

Blackstone Environmental Solutions, LLC

Environmental Consulting and Licensed Site Professional Services

Erik Johnson
Bureau of Waste Site Cleanup
Northeast Regional Office
MA Department of Environmental Protection
150 Presidential Way
Woburn, MA 01801

October 20, 2023
Project #1843

RE: Imminent Hazard Evaluation Results-Amendment
300 Foot Street Frontage at 14 and 16 Barnes Road
Salem, MA 01970
RTN 3-38273

Dear Mr. Johnson:

Blackstone Environmental Solutions LLC (BES) on behalf of JL Realty Trust, JMI Realty Trust, and Barnes Road Trust is providing this Imminent Hazard Evaluation (IHE) Results Amendment submittal associated with the release of oil and/or hazardous material (OHM) reported under Massachusetts Department of Environmental Protection (MassDEP) Release Tracking Number 3-38273 at portions of the vacant land located at 14 Barnes Road and 16 Barnes Road in Salem, Massachusetts. This IHE Results Amendment has been prepared in response to the IHE Results submittal filed with MassDEP on October 18, 2023 and our subsequent phone conversation. This IHE Results Amendment provides more clarity on the specific areas where risk assessment conclusions provided herein are made.

These two properties are part of the larger Disposal Site associated with RTN 3-38273 and include portions of the properties at 9 Cedar Road, 12 Cedar Road, 14 Cedar Road, 15 Cedar Road, and 16 Cedar Road. While most of these areas are exceptionally difficult to reach on foot, due to dense trees and vegetation, wetlands, surface water body, steep slopes and no roadways, the information here reported concerns the areas which, with trespass, could be accessed although with difficulty and no trails.

BES in coordination with its subcontracted risk assessor, O'Reilly, Talbot, & Okun Associates (OTO) of Westborough, MA has attached the Imminent Hazard Evaluation Results prepared for 14 and 16 Barnes Road along with the supporting figures and soil laboratory analytical report. Specifically, this IHE was performed to evaluate the risks associated the potential trespasser exposure pathway via dermal contact to soil at a portion of 14 Barnes Road and 16 Barnes Road. The laboratory soil sampling activities was performed at the aforementioned properties on September 27, 2023.

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A summary of findings outlined in the Imminent Hazard Evaluation are noted below:

- **A condition of No Imminent Hazard exists for human health, safety, and the environment exists for the portions of 14 Barnes Road and 16 Barnes Road in Salem, Massachusetts located along approximately 330 feet of street frontage existing along the southern boundary for 16 Barnes Road.**

MassDEP Bureau of Waste Site Cleanup (BWSC) Form 105 has been filed with this submittal via eDEP for RTN 3-38273. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Sincerely,

Blackstone Environmental Solutions, LLC



Michael C. Bricher, LSP, P.G.
Principal

List Of Attachments

Figures

Figure 1: Site Locus

Figure 2: Site Plan

Appendix A- Imminent Hazard Evaluation prepared by O'Reilly Talbot & Okun Associates

Appendix B- Soil Laboratory Analytical Report

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October 18, 2023
File No: 5210-11-01

Prepared for:
Blackstone Environmental Solutions, LLC
76 Bay View Drive
Shrewsbury, Massachusetts 01545

IMMINENT HAZARD EVALUATION
**300-foot Street Frontage at
14 & 16 Barnes Road
Salem, Massachusetts
MassDEP RTN 3-38273**

Prepared by:
O'Reilly, Talbot & Okun Associates, Inc.
Westborough, MA 01581

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Chemicals in Soil - Shortform 2012 (sf12tsih), Vlookup Version 0315

1.0 INTRODUCTION

This report presents an Imminent Hazard Evaluation (IHE) for the release of oil and/or hazardous material (OHM) at the portions of 14 Barnes Road and 16 Barnes Road in Salem, Massachusetts located along approximately 330 feet of street frontage existing along the southern boundary for 16 Barnes Road. These portions of the two properties are part of the larger Massachusetts Department of Environmental Protection (MassDEP) Disposal Site assigned Release Tracking Number (RTN) 3-38273 (the "Site"). The Site includes portions of the properties at 14 Barnes, 9 Cedar Road, 12 Cedar Road, 14 Cedar Road, 15 Cedar Road, and 16 Cedar Road.

The IHE was completed as part of the Immediate Response Action (Plan) submitted by Blackstone Environmental Solutions LLC (BES) to MassDEP in October 2023. The Site information provided in the IRA and the subsequent soil data provided by BES for 14 and 16 Barnes Road were used in the IHE.

The IHE was completed in accordance with MassDEP regulations under the Massachusetts Contingency Plan (MCP: 310 CMR 40.0950) and applicable MassDEP guidance.

