HRS DOCUMENTATION RECORD COVER SHEET

Name of Site: Creese & Cook Tannery (Former)

EPA ID No.: MAD001031574

Contact Persons

Site Investigation:	Weston Solutions, Inc. (WESTON®)/ Superfund Technical Assessment and Response Team III (START) 3 Riverside Drive Andover, MA 01810 (Mr. Gerald A. Hornok and Mr. John F. Kelly)	(978) 552-2100
Documentation Record:	U.S. Environmental Protection Agency (EPA) Region I 5 Post Office Square, Suite 100 Boston, MA 02109-3912 (Ms. Nancy Smith)	(617) 918-1436

Pathways, Components, or Threats Not Scored

Ground Water Migration Pathway

Limited ground water sampling has occurred at the Creese & Cook Tannery (Former) facility property. Historical ground water monitoring well samples and seep samples along the banks of the Crane River have been collected. Analytical results of the samples indicated a release of site-related hazardous substances to the ground water. Recent ground water and seep sampling has not been performed, and to date, a release of hazardous substances to ground water from on-site sources has not been supported. The Ground Water Migration Pathway has not been scored because recent data are unavailable; consequently, the resulting pathway score would not contribute significantly to the overall site score. Therefore, this pathway has not been included in the HRS documentation record.

Air Migration Pathway

To date, a release of hazardous substances to air from on-site sources has not been documented. The Air Migration Pathway has not been scored because the data are unavailable; consequently, the resulting pathway score would not contribute significantly to the overall site score. Therefore, this pathway has not been included in the HRS documentation record.

HRS DOCUMENTATION RECORD

Name of Site: Creese & Cook Tannery (Former) **Date Prepared:** September 2012

EPA Region: Region I

Street Address of Site*: 55 Clinton Avenue

City, County, State, Zip Code: Danvers, Essex County, Massachusetts, 01923

General Location in the State: Northeastern Massachusetts

Topographic Map: U.S. Geological Survey, Salem, Massachusetts 7.5-minute × 15-minute series Topographical Map. 1985 [19].

Latitude:** 42° 33′ 11.2″ North

Longitude:** 70° 55′ 36.2″ West

Scores

Ground Water Pathway	NS
Surface Water Pathway	100.00
Soil Exposure Pathway	68.40
Air Pathway	NS
HRS SITE SCORE	**60.57**

NS = Not Scored

* The street address, coordinates, and contaminant locations presented in this Hazard Ranking System (HRS) documentation record identify the general area the site is located. They represent one or more locations U.S. Environmental Protection Agency (EPA) considers to be part of the site based on the screening information EPA used to evaluate the site for National Priorities List (NPL) listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, placed, or otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

** The geographic coordinates of the site were measured from the location where the former steam process pipe/footbridge intersects Source number (No.) 4 [5, pp. 1-2]. See Reference 5 for the location of the latitude and longitude measurement point.

WORKSHEET FOR COMPUTING HRS SITE SCORE

	S	S^2
1. Ground Water Migration Pathway Score (S_{gw})	NS	--
2. Surface Water Overland/Flood Migration Component (S_{sw}) (from Table 4-1, line 30)	100.00	10,000
3. Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	68.40	4,678.56
4. Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	--
5. Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		14,678.56
6. **HRS Site Score** Divide the value on line 5 by 4 and take the square root		60.57

HRS Table 4-1 [1, Table 4-1]
Surface Water Overland/Flood Migration Component Scoresheet

