted at the disposal site and the achievement of a condition of No Significant Risk for RTN 3-1322.

If you have any questions regarding this submittal, please feel free to contact the undersigned.

Sincerely,
SOVEREIGN CONSULTING INC.

Tamara Hagie
Project Manager

Philip D. McBain, LSP
Senior Project Manager

Attachments: M3RC and PSSC
Transmittal Form BWSC-104

cc: *With Attachments:*
Ms. Annette Dokken - Motiva
Mr. Galal F. Ibrahim - property owner
Mr. Paul Passman - Dialysis Clinic Inc.
Mr. James Herra - Disabled American Veterans Chapter 27
MBTA c/o Transit Realty Associates.
MassDOR - 21J
Sovereign File - 2R759

Massachusetts Department of Environmental Protection

eDEP Transaction Copy

Here is the file you requested for your records.

To retain a copy of this file you must save and/or print.

Username:	**THAGIE**
Transaction ID:	**677367**
Document:	**BWSC104 Permanent And Temporary Solution Statement**
Size of File:	**217.77K**
Status of Transaction:	**In Process**
Date and Time Created:	**8/25/2014:1:24:25 PM**

Note: This file only includes forms that were part of your transaction as of the date and time indicated above. If you need a more current copy of your transaction, return to eDEP and select to "Download a Copy" from the Current Submittals page.

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC 104

PERMANENT AND TEMPORARY SOLUTION STATEMENT
Pursuant to 310 CMR 40.1000 (Subpart J)

Release Tracking Number
3 - 1322

For sites with multiple RTNs, enter the Primary RTN above.

A. SITE LOCATION:

1. Site Name/Location Aid: SHELL STATION

2. Street Address: 620 BROADWAY

3. City/Town: SOMERVILLE 4. ZIP Code: 021430000

5. Coordinates: a. Latitude: N 42.39916 b. Longitude: W 71.11000

☑ 6. Check here if the disposal site that is the source of the release is Tier Classified. Check the current Tier Classification Category:

☐ a. Tier I ☐ b. Tier ID ☑ c. Tier II

B. THIS FORM IS BEING USED TO: (check all that apply)

1. List Submittal Date of the Permanent or Temporary Solution Statement, or RAO Statement (if previously submitted): _____ mm/dd/yyyy

☑ 2. Submit a **Permanent or Temporary Solution Statement**

☐ a. Check here if this Permanent or Temporary Solution Statement covers additional Release Tracking Numbers (RTNs). RTNs that have been previously linked to a Tier Classified Primary RTN do not need to be listed here.

b. Provide the additional Release Tracking Number(s) covered by this Permanent or Temporary Solution Statement. ☐ - ☐ ☐ - ☐

☐ 3. Submit a **Revised Permanent or Temporary Solution Statement** (or revised RAO Statement)

☐ a. Check here if this Revised Permanent or Temporary Solution Statement covers additional Release Tracking Numbers (RTNs), not listed on the Permanent or Temporary Solution Statement or previously submitted Revised Permanent or Temporary Solution Statements. RTNs that have been previously linked to a Tier Classified Primary RTN do not need to be listed here.

b. Provide the additional Release Tracking Number(s) covered by this Permanent or Temporary Solution Statement. ☐ - ☐ ☐ - ☐

☐ 4. Submit a **Permanent or Temporary Solution Partial Statement**

Check above box, if any Response Actions remain to be taken to address conditions associated with this disposal site having the Primary RTN listed in the header section of this transmittal form. This Permanent or Temporary Solution Statement will record only a Permanent or Temporary Solution-Partial Statement for that RTN. A final Permanent or Temporary Solution Statement will need to be submitted that references all Permanent or Temporary Solution-Partial Statements and, if applicable, covers any remaining conditions not covered by the Permanent or Temporary Solution-Partial Statements.