On August 11, 2023, MassDEP was notified on behalf of Barnes Road Trust that the vacant property located at 14 Barnes Road has triggered a MCP 2-hour reporting condition (i.e., potential Imminent Hazard Condition). The 14 Barnes Road property is located immediately adjacent to 14 Cedar Road. The dataset generated as part of an assessment by Weston & Sampson on October 9, 2020, includes a total polychlorinated biphenyls (PCB) concentration of 118.3 mg/kg that was collected in the top 6 inches of material at location N-9. This PCB concentration is above the notification threshold for the purpose of fulfilling the "Two Hour" release notification obligations of 310 CMR 30.0311(7), as a "Could Pose" Imminent Hazard to human health.

MassDEP verbally approved environmental response actions to be conducted under RTN 3-38273 for 12 Cedar Road, 14 Cedar Road, and 14 Barnes Road, and includes but not limited to an expedited subsurface investigation program to address the potential Imminent Hazard condition to human health at the Site. The assessment activities will be performed to further investigate the source of the shallow heavy metals, including chromium and lead, and PCB impacted soils. Also, MassDEP has approved the installation of a security fence along the southern boundary of 16 Barnes Road in order to restrict access to 14 Barnes Road via a trespasser scenario.

On August 28, 2023, a Site inspection was conducted with representatives of MassDEP, Ash Desmond (Bureau of Waste Site Cleanup BWSC)] and Andrew Danikas (asbestos inspector), and Michael Bricher, LSP, of BES. The inspection consisted of a walkthrough of 14 Barnes, 16 Barnes Road, 9 Cedar Road, 12 Cedar Road, and 15 Cedar Road. Due to the dense forest land, poison ivy/oak vegetation, thorns, ticks, wetlands, and terrain (i.e., physical barriers), access was limited at each

of the aforementioned properties. A summary of Site observations for 14 and 16 Barnes Road is noted below.

16 Barnes Road: This property was accessed from the south along Barnes Road. MassDEP and BES reviewed the area along the southern property boundary for the installation of a potential fence installation. We agreed that there would need to be a significant amount of tree/vegetation removal and to go around a bedrock outcrop to complete the fence installation along the southern property boundary line. It was also noted that a significant elevation drop at approximately 100 feet from the road going straight in towards 14/16 Barnes Road property boundary and that it would be unsafe to access 14 Barnes Road from the southwest. Also, we noted multiple construction/demolition/solid waste debris (i.e., brick, asphalt, concrete/tires/metal, broken tiles) along the property boundary for 14 and 16 Barnes Road. Asbestos Inspector Danikas collected two samples of the tile and roofing material for asbestos. It was later confirmed by MassDEP that the tile sample tested positive for asbestos.

According to the property owner, Kathleen Ingemi for JMI Realty Trust, this area of 16 Barnes Road has been subject to illegal dumping activities over the years by nearby owners. Nonetheless, this area of the Site will need to be assessed by a licensed asbestos inspector/management company.

14 Barnes Road: MassDEP and BES accessed 14 Barnes Road from the west via 379-381 Highland Avenue. Access was limited to the westernmost portion of 14 Barnes Road due to physical barriers. There was some solid waste debris (tires, metal, brick, concrete, abandoned storage shed) observed in this area, but MassDEP asbestos inspector did not identify any potential asbestos containing material at the surface.

Containment Measure Actions: At the time of release notification for 14 Barnes Road, BES presented a verbal IRA Plan to MassDEP to erect a 6-foot-high chain-link security fence along the southern boundary of 16 Barnes Road to restrict access to the heavy metal and PCB impacted surficial soil areas reported at the Site. Based on the MassDEP/BES Site Visit on August 28, 2023, there are logistical challenges (i.e., physical barriers) with installing a security fence along the southern boundary of 16 Barnes Road. Based on feedback received by BES from Mr. Erik Johnson of MassDEP BWSC on August 30, 2023, MassDEP would consider using the existing physical barriers on 16 Barnes Road in lieu of a security fence if surficial soil data shows that the heavy metals and PCBs are below Imminent Hazard levels.

Following the completion of the upcoming IH Evaluation for potential trespasser exposure via dermal contact to soil at 14 and 16 Barnes Road, the need to supplement the existing physical barriers with additional containment measures will be assessed.

2.0 SURFICIAL SOIL SAMPLING

On September 27, 2023, BES personnel conducted a surficial soil assessment program on 14 and 16 Barnes Road. The assessment program area was divided into 5 zones for surficial soil sampling. These five sampling zones were identified as SS-31, SS-32, SS-33, SS-34, and SS-35. The sampling zones were strategically selected to represent areas that would most easily be accessed in a trespasser scenario from Barnes Road. Approximately 330 feet of street frontage exists along the southern boundary for 16 Barnes Road. Refer to IRA Plan Figure 2-Soil Sample Location Map for a depiction of the five sampling zones.