Factor Categories and Factors	Maximum Value	Value Assigned
Drinking Water Threat		
Likelihood of Release:		
1. Observed Release	550	550
2. Potential to Release by Overland Flow:		
2a. Containment	10	NS
2b. Runoff	25	NS
2c. Distance to Surface Water	25	NS
2d. Potential to Release by Overland Flow (lines 2a x [2b + 2c])	500	NS
3. Potential to Release by Flood:		
3a. Containment (Flood)	10	NS
3b. Flood Frequency	50	NS
3c. Potential to Release by Flood (lines 3a x 3b)	500	NS
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	NS
5. Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics:		
6. Toxicity/Persistence	(a)	NS
7. Hazardous Waste Quantity	(a)	NS
8. Waste Characteristics	100	NS
Targets:		
9. Nearest Intake	50	NS
10. Population:		
10a. Level I Concentrations	(b)	NS
10b. Level II Concentrations	(b)	NS
10c. Potential Contamination	(b)	NS
10d. Population (lines 10a + 10b + 10c)	(b)	NS
11. Resources	5	NS
12. Targets (lines 9 + 10d + 11)	(b)	NS
Drinking Water Threat Score:		
13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)	100	NS
Human Food Chain Threat		
Likelihood of Release:		
14. Likelihood of Release (same value as line 5)	550	550
Waste Characteristics:		
15. Toxicity/Persistence/Bioaccumulation	(a)	5×10^8
16. Hazardous Waste Quantity	(a)	100
17. Waste Characteristics	1,000	320

HRS Table 4-1 [1, Table 4-1]
Surface Water Overland/Flood Migration Component Scoresheet (Concluded)

Factor Categories and Factors	Maximum Value	Value Assigned
Targets:		
18. Food Chain Individual	50	45
19. Population:		
19a. Level I Concentrations	(b)	NS
19b. Level II Concentrations	(b)	0.03
19c. Potential Human Food Chain Contamination	(b)	NS
19d. Population (lines 19a + 19b + 19c)	(b)	0.03
20. Targets (lines 18 + 19d)	(b)	45.03
Human Food Chain Threat Score:		
21. Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100	96.06
Environmental Threat		
Likelihood of Release:		
22. Likelihood of Release (same value as line 5)	550	550
23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	5×10^8
24. Hazardous Waste Quantity	(a)	100
25. Waste Characteristics	1,000	320
Targets:		
26. Sensitive Environments:		
26a. Level I Concentrations	(b)	NS
26b. Level II Concentrations	(b)	55
26c. Potential Contamination	(b)	NS
26d. Sensitive Environments (lines 26a + 26b + 26c)	(b)	55
27. Targets (value from 26d)	(b)	55
Environmental Threat Score:		
Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum of 60)	60	60.00
Surface Water Overland/Flood Migration Component Score for a Watershed		
29. Watershed Score[c] (lines 13 + 21 + 28, subject to a maximum of 100)	100	100.00
Surface Water Overland/Flood Migration Component Score		
30. Component Score (S_{of}), (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100) (c)	100	100.00

(a) Maximum value applies to waste characteristics category.
(b) Maximum value not applicable. (c) Do not round to nearest integer.

HRS Table 5-1 [1, Table 5-1]
Soil Exposure Pathway Scoresheet

Factor Categories and Factors	Maximum Value	Value Assigned
Resident Population Threat		
Likelihood of Exposure:		
1. Likelihood of Exposure	550	550
Waste Characteristics:		
2. Toxicity	(a)	10,000
3. Hazardous Waste Quantity	(a)	10
4. Waste Characteristics	100	18
Targets:		
5. Resident Individual	50	50
6. Resident Population:		
6a. Level I Concentrations	(b)	520
6b. Level II Concentrations	(b)	0
6c. Resident Population (lines 6a + 6b)	(b)	520
7. Workers	15	0
8. Resources	5	0
9. Terrestrial Sensitive Environments	(c)	NS
10. Targets (lines 5 + 6c + 7 + 8 + 9)	(b)	570
Resident Population Threat Score:		
11. Resident Population Threat (lines 1 x 4 x 10)	(b)	5,643,000
Nearby Population Threat		
Likelihood of Exposure:		
12. Attractiveness/Accessibility	100	NS
13. Area of Contamination	100	NS
14. Likelihood of Exposure	500	NS
Waste Characteristics:		
15. Toxicity	(a)	NS
16. Hazardous Waste Quantity	(a)	NS
17. Waste Characteristics	100	NS
Targets:		
18. Nearby Individual	1	NS
19. Population Within 1 Mile	(b)	NS
20. Targets (lines 18 + 19)	(b)	NS
Nearby Population Threat Score:		
21. Nearby Population Threat (lines 14 x 17 x 20)	(b)	NS