Also, specify if you are an Eligible Person or Tenant pursuant to M.G.L. c. 21 s.2, and have no further obligation to conduct response actions on the remaining portion(s) of the disposal site:

☐ a. Eligible Person ☐ b. Eligible Tenant

☐ 5. Submit a **Revised Permanent or Temporary Solution Partial Statement** (or revised RAO-Partial Statement)

☐ 6. Submit an optional **Phase I Completion Statement** supporting the Permanent or Temporary Solution Statement

☐ 7. Submit a **Periodic Review Opinion evaluating the status of a Temporary Solution,** as specified in 310 CMR 40.1051 (Section F is optional)

☐ 8. Submit a **Retraction** of a previously submitted **Permanent or Temporary Solution Statement** (or RAO Statement) (Sections E & F are not required)

(All sections of this transmittal form must be filled out unless otherwise noted above)

C. DESCRIPTION OF RESPONSE ACTIONS: (check all that apply; for volumes, list cumulative amounts)

- ☑ 1. Assessment and/or Monitoring Only
- ☐ 2. Temporary Covers or Caps
- ☐ 3. Deployment of Absorbent or Containment Materials
- ☐ 4. Treatment of Water Supplies
- ☐ 5. Structure Venting System/HVAC Modification System
- ☐ 6. Engineered Barrier
- ☑ 7. Product or NAPL Recovery
- ☐ 8. Fencing and Sign Posting
- ☐ 9. Groundwater Treatment Systems
- ☐ 10. Soil Vapor Extraction
- ☐ 11. Remedial Additives
- ☐ 12. Air Sparging
- ☐ 13. Active Exposure Pathway Mitigation System
- ☐ 14. Passive Exposure Pathway Mitigation System
- ☑ 15. Monitored Natural Attenuation
- ☐ 16. In-Situ Chemical Oxidation
- ☑ 17. Removal of Contaminated Soils
- ☑ a. Re-use, Recycling or Treatment ☐ i. On Site Estimated volume in cubic yards _____
  ☑ ii. Off Site Estimated volume in cubic yards 1220

iia. Facility Name: AGGREGATE INDUSTRIES Town: STOUGHTON State: MA

iib. Facility Name: _____ Town: _____ State: _____

iii. Describe: _____

- ☐ b. Landfill
  - ☐ i. Cover Estimated volume in cubic yards _____
    Facility Name: _____ Town: _____ State: _____
  - ☐ ii. Disposal Estimated volume in cubic yards _____
    Facility Name: _____ Town: _____ State: _____
- ☐ 18. Removal of Drums, Tanks or Containers:
  - a. Describe Quantity and Amount: _____
  - b. Facility Name: _____ Town: _____ State: _____
  - c. Facility Name: _____ Town: _____ State: _____
- ☐ 19. Removal of Other Contaminated Media:
  - a. Specify Type and Volume: _____
  - b. Facility Name: _____ Town: _____ State: _____
  - c. Facility Name: _____ Town: _____ State: _____

C. DESCRIPTION OF RESPONSE ACTIONS (cont.): (check all that apply; for volumes, list cumulative amounts)

☐ 20. Other Response Actions:

Describe:

☐ 21. Use of Innovative Technologies:

Describe:

D. SITE USE:

1. Are the response actions that are the subject of this submittal associated with the *redevelopment, reuse* or the *major expansion of the current use* of property(ies) impacted by the presence of oil and/or hazardous materials?

☐ a. Yes ☑ b. No ☐ c. Don't know

2. Is the property a *vacant or under-utilized commercial or industrial* property ("a brownfield property")?

☐ a. Yes ☑ b. No ☐ c. Don't know

3. Will funds from a state or federal brownfield incentive program be used on one or more of the property(ies) within the disposal site?

☐ a. Yes ☑ b. No ☐ c. Don't know If Yes, identify program(s):

4. Has a Covenant Not to Sue been obtained or sought?

☐ a. Yes ☑ b. No ☐ c. Don't know

5. Check all applicable categories that apply to the person making this submittal:

☐ a. Redevelopment Agency or Authority
☐ b. Community Development Corporation
☐ c. Economic Development and Industrial Corporation
☐ d. Private Developer
☐ e. Fiduciary
☐ f. Secured Lender
☐ g. Municipality
☐ h. Potential Buyer (non-owner)
☑ i. Other, describe: PRP

This data will be used by MassDEP for information purposes only, and does not represent or create any legal commitment, obligation or liability on the part of the party or person providing this data to MassDEP.

E. PERMANENT OR TEMPORARY SOLUTION CATEGORY:

Specify the category of Solution that applies to the Disposal Site, or Site of the Threat of Release. Select either **1, 2, or 3.**

☐ **1. Permanent Solution with No Conditions** (check one)

☐ a. A threat of release has been eliminated.

☐ b. All contamination has been reduced to Natural Background levels.

☐ c. A condition of No Significant Risk exists or has been achieved with no Activity and Use Limitation or other limitations, assumptions, or conditions (310 CMR 40.1013).