As previously noted, this area of the Site consists of thick wooded vegetation with exposed bedrock outcroppings. Also, multiple construction/demolition/solid waste debris material (i.e., brick, asphalt, concrete/tires/metal, broken tiles) was observed during this assessment program.

The soil samples were collected at a depth of 0 to 1' below grade using a hand auger. The soil samples comprised mostly of organics with some silts, sands, and gravel. There were no overt petroleum odors, soil staining, or visual evidence of release of oil and/or hazardous material at these locations. Also, soil samples were field screened for total volatile organic compounds (TVOCs) with a photoionization detector (PID) equipped with a 10.6 eV lamp and calibrated to 100 ppmv isobutylene utilizing the MassDEP approved "Jar Headspace Analytical Screening Procedure". The PID screening reading results for all soil samples were non-detect (0.0 parts per million (ppm)).

A total of five soil samples (i.e., SS-31 through SS-35) were collected and submitted to New England Testing Laboratory (NET Lab) of West Warwick, RI under standard chain of custody (COC) procedures for the following analyses: MCP 14 Metals by EPA Method 6000/7000; and polychlorinated biphenyls (PCBs) by EPA Method 8082A. In addition, soil sample SS-32 as submitted for SVOC laboratory analysis via EPA Method 8270. These soil sample laboratory analytical results will be presented in the IRA Status Report #1, anticipated for MassDEP submittal on or before December 5, 2023.

The analytical results for detected analytes are presented in Table 1. It is noted on this table that PCBs were not detected at analytical detection limits less than 86 ug/kg. Metals were detected in each sample. SVOCs, primarily polycyclic aromatic hydrocarbons (PAHs), were detected in the one sample (SS-3) analyzed for this group of compounds. It is also noted that the maximum concentration of arsenic, cadmium, and mercury are below MassDEP's Background Concentrations in "Natural" Soil (MassDEP, 2002). These three metals are not considered to be constituents of concern for this IHE.

2.0 SITE-SPECIFIC IMMINENT HAZARD EVALUATION FOR HUMAN HEALTH

The Site-specific exposures considered in this IHE (310 CMR 40.0953) are as follows. The short period of time considered in the evaluation was five years. For the evaluation of soil-related exposures, the level of OHM starting at zero to twelve inches

within the ground surface were used in the development of Exposure EPCs. No hot spots were not identified for the subject portions of the Site. The IHE was focused on the detected metals (exceeding MassDEP Background Concentrations for "Natural" Soil [MassDEP, 2002]), and SVOCs as constituents of concern. Maximum detected concentrations were used as EPCs.

The IHE was conducted in a manner, which results in conservative estimates of potential exposures. The IHE clearly identifies and explains the basis for exposure parameters chosen for the Risk Characterization.

The characterization of the risk of harm to human health was conducted using a Method 3 approach, as described in 310 CMR 40.0993. The toxicity information used to characterize risk is consistent with the type and duration of exposure under evaluation, and primary consideration given to information developed by MassDEP (310 CMR 40.0955(2)(a)).

2.1 IMMINENT HAZARD EVALUATION FOR TRESPASSERS

The properties at 14 and 16 Barnes Road are currently undeveloped. However, the closest occupied residential building is less than 500 feet away. Therefore, members of the general public could trespass on these properties in the absence of barriers.

Therefore, the IHE for human health was evaluated for a trespasser that would occasionally access the properties. Direct contact risks to soil by trespassers were calculated using the MassDEP Method 3 Imminent Hazard Assessment for Trespasser Exposed to Chemicals in Soil - Shortform 2012 (sf12tsih) (Vlookup Version 0315). (Attachment 1).

The default exposure assumptions in this Shortform for subchronic noncancer effects assumes the receptor is a 11 to 12 year old, soil ingestion rate of 50 mg/day, exposure frequency of 2 days/week for 30 weeks (60 days/year), and exposure period of 1 year for noncancer subchronic effects (Table TSIH-4, Sheet: Exp). The equations to calculate noncancer risk for a trespasser are presented in Table TSIH-3, Sheet: NC Eq.

For carcinogenic effects, the receptor is a 11 to 16 year old, soil ingestion rate of 50 mg/day, exposure frequency of 2 days/week for 30 weeks (60 days/year), and exposure period of 5 years over a 70 year lifetime (Table TSIH-4, Sheet: Exp). The equations to calculate cancer risk for a trespasser are presented in Table TSIH-2, Sheet: C Eq.

Exposure point concentrations (EPCs) were selected from the five samples (SS-31 to SS-35) as the maximum detected concentrations of detected analytes (Table 1). These EPCs were input into the Shortform (Table TSIH-2, Sheet: EPCs).