HRS Table 5-1 [1, Table 5-1] Soil Exposure Pathway Scoresheet (Concluded)		
Soil Exposure Pathway Score		
22. Soil Exposure Pathway Score (S_s), (lines [11 +21]/82,500, subject to a maximum of 100) (d)	100	68.40

(a) Maximum value applies to waste characteristics category.
(b) Maximum value not applicable.
(c) No specific maximum value applies to factor. However, pathway score based solely on terrestrial sensitive environments is limited to maximum of 60.
(d) Do not round to nearest integer

ACRONYM/ABBREVIATION LIST

°	Degrees
‘	Minutes
%	Percent
“	Seconds
ABN	Acid Base Neutral
ACM	Asbestos-containing Material
ACOP	Administrative Consent Order with Penalty
AG	Attorney General
ATSDR	Agency for Toxic Substances and Disease Registry
AUL	Activity and Use Limitation
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CDD	Chlorodibenzodioxin
CDF	Chlorodibenzofuran
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COD	Chemical Oxygen Demand
COPC	Contaminants of Potential Concern
CRQL	Contract Required Quantitation Limit
CWA	Clean Water Act
EPA	U.S. Environmental Protection Agency
ESAT	Environmental Services Assistance Team
ft	Feet
ft^2	Square feet
GPS	Global Positioning System
H&A	Haley & Aldrich
HRS	Hazard Ranking System
HpCDD	Heptachlorodibenzodioxin
HpCDF	Heptachlorodibenzofuran
HxCDD	Hexachlorodibenzodioxin
HxCDF	Hexachlorodibenzofuran
IHE	Imminent Hazard Evaluation
IRA	Immediate Response Action
kg	Kilogram
L	Liter
LSP	Licensed Site Professional
MassDEP	Massachusetts Department of Environmental Protection
MA DEQE	Massachusetts Department of Environmental Quality Engineering
MBTA	Massachusetts Bay Transit Authority
MCP	Massachusetts Contingency Plan
mg	Milligrams

MGP	Manufactured Gas Plant
MW	Monitoring Well
NERO	Northeast Regional Office
ng	Nanograms
No.	Number
NOR	Notice of Responsibility
NS	Not Scored
OHM	Oil and/or Hazardous Materials
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCP	Pentachlorophenol
ppb	Parts per billion
ppm	Parts per million
PRP	Potentially Responsible Party
QAPP	Quality Assurance Project Plan
RAM	Release Abatement Measure
RCRA	Resource Conservation and Recovery Act
REW	R.E.W. Environmental Consultants
RFI	Request for Information
RTN	Release Tracking Number
SCDM	Superfund Chemical Data Matrix
SI	Site Investigation
SIP	Site Inspection Prioritization
SIW	Site Inspection Worksheet
SOP	Standard Operation Procedure
SOW	Scope of Work
SR	Site Reassessment
START	Superfund Technical Assistance and Response Team
SVOC	Semivolatile organic compound
T&B	Tighe & Bond
TCDF	Tetrachlorodibenzofuran.
TCLP	Toxicity characteristic leaching procedure
TDD	Technical Direction Document
TDL	Target Distance Limit
TKN	Total Kjedahl Nitrogen
TMDL	Total Maximum Daily Load
TPH	Total Petroleum Hydrocarbons
VOC	Volatile organic compound
W&C	Woodard & Curran
XRF	X-Ray Fluorescence
yd^3	cubic yard