E. PERMANENT OR TEMPORARY SOLUTION CATEGORY (cont.):

☑ **2. Permanent Solution with Conditions** (check a and/or b):

☐ a. **An AUL has been implemented** pursuant to 310 CMR 1012(2) (check one)

☐ i. Required pursuant to 310 40.1012(2)

☐ ii. Optionally implemented pursuant to 310 40.1012(3)

☑ b. **Limitations or conditions apply** pursuant to 310 CMR 40.1013 (check all that apply):

☐ i. Gardening Best Management Practices (BMPs) for non-commercial gardening in a residential setting

☑ ii. Concentrations of Oil and Hazardous Material consistent with Anthropogenic Background

☐ iii. Residual contamination in a Public or Railroad Right-of-Way

☐ iv. Groundwater contamination would exceed GW-2 Standards except for the absence of an occupied building or structure

☐ **3. Temporary Solution** (check one)

☐ a. Response actions to achieve a Permanent Solution **are not currently feasible**

☐ b. Response actions to achieve a Permanent Solution **are feasible** and are being continued toward a Permanent Solution

F. PERMANENT AND TEMPORARY SOLUTION INFORMATION:

1. Specify the Risk Characterization Method(s) used to achieve the Permanent or Temporary Solution, described above:

☐ a. Method 1 ☐ b. Method 2 ☑ c. Method 3

☐ d. Method Not Applicable-Contamination reduced to or consistent with background, or Threat of Release abated

2. Specify all Soil Category(ies) applicable. More than one Soil Category may apply at a Site. Be sure to check off all **APPLICABLE** categories:

☐ a. S-1/GW-1	☐ d. S-2/GW-1	☐ g. S-3/GW-1	☐ j. Not Applicable
☑ b. S-1/GW-2	☐ e. S-2/GW-2	☑ h. S-3/GW-2	
☑ c. S-1/GW-3	☐ f. S-2/GW-3	☑ i. S-3/GW-3	

3. Specify all Groundwater Category(ies) impacted. A site may impact more than one Groundwater Category. Be sure to check off all **IMPACTED** categories:

☐ a. GW-1 ☑ b. GW-2 ☐ c. GW-3 ☐ d. No Groundwater Impacted

☐ 4. Check here if the risk assessment includes any changes to the groundwater category pursuant to 310 CMR 40.0932(5)(a) through (e). Check all conditions that apply:

☐ a. An InterimWellhead Protection Area does not apply based on a hydrogeologic evaluation (310 CMR 40.0932(5)(a))

☐ b. Groundwater was determined not to be in a Potentially Productive Aquifer or is not feasible to be developed as a drinking water supply (310 CMR 40.0932(5)(b))

☐ c. A Non-Potential DrinkingWater Source Area determination was made (310 CMR 40.0932(5)(c))

☐ d. Existing private wells were permanently closed (310 CMR 40.0932(5)(d))

☐ e. Groundwater is located within a Zone A, but is not hydrogeologically connected to a drinking water supply (310 CMR 40.0932(5)(e))

☐ 5. Check here if the Permanent or Temporary Solution supports a finding of No Significant Risk for petroleum in a GW-1 area pursuant to 310 CMR 40.0924(2)(b)3.

F. PERMANENT AND TEMPORARY SOLUTION INFORMATION (cont.):

6. Specify whether remediation was conducted:

☐ a. Check here if soil remediation was conducted.

☐ b. Check here if groundwater remediation was conducted.

☐ c. Check here if other remediation was conducted.
Specify:

7. Specify whether the analytical data used to support the Permanent or Temporary Solution used the Compendium of Analytical Methods (CAM):

☑ a. CAM used to support all analytical data.

☐ b. CAM used to support some of the analytical data.

☐ c. CAM not used.

☑ 8. Check here to indicate that the Permanent or Temporary Solution Statement includes a Data Usability Assessment and Data Representativeness Evaluation pursuant to 310 CMR 40.1056.

9. Estimate the number of acres this Permanent or Temporary Solution Statement applies to: 0.28

G. LSP SIGNATURE AND STAMP:

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and 309 CMR4.03(2), and (iii) the provisions of 309 CMR 4.03(3), to the best of my knowledge, information and belief,

> *if Section B indicates that either a* ***Permanent or Temporary Solution Statement, Phase I Completion Statement and/or Periodic Review Opinion*** *is being provided,* the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal.