The toxicity values for COCs are encoded in the Shortform (Table TSIH-5; Sheet: Chem). It is noted that chromium was evaluated in the trivalent form. Hexavalent

chromium was not detected in the sediments in the Mill Pond, nor in other soil, lagoon, and sediment samples collected for the ADW Disposal Site.

Subchronic noncarcinogenic risks were calculated as the Hazard Index (HI). Cancer risks were calculated as the Excess Lifetime Cancer Risk (ELCR) (Table TSIH-2, Sheet: EPCs).

The total IH noncancer risk HI from soil exposure by trespassers is 0.08. This value is well below the MassDEP IH noncancer risk limit for HI of 10, with the Hazard Quotient for lead being less than 1. The total IH cancer risk ELCR from soil exposure by trespassers is 8E-07. This value is well below the MassDEP IH cancer risk ELCR of 1E-05.

Therefore, a condition of No Imminent Hazard was concluded for trespassers.

3.0 SITE-SPECIFIC IMMINENT HAZARD EVALUATION FOR SAFETY

In accordance with Section 310 CMR 40.0960 of MCP, the Site was also evaluated for the risk of harm to safety associated with current and reasonably foreseeable conditions at the site. In general, this evaluation considers acute hazards such as fire and explosion, the potential for exposure to acute concentrations that might be immediately threatening to life or health, and the potential for chronic exposure levels to the general public that might result from ongoing uncontrolled releases.

According to the MCP, the following Site conditions indicate a condition of No Significant Risk of harm to safety exists at the site:

- No applicable or suitably analogous safety standards were identified for the site (310 CMR 40.0960(2)); therefore, there were no exceedances of these standards.
- No rusted or corroded drums or containers, open pits, lagoons, or other dangerous structures were observed on the site (310 CMR 40.0960(3)(a)).
- There is no present threat of fire or explosion, including the presence of explosive vapors resulting from a release of OHM (310 CMR 40.0960(3)(b)).
- No uncontained material which exhibit the characteristics of corrosivity, reactivity or flammability exists at the site (310 CMR 40.0960(3)(c)).

Therefore, a condition of No Imminent Hazard exists for Safety.

4.0 SITE-SPECIFIC IMMINENT HAZARD EVALUATION FOR THE ENVIRONMENT

An IH to the environment would exist with evidence of stressed biota or immediate or acute adverse impacts to freshwater or saltwater fish populations. These conditions do not exist. Therefore, a condition of No Imminent Hazard to the environment was concluded.

5.0 CONCLUSIONS

A **condition of No Imminent Hazard exists** for human health, safety, and the environment exists for the portions of 14 Barnes Road and 16 Barnes Road in Salem, Massachusetts located along approximately 330 feet of street frontage existing along the southern boundary for 16 Barnes Road.

REFERENCES

Massachusetts Department of Environmental Protection (MassDEP). 1995. *Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan*. July 1995.

MassDEP. 2002. *Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil. Technical Update*. May 2002.

MassDEP. 2014, updated 2019. *310 CMR 40.0000, the Massachusetts Contingency Plan*. Effective June 2014. Updated December 2019.

MassDEP. 2015. *ShortForms for Human Health Risk Assessment under the MCP*. ShortForm Version 10-12. Vlookup Version v0315.

*Imminent Hazard Evaluation
Street frontage at
14 and 16 Barnes Road
Salem, MA
October 2023
5210-11-01*

TABLES and ATTACHEMENTS

Table 1
Soil Exposure Point Concentrations (EPCs) - Metals SVOCs
Vacant Parcels
Cedar Road Barnes Road
Salem, MA