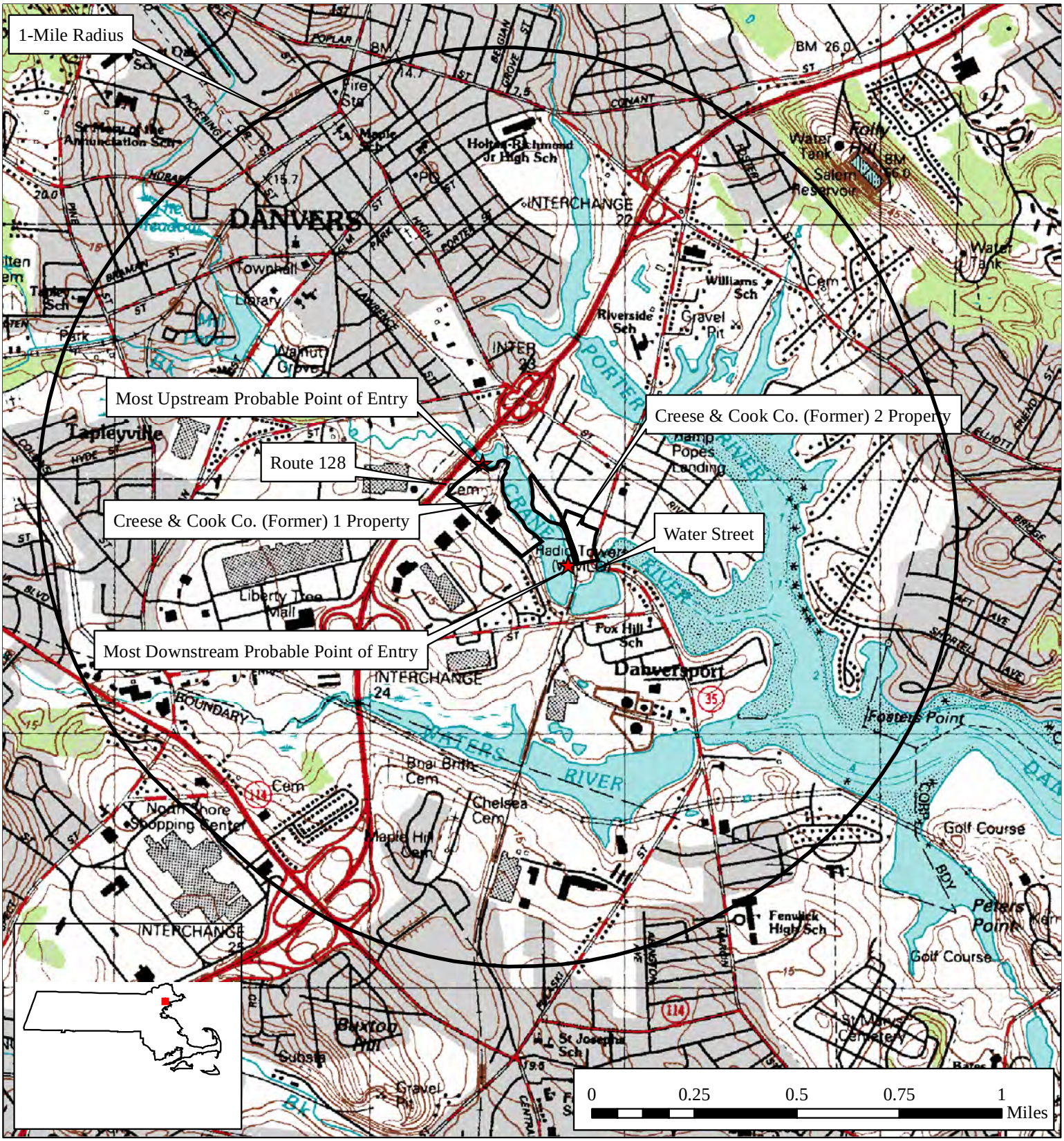

Figure 1

Site Location Map

Creese & Cook Tannery (Former)
Danvers, Massachusetts

EPA Region I
Superfund Technical Assessment and Response Team (START) III
Contract No. EP-W-05-042

TDD Number:	11-12-0002
Created by:	D. Brammer
Created on:	12 January 2010
Modified by:	G. Hornok
Modified on:	10 August 2012