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

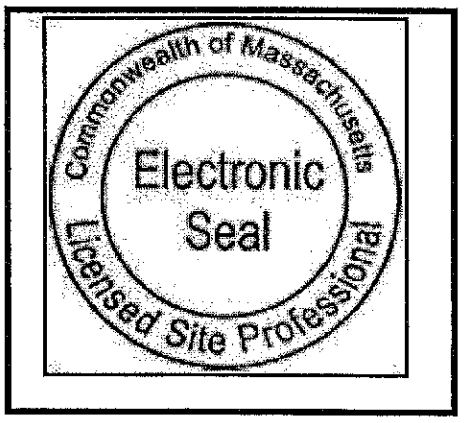
1. LSP#: 5121

2. First Name: PHILIP D 3. Last Name: MCBAIN

4. Telephone: 508-339-3200 5. Ext.: 252 6. Email: pmcbain@sovcon.com

7. Signature: PHILIP D MCBAIN

8. Date: 8/25/2014 (mm/dd/yyyy) 9. LSP Stamp:



H. PERSON MAKING SUBMITTAL:

1. Check all that apply: ☐ a. change in contact name ☐ b. change of address ☑ c. change in the person undertaking response actions

2. Name of Organization: SHELL OIL PRODUCTS US

3. Contact First Name: ANNETTE 4. Last Name: DOKKEN

5. Street: 20945 S. WILMINGTON AVENUE 6. Title: PROGRAM MANAGER

7. City/Town: CARSON 8. State: CA 9. ZIP Code: 908100000

10. Telephone: 561-433-2052 11. Ext.: 12. Email: annette.dokken@shell.com

I. RELATIONSHIP TO RELEASE OR THREAT OF RELEASE OF PERSON MAKING SUBMITTAL:

☐ Check here to change relationship

☑ 1. RP or PRP ☐ a. Owner ☐ b. Operator ☐ c. Generator ☐ d. Transporter

☑ e. Other RP or PRP Specify: FORMER OWNER

☐ 2. Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ 3. Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ 4. Any Other Person Making Submittal Specify Relationship: _____

J. REQUIRED ATTACHMENT AND SUBMITTALS:

☐ 1. Check here if the Permanent or Temporary Solution on which this opinion is based, if any, are (were) subject to any order(s), permit (s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

☐ 2. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the submittal of a Permanent or Temporary Solution Statement that relies on the public way/rail right-of-way exemption from the requirements of an AUL.

☑ 3. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the submittal of a Permanent or Temporary Solution Statement with instructions on how to obtain a full copy of the report.

☑ 4. Check here to certify that documentation is attached specifying the location of the Site, or the location and boundaries of the Disposal Site subject to this Permanent or Temporary Solution Statement. If submitting a Permanent or Temporary Solution Statement for a PORTION of a Disposal Site, you must document the location and boundaries for both the portion subject to this submittal and, to the extent defined, the entire Disposal Site.

☑ 5. Check here to certify that, pursuant to 310 CMR 40.1406, notice was provided to the owner(s) of each property within the disposal site boundaries, or notice was not required because the disposal site boundaries are limited to property owned by the party conducting response actions. (check all that apply)

☐ a. Notice was provided prior to, or concurrent with the submittal of a Phase II Completion Statement to the Department.

☑ b. Notice was provided prior to, or concurrent with the submittal of this Permanent or Temporary Solution Statement to the Department.

☐ c. Notice not required. d. Total number of property owners notified, if applicable: 3

☐ 6. Check here if you are submitting one or more AULs. You must submit an AUL Transmittal Form (BWSC113) and a copy of each implemented AUL related to this Permanent Solution or Temporary Solution Statement. Specify the type of AUL(s) below: (required for Permanent Solution with Conditions Statements where an AUL is being implemented)

☐ a. Notice of Activity and Use Limitation b. Number of Notices submitted: _____

☐ c. Grant of Environmental Restriction d. Number of Grants submitted: _____

☐ 7. If a Permanent Solution Compliance Fee is required for any of the RTNs listed on this transmittal form, check here to certify that a Permanent Solution Compliance Fee was submitted to DEP, P. O. Box 4062, Boston, MA 02211.

☐ 8. Check here if any non-updatable information provided on this form is incorrect, e.g. Site Address/Location Aid. Send corrections to bwsc.edep@state.ma.us.

☑ 9. Check here to certify that the LSP Opinion containing the material facts, data, and other information is attached.