Sample ID & Depth Sample Date Soil Material							SS-31/0-1' 9/27/2023 Organics		SS-32/0-1' 9/27/2023 Organics		SS-33/0-1' 9/27/2023 Organics		SS-34/0-1' 9/27/2023 Organics		SS-35/0-1' 9/27/2023 Organics		Maximum Detected Concentration
Compound Name	RCS-1	S-1 SOIL & GW-2	S-1 SOIL & GW-3	UCL	MassDEP "Natural" Soil Background	Units	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	
Total Metals																	
Antimony	20	20	20	300	1	mg/kg	7.08	1.01	2.52	1.01	ND	0.9	ND	0.85	ND	0.83	7.08
Arsenic	20	20	20	500	20	mg/kg	5.12	1.53	5.46	1.53	3.72	1.37	3.63	1.29	3.52	1.25	5.46
Barium	1000	1000	1000	10000	50	mg/kg	38.7	0.51	106	0.5	41.5	0.45	58.1	0.42	41.5	0.41	106
Beryllium	90	90	90	2000	0.4	mg/kg	ND	0.51	ND	0.5	0.49	0.45	0.5	0.42	0.47	0.41	0.5
Cadmium	70	70	70	1000	2	mg/kg	ND	0.77	1.42	0.76	0.7	0.68	0.92	0.64	0.63	0.63	1.42
Chromium	100	100	100	2000	30	mg/kg	9.78	0.77	42.6	0.76	12.4	0.68	15.7	0.64	15.8	0.63	42.6
Lead	200	200	200	6000	100	mg/kg	41.7	0.77	252	0.76	44	0.68	69.7	0.64	46.5	0.63	252
Nickel	600	600	600	10000	20	mg/kg	7.68	0.77	17.2	0.76	14.2	0.68	13.8	0.64	15.8	0.63	17.2
Vanadium	400	400	400	7000	30	mg/kg	31.7	0.51	69.2	0.5	39.7	0.45	55.9	0.42	36	0.41	69.2
Zinc	1000	1000	1000	10000	100	mg/kg	54.2	3.1	169	3.1	94.8	2.7	104	2.6	81.9	2.5	169
Mercury	20	20	20	300	0.3	mg/kg	ND	0.185	0.253	0.156	ND	0.152	ND	0.16	ND	0.161	0.253
Semivolatile organic compounds																	
Acenaphthene	4000	1000000	1000000	1.00E+07	500	ug/kg			1,420	828							1,420
Acenaphthylene	1000	600000	10000	1.00E+07	500	ug/kg			912	828							912
Anthracene	1000000	1000000	1000000	1.00E+07	1,000	ug/kg			4,590	828							4,590
Benzo(a)anthracene	7000	7000	7000	3000000	2,000	ug/kg			12,500	828							12,500
Benzo(a)pyrene	2000	2000	2000	300000	2,000	ug/kg			12,700	828							12,700
Benzo(b)fluoranthene	7000	7000	7000	3000000	2,000	ug/kg			16,400	828							16,400
Benzo(g,h,i)perylene	1000000	1000000	1000000	1.00E+07	1,000	ug/kg			9,340	828							9,340
Benzo(k)fluoranthene	70000	70000	70000	1.00E+07	1,000	ug/kg			5,990	828							5,990
Biphenyl	50	6000	1000000	1.00E+07		ug/kg			233	191							233
Chrysene	70000	70000	70000	1.00E+07	2,000	ug/kg			13,800	828							13,800
Dibenz(a,h)anthracene	700	700	700	300000	500	ug/kg			2,420	828							2,420
Dibenzofuran	100000					ug/kg			1,340	828							1,340
Fluoranthene	1000000	1000000	1000000	1.00E+07	4,000	ug/kg			25,200	828							25,200
Fluorene	1000000	1000000	1000000	1.00E+07	1,000	ug/kg			2,030	828							2,030
Indeno(1,2,3-cd)pyrene	7000	7000	7000	3000000	1,000	ug/kg			9,040	828							9,040
Naphthalene	4000	20000	500000	1.00E+07	500	ug/kg			1,150	828							1,150
Phenanthrene	10000	500000	500000	1.00E+07	3,000	ug/kg			22,000	828							22,000
Pyrene	1000000	1000000	1000000	1.00E+07	4,000	ug/kg			25,600	828							25,600

Notes:

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

ND = not detected above the lab reporting limits shown

Bold/Highlighted values exceed MassDEP Most Stringent Standard

UCL- MassDEP Upper Concentration Limit

-- = Analyte not sampled for

ug/Kg = micrograms per kilogram (parts per billion)

NE = No Method 1 Standard or UCL available

14 Barnes Road =







16 Barnes Road =



Table 1A
Summary of Soil Sample Analytical Results-PCBs
Vacant Parcels
Cedar Road Barnes Road
Salem, MA

Salem, MA																				
Sample ID & Depth Sample Date Soil Material										SS-31/0-1' 9/27/2023 Organics		SS-32/0-1' 9/27/2023 Organics		SS-33/0-1' 9/27/2023 Organics		SS-34/0-1' 9/27/2023 Organics		SS-35/0-1' 9/27/2023 Organics		
Compound Name		RCS-1	S-1 SOIL & GW-2	S-1 SOIL & GW-3	S-2 SOIL & GW-2	S-2 SOIL & GW-3	S-3 SOIL & GW-2	S-3 SOIL & GW-3	UCL	Units	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit	Sample Result	Reporting Limit
Aroclor-1016		1000	1000	1000	4000	4000	4000	4000	100000	ug/kg	ND	86	ND	82	ND	79	ND	77	ND	78
Aroclor-1221		1000	1000	1000	4000	4000	4000	4000	100000	ug/kg	ND	86	ND	82	ND	79	ND	77	ND	78
Aroclor-1232		1000	1000	1000	4000	4000	4000	4000	100000	ug/kg	ND	86	ND	82	ND	79	ND	77	ND	78
Aroclor-1242		1000	1000	1000	4000	4000	4000	4000	100000	ug/kg	ND	86	ND	82	ND	79	ND	77	ND	78
Aroclor-1248		1000	1000	1000	4000	4000	4000	4000	100000	ug/kg	ND	86	ND	82	ND	79	ND	77	ND	78
Aroclor-1254		1000	1000	1000	4000	4000	4000	4000	100000	ug/kg	ND	86	ND	82	ND	79	ND	77	ND	78
Aroclor-1260		1000	1000	1000	4000	4000	4000	4000	100000	ug/kg	ND	86	ND	82	ND	79	ND	77	ND	78
Aroclor-1262		1000	1000	1000	4000	4000	4000	4000	100000	ug/kg	ND	86	ND	82	ND	79	ND	77	ND	78
Aroclor-1268		1000	1000	1000	4000	4000	4000	4000	100000	ug/kg	ND	86	ND	82	ND	79	ND	77	ND	78
PCBs (Total)		1000	1000	1000	4000	4000	4000	4000	100000	ug/kg	ND	86	ND	82	ND	79	ND	77	ND	78