Data Sources:
Topos: MicroPath/USGS
Quadrangle Name(s): Salem, MA 1985
All other data: Weston START (Ref. 11, 12; 19)

WESTON SOLUTIONS
The Trusted Integrator for Sustainable Solutions

Figure 2

Site Map

Creese & Cook Tannery (Former)
Danvers, Massachusetts

EPA Region I
Superfund Technical Assessment and Response Team (START) III
Contract No. EP-W-05-042

TDD Number:	11-12-0002
Created by:	D. Brammer
Created on:	11 January 2010
Modified by:	G. Hornok
Modified on:	10 August 2012

LEGEND

- **55 Clinton Avenue Parcel**
- **33 Water Street Parcel**
- **20 Cheever Street Parcel**
- **MBTA ROW Parcel**
- **Fenced Imminent Hazard Areas**
- **Source Areas**
- **Cemetery**
- **Beamhouse Footprint**
- **On-Site Disposal Cell**
- **Probable Point of Entry (PPE)**
- **PPE Frontage**

N

0 50 100 200 Feet

Data Sources:
Imagery: Massachusetts GIS, 2008 Orthoimagery
All other data: Weston START
References 11, 12

WESTON SOLUTIONS
The Trusted Integrator for Sustainable Solutions

Figure 3a
Soil/Source Sample Location Map A

Creese & Cook Tannery (Former)
Danvers, Massachusetts

EPA Region I
Superfund Technical Assessment and Response Team (START) III
Contract No. EP-W-05-042

TDD Number:	11-12-0002
Created by:	G. Hornok
Created on:	17 November 2011
Modified by:	G. Hornok
Modified on:	10 August 2012

LEGEND

- Dec. 2011 Soil/Source Sample
- May 2011 Soil/Source Sample
- 55 Clinton Ave Parcel
- Source Areas
- Fenced Imminent Hazard Areas
- Beamhouse Footprint
- Cemetery

0 25 50 100 150 Feet

Data Sources:
Imagery: Massachusetts GIS, Orthoimagery, 2008
All other data: Weston START, (Ref. 11)