Notes:
mg/kg= milligrams per kilogram (parts per million)
ND = not detected above the lab reporting limits shown
UCL- MassDEP Upper Concentration Limit
Bold/Highlighted values exceed MassDEP/EPA Unrestrictive Use
-- = Analyte not sampled for
ug/Kg = micrograms per kilogram (parts per billion)
NE = No Method 1 Standard or UCL available
14 Barnes Road = 
16 Barnes Road = 
12 Cedar Road = 
14Cedar Road= 

Method 3 Imminent Hazard Risk Assessment for a Trespasser Exposed to Chemicals in Soil Shortform 2012 (sf12tsih)

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Tab

EPCs	Table TSIH-1: Select chemicals and enter Exposure Point Concentrations (EPCs). Estimated risks are shown to the right.
C Eq	Table TSIH-2: Equations to calculate cancer risks
NC Eq	Table TSIH-3: Equations to calculate noncancer risks
Exp	Table TSIH-4: Definitions and exposure factors
Chem	Table TSIH-5: Chemical-specific data
Cyanide	Table TSIH-6: Cyanide calculations

Spreadsheets designed by Andrew Friedmann, MassDEP

Questions and Comments may be addressed to:

Lydia Thompson

Massachusetts Department of Environmental Protection

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Trespasser - Soil: Table TSIH-1
Exposure Point Concentration (EPC)
Based on Trespasser Ages 11-16 (Cancer) and 11-12 (Non-Cancer)

ShortForm Version 10-12

Vlookup Version v0315

****Do not insert or delete any rows****

Click on empty cell below and select OHM using arrow.

ELCR (all chemicals) = 7.8E-07

HI (all chemicals) = 8.3E-02

Oil or Hazardous Material	EPC (mg/kg)	ELCR _{ingestion}	ELCR _{dermal}	ELCR _{total}	Subchronic		HQ _{total}
					HQ _{ing}	HQ _{derm}	
ANTIMONY	7.08				6.3E-03	4.4E-03	1.1E-02
BARIUM	106				5.4E-04	3.7E-04	9.1E-04
BERYLLIUM	0.5				3.5E-05	2.5E-05	6.0E-05
CHROMIUM (TOTAL)	42.6				7.6E-04	5.2E-04	1.3E-03
LEAD	252				6.0E-02	5.0E-03	6.5E-02
NICKEL	17.2				3.0E-04	4.2E-04	7.3E-04
VANADIUM	69.2				2.7E-03	1.9E-03	4.6E-03
ZINC	169				2.0E-04	1.4E-04	3.4E-04
ACENAPHTHENE	1.42				7.6E-07	1.7E-06	2.5E-06
ACENAPHTHYLENE	0.912				3.2E-07	7.5E-07	1.1E-06
ANTHRACENE	4.59				4.9E-07	1.1E-06	1.6E-06
BENZO(a)ANTHRACENE	12.5	3.3E-08	1.7E-08	5.1E-08	4.4E-06	2.0E-06	6.5E-06
BENZO(a)PYRENE	12.7	3.4E-07	1.8E-07	5.2E-07	4.5E-06	2.1E-06	6.6E-06
BENZO(b)FLUORANTHENE	16.4	4.4E-08	2.3E-08	6.7E-08	5.8E-06	2.7E-06	8.5E-06
BENZO(g,h,i)PERYLENE	9.34				3.3E-06	7.7E-06	1.1E-05
BENZO(k)FLUORANTHENE	5.99	1.6E-09	8.3E-10	2.4E-09	2.1E-06	9.8E-07	3.1E-06
BIPHENYL, 1,1-	0.233	2.3E-11	1.8E-11	4.0E-11	1.7E-07	1.1E-07	2.8E-07
CHRYSENE	13.8	3.7E-09	1.9E-09	5.6E-09	4.9E-06	2.3E-06	7.2E-06
DIBENZO(a,h)ANTHRACENE	2.42	6.5E-08	3.4E-08	9.8E-08	8.6E-07	4.0E-07	1.3E-06
FLUORANTHENE	25.2				2.7E-05	6.2E-05	8.9E-05
FLUORENE	2.03				5.4E-07	1.2E-06	1.8E-06
INDENO(1,2,3-cd)PYRENE	9.04	2.4E-08	1.3E-08	3.7E-08	3.2E-06	1.5E-06	4.7E-06
NAPHTHALENE	1.15				6.1E-07	1.4E-06	2.0E-06
PHENANTHRENE	22				7.8E-06	1.8E-05	2.6E-05
PYRENE	25.6				9.1E-06	2.1E-05	3.0E-05