WESTON SOLUTIONS
The Trusted Integrator for Sustainable Solutions

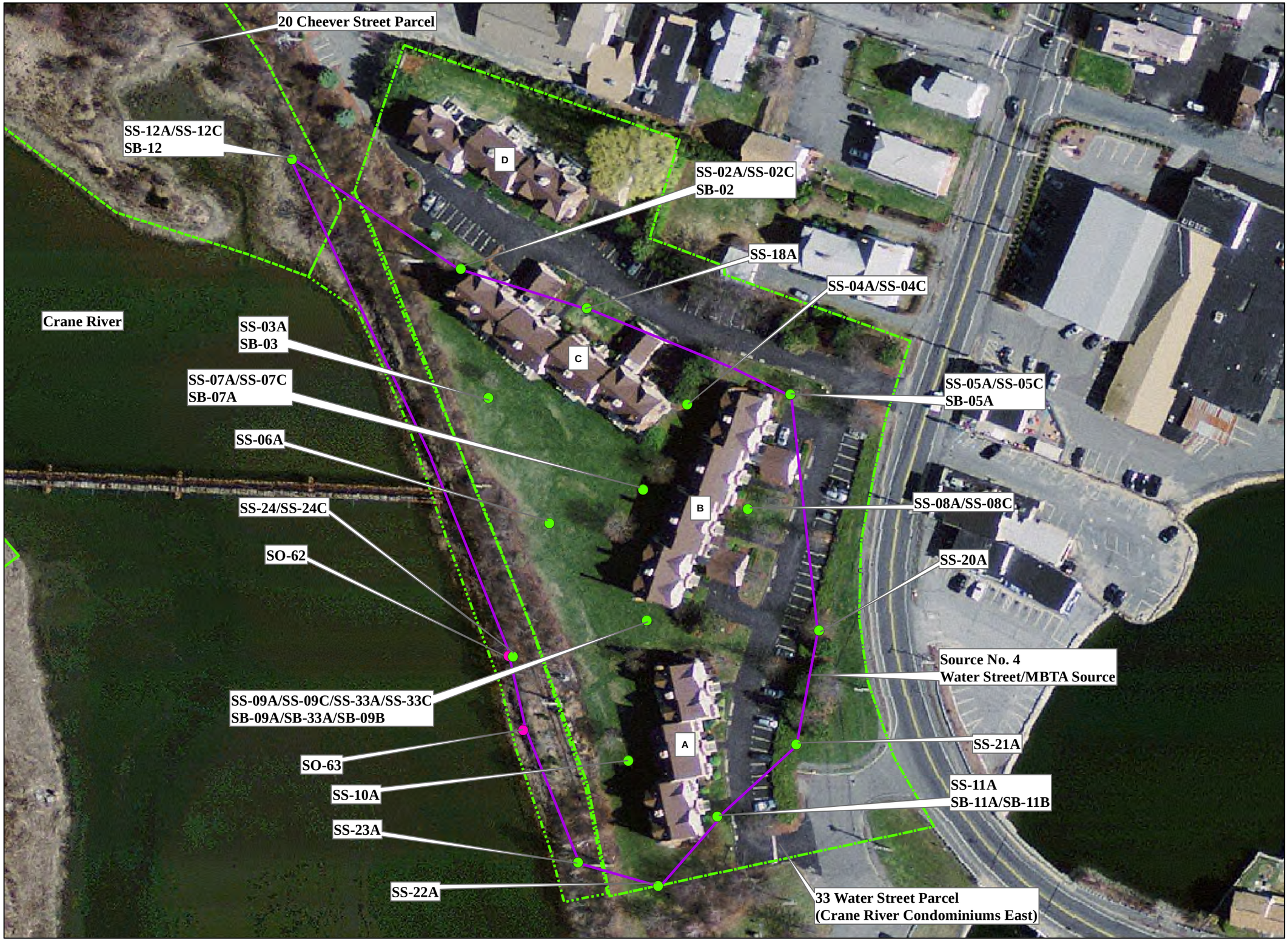

Figure 3b

Soil/Source Sample Location Map B

Creese & Cook Tannery (Former)
Danvers, Massachusetts

EPA Region I
Superfund Technical Assessment and Response Team (START) III
Contract No. EP-W-05-042

TDD Number:	11-12-0002
Created by:	G. Hornok
Created on:	17 November 2011
Modified by:	G. Hornok
Modified on:	10 August 2012

LEGEND

- April 2011 Soil/Source Sample
- Dec. 2011 Soil/Source Sample
- Source Areas
- 33 Water St Parcel
- 20 Cheever St Parcel
- 55 Clinton Ave Parcel
- MBTA ROW Parcel
- A — Condominium Building Designation

N

0 25 50 100 Feet

Data Sources:

Imagery: Massachusetts GIS, Orthoimagery, 2008
All other data: Weston START, (Ref. 11)

WESTON SOLUTIONS
The Trusted Integrator for Sustainable Solutions

Figure 4a

Target Distance Limit

Creese & Cook Tannery (Former)
Danvers, Massachusetts

EPA Region I
Superfund Technical Assessment and Response Team (START) III
Contract No. EP-W-05-042

TDD Number:	11-12-0002
Created by:	D. Brammer
Created on:	20 January 2010
Modified by:	B. Mace
Modified on:	12 July 2012

Legend

- **Site Boundary**
- **Source Areas**
- **SWP**
- **Probable Point of Entry (PPE)**

Data Sources:
Topos: MicroPath
Quadrangle Name(s): Salem, MA 1985
Imagery: MASSGIS, 1992; 1997
USA Topo Maps 2011 National Geographic Society
NWI Data: USGS, 2010
All other data: START

WESTON SOLUTIONS
The Trusted Integrator for Sustainable Solutions

Figure 4b

Sediment Sample Location Map

Creese & Cook Tannery (Former)
Danvers, Massachusetts

EPA Region I
Superfund Technical Assessment and Response Team (START) III
Contract No. EP-W-05-042

TDD Number:	11-12-0002
Created by:	G. Hornok
Created on:	17 November 2011
Modified by:	G. Hornok
Modified on:	9 April 2012

Legend

- May 2011 Sediment Sample
- Dec. 2011 Sediment Sample
- Source Areas
- PPE Frontage
- Probable Point of Entry (PPE)
- **Downstream Flow**
- **Upstream Flow/ Tidal Influence**

0 125 250 500 Feet

Data Sources:

Imagery: Massachusetts Orthoimagery, 2008
All other data: Weston START
References 11, 12

WESTON SOLUTIONS
The Trusted Integrator for Sustainable Solutions

Figure 5

Area A Surface Soil Sample Location Map

Creese & Cook Tannery (Former)
Danvers, Massachusetts

EPA Region I
Superfund Technical Assessment and Response Team (START) III
Contract No. EP-W-05-042

TDD Number:	11-12-0002
Created by:	G. Hornok
Created on:	17 November 2011
Modified by:	G. Hornok
Modified on:	10 August 2012

LEGEND

- May 2011 Surface Soil Sample
- Dec. 2011 Surface Soil Sample
- Area A
- 33 Water St Parcel
- 20 Cheever St Parcel
- MBTA ROW Parcel
- A — Condominium Building Designation

Data Sources:

Imagery: Microsoft Bing Maps 2012
All other data: Weston START (Ref. 12)

Creese & Cook Co. (Former)
MAD001031574

HRS Documentation Record
September 2012

The Trusted Integrator for Sustainable Solutions

REFERENCES

Ref.
No. Description of the Reference

[1] U.S. Environmental Protection Agency (EPA). 1990. *Hazard Ranking System; Final Rule*, 40 CFR Part 300, Appendix A. The complete *Hazard Ranking System; Final Rule* is available from http://www.epa.gov/superfund/sites/npl/hrsres/index.htm#HRS%20 Rule. 14 December. Excerpt. 96 pages.

[2] Reference Number Reserved.

[3] Reference Number Reserved.

[4] U.S. Environmental Protection Agency (EPA). 2012. *Superfund Chemical Data Matrix (SCDM)*. Available from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm. 31 March. Excerpt. 20 pages.

[5] Mace, B. Weston Solutions, Inc., Superfund Technical Assistance and Response Team III (START). 2012. Project Note, Creese & Cook Site, RE: Latitude/Longitude Calculations. TDD No. 11-12-0002. 9 April. 2 pages.

[6] U.S. Environmental Protection Agency (EPA). 2012. Superfund Information Systems, Creese & Cook Co (Former) 1 Site Information. Available from http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0100380. Internet accessed 23 July. 2 pages.

[7] U.S. Environmental Protection Agency (EPA). 2012. Superfund Information Systems, Creese & Cook Co (Former) 2 Site Information. Available from http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0105956. Internet accessed 23 July. 2 pages.

[8] Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2011. *Site Assessment Program Site-Specific Quality Assurance Project Plan for Surface Soil/Source and Sediment Sampling, Creese & Cook Co. (Former) 1 Site Reassessment, Danvers, Massachusetts*. TDD No. 09-11-0005. 18 April. 90 pages.

[9] Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2011. *Creese & Cook Co. (Former) 1 Site-Specific Quality Assurance Project Plan (QAPP) Addendum for Additional Soil/Source and Sediment Sampling*. TDD No. 01-09-11-0005. 22 November. 20 pages.

[10] Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2011. *Site Assessment Program Site-Specific Quality Assurance Project Plan for Surface and Subsurface Soil/Source Sampling, Creese & Cook Co. (Former) Combined 2 Preliminary Assessment/Site Inspection, Danvers, Massachusetts*. TDD No. 10-03-0005. 21 January. 83 pages.