Note! Cr(VI) limit is 200 mg/kg due to contact dermatitis.
 Note! Lead IH HQ limit is 1, not 10.

Trespasser - Soil: Table TSIH-2

Equations to Calculate Cancer Risk for a Trespasser (Age 11-16 years)

Vlookup Version v0315

Cancer Risk from Ingestion

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

$$LADD_{ing} = \frac{[OHM]_{soil} * IR * RAF_{c-ing} * EF_{ing} * ED * EP * C}{BW * AP_{lifetime}}$$

Cancer Risk from Dermal Absorption

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

$$LADD_{derm} = \frac{[OHM]_{soil} * SA * RAF_{c-derm} * SAF * EF_{derm} * ED * EP * C}{BW * AP_{lifetime}}$$

Parameter	Value	Units
CSF	OHM specific	(mg/kg-day) ⁻¹
LADD	OHM specific	mg/kg-day
[OHM] _{soil}	OHM specific	mg/kg
IR	50	mg/day
RAF _{c-ing}	OHM specific	dimensionless
RAF _{c-derm}	OHM specific	dimensionless
EF _{ing,derm}	0.164	event/day
ED	1	day/event
EP	5	years
C	0.000001	kg/mg
BW	48.2	kg
AP _(lifetime)	70	years
SA	2796	cm ² / day
SAF	0.14	mg/cm ²

Trespasser - Soil: Table TSIH-3

Equations to Calculate Subchronic Noncancer Risk for a Trespasser (Age 11-12 years)

Vlookup Version v0315

Subchronic Noncancer Risk from Ingestion

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

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

Subchronic Noncancer Risk from Dermal Absorption

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

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

Parameter	Value	Units
RfD	OHM specific	mg/kg-day
ADD	OHM specific	mg/kg-day
[OHM] _{soil}	OHM specific	mg/kg
IR	50	mg/day
RAF _{nc-ing}	OHM specific	dimensionless
RAF _{nc-derm}	OHM specific	dimensionless
EF _{ing,derm}	0.286	event/day
ED	1	day/event
EP	0.577	years
C	0.000001	kg/mg
BW	40.3	kg
AP	0.577	year
SA	2477	cm ² / day
SAF	0.14	mg/cm ²

Trespasser - Soil: Table TSIH-4
Definitions and Exposure Factors

Vlookup Version v0315

Parameter	Value	Units	Notes
ELCR - Excess Lifetime Cancer Risk	chemical specific	dimensionless	Pathway specific (ing =ingestion, derm=dermal, inh=inhilation)
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
HQ - Hazard Quotient	chemical specific	dimensionless	Pathway specific (ing =ingestion, derm=dermal, inh=inhilation)
RfD - Reference Dose	chemical specific	mg/kg-day	see Table RS-7
ADD - Average Daily Dose	chemical specific	mg/kg-day	Pathway specific
EPC - Exposure Point Concentration	chemical specific	mg/kg	
IR - Soil Ingestion Rate	50	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	
EF _{subchronic} - Exposure Frequency for subchronic ingestion or dermal exposure	0.286	event/day	2 days/week
EF _{cancer} - Exposure Frequency for cancer, ingestion or dermal exposure	0.164	event/day	2 days/week, 30 weeks/year
ED - Exposure Duration	1	day/event	
EP ₍₁₁₋₁₂₎ - Exposure Period for age group 11-12	0.577	years	30 weeks
EP ₍₁₁₋₁₆₎ - Exposure Period for age group 11-16	5	years	
BW ₍₁₁₋₁₂₎ - Body Weight for age group 11-12	40.3	kg	U.S. EPA. 1997. Exposure Factors Handbook. Table 7-7
BW ₍₁₁₋₁₆₎ - Body Weight for age group 11-16	48.2	kg	Ibid
AP _{subchronic} - Averaging Period for subchronic noncancer	0.577	years	30 weeks
AP _{cancer} - Averaging Period for lifetime	70	years	
SA ₍₁₁₋₁₂₎ - Surface Area for age group 11-12	2477	cm ² / day	50th percentile of forearms, hands, and feet for females. MADEP 1995 Guidance for Disposal Site Risk Characterization, Table B-2.
SA ₍₁₁₋₁₆₎ - Surface Area for age group 11-16	2796.1	cm ² / day	Ibid
SAF - Surface Adherence Factor, Trespasser	0.14	mg/cm ²	SAF developed for ShortForm according to procedure outlined in MA DEP Technical Update: Weighted Skin-Soil Adherence Factors, April 2002.

Trespasser - Soil: Table TSIH-5
Chemical-Specific Data

Vlookup Version v0315

Oil or Hazardous Material	CSF (mg/kg-day) ⁻¹	RAF _{c-ing}	RAF _{c-derm}	Subchronic RfD mg/kg-day	Subchronic RAF _{nc-ing}	Subchronic RAF _{nc-derm}
ANTIMONY				4.0E-04	1	0.1
BARIUM				7.0E-02	1	0.1
BERYLLIUM				5.0E-03	1	0.1
CHROMIUM (TOTAL)				2.0E-02	1	0.1
LEAD				7.5E-04	0.5	0.006
NICKEL				2.0E-02	1	0.2
VANADIUM				9.0E-03	1	0.1
ZINC				3.0E-01	1	0.1
ACENAPHTHENE				2.0E-01	0.3	0.1
ACENAPHTHYLENE				3.0E-01	0.3	0.1
ANTHRACENE				1.0E+00	0.3	0.1
BENZO(a)ANTHRACENE				3.0E-01	0.3	0.02
BENZO(a)PYRENE				3.0E-01	0.3	0.02
BENZO(b)FLUORANTHENE				3.0E-01	0.3	0.02
BENZO(g,h,i)PERYLENE				3.0E-01	0.3	0.1
BENZO(k)FLUORANTHENE				3.0E-01	0.3	0.02
BIPHENYL, 1,1-				5.0E-01	1	0.1
CHRYSENE				3.0E-01	0.3	0.02
DIBENZO(a,h)ANTHRACENE				3.0E-01	0.3	0.02
FLUORANTHENE				1.0E-01	0.3	0.1
FLUORENE				4.0E-01	0.3	0.1
INDENO(1,2,3-cd)PYRENE				3.0E-01	0.3	0.02
NAPHTHALENE				2.0E-01	0.3	0.1

Trespasser - Soil: Table TSIH-6 Cyanide Calculations

The soil cyanide concentration limit set to protect a trespasser against an acute, potentially lethal one-time dose of cyanide from incidental ingestion of contaminated soil is 8,000 mg/kg_{soil}. This is the concentration of available cyanide in soil below which acute human health effects would not be expected following a one-time exposure. This soil concentration is calculated using the equation below with a one-time soil ingestion estimate of 50 mg_{soil} and an available cyanide dose limit of 0.01 mg/kg_{body weight}.

MassDEP's guidance on evaluating the risk from a one-time cyanide dose considers cyanide's potentially lethal effects as well as information on cyanide metabolism:

Cyanides are detoxified rapidly by the body, and a large acute dose which overwhelms the detoxification mechanism is potentially more toxic than the same dose distributed over a period of hours. (MassDEP *Background Documentation for the Development of an Available Cyanide Benchmark Concentration*, originally dated October 1992, Modified August 1998)

Assessment of a potential one-time dose requires an estimate of the maximum soil concentration the trespasser could contact at any one time. The average soil concentration within a typical exposure area will underestimate the potential one-time dose. Therefore, to assess the acute risk of a one-time potentially lethal dose, the EPC for cyanide should be a conservative estimate of the maximum soil concentration.

The trespasser soil concentration limit to protect against adverse effects from an acute (one-time) exposure to cyanide is 8000 mg/kg.

Concentration Calculation for Cyanide

$$\text{Concentration} = \frac{\text{HQ} \times \text{Acute Dose Limit} \times \text{BW}}{\text{IR} \times \text{RAF} \times \text{Conversion Factor}}$$

Parameter	Value	Units
HQ (Hazard Quotient)	1	(unitless)
Acute Dose Limit	0.01	mg avail. CN/ kg BW
BW (Body Weight) ¹¹⁻¹²	40.3	kg
IR ^(1-time reasonable max)	50	mg
Conversion Factor	1.0E-06	kg soil / mg soil
RAF	1	(unitless)

The toxicological basis for estimating an allowable one-time is documented in MassDEP's 1992 *Background Documentation for the Development of an "Available Cyanide" Benchmark Concentration*, which is published at: <http://www.mass.gov/eea/docs/dep/toxics/stypes/dscyanide.pdf>

Trespasser - Soil: Table TSIH-6 Cyanide Calculations

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