[11] Weston Solutions, Inc. 2011. Field Logbook Notes, Creese & Cook Co. (Former) 1. TDD No. 09-11-0005. 27 pages.

[12] Weston Solutions, Inc. 2011. Field Logbook Notes, Creese & Cook Co. (Former) 2. TDD

REFERENCES

Ref.
No. Description of the Reference

No. 10-03-0005. 17 pages.

[13] Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. *Trip Report for Creese & Cook Co. (Former) 1 Site Reassessment, Danvers, Massachusetts*. TDD No. 09-11-0005. 5 July. 136 pages.

[14] Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2011. *Trip Report for Creese & Cook Co. (Former) 2 Combined Preliminary Assessment/Site Investigation, Danvers, Massachusetts*. TDD No. 10-03-0005. 15 September. 199 pages.

[15] Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. *Final Report for Creese & Cook Co. (Former) 1 Site Reassessment, Danvers, Massachusetts*. TDD No. 09-11-0005. 8 August 2012. 240 pages.

[16] Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. *Final Report for Creese & Cook Co. (Former) 2 Site Inspection, Danvers, Massachusetts*. TDD No. 10-03-0005. 20 July. 350 pages.

[17] Town of Danvers. 1970. Tax Map Index, Map 58, Map 59. Danvers Tax Assessors Office, obtained 5 April, 2012. 3 Pages

[18] Town of Danvers. 2012. Unofficial Property Record Cards. Danvers Tax Assessors Office, obtained 5 April. 62 pages.

[19] United States Department of the Interior, Geologic Survey. 1985. Salem, Massachusetts, 1:25,000-scale Metric Topographic Map. 1 page

[20] Mace, B. Weston Solutions, Inc., Superfund Technical Assistance and Response Team III (START). 2012. Project Note, Creese & Cook (Former). Latitude and Longitude of Source Areas. 9 July. 2 pages.

[21] Mace, B. Weston Solutions, Inc., Superfund Technical Assistance and Response Team III (START). 2012. Project Note, Creese & Cook (Former). Source Area Calculations. 29 March. 3 pages.

[22] Kelly, J. Weston Solutions, Inc., Superfund Technical Assistance and Response Team III (START). 2012. Project Note, Creese & Cook (Former). Observed Release by Direct Observation. 7 June. 15 pages.

[23] Sharp, R. Weston Solutions, Inc., Superfund Technical Assistance and Response Team III (START). 2012. Project Note, Creese & Cook (Former). Distance between sediment sample locations and probably point of entry. 29 March. 3 pages.

[24] Hornok, G. Weston Solutions, Inc., Superfund Technical Assistance and Response Team III (START). 2012. Wetland Delineation Memorandum. 15 February. 25 pages.

REFERENCES

Ref. No. | Description of the Reference

[25] Weston Solutions, Inc. 2011. Field Data Sheets, Creese & Cook Co., RE: Sediment Sample Description Field Data Sheets. TDD No. 09-11-0005. 32 pages.

[26] Weston Solutions, Inc. 2011. Field Data Sheets, Creese & Cook Co., RE: Soil/Source Sample Description Field Data Sheets. TDD No. 09-11-0005. 37 pages.

[27] Weston Solutions, Inc. 2011. Field Data Sheets, Creese & Cook Co. (Former) 2, RE: Surface/Subsurface Soil Sample Description Field Data Sheets. 77 pages.

[28] U.S. Environmental Protection Agency (EPA). 2011. Contract Laboratory Program, Organic Chain of Custody Records. 19 pages.

[29] U.S. Environmental Protection Agency (EPA). 2011. Contract Laboratory Program, Inorganic Chain of Custody Records. 30 pages.

[30] Town of Danvers. 1897. Part of the Town of Danvers Map Plate. Available from www.salemdeeds.com. Internet accessed 15 January 2010. 1 page.

[31] Southern Essex District Registry of Deeds. 1911. Plan Map, Plan Book 2119, Plan 495. Available from www.salemdeeds.com. 29 December. Internet accessed 15 January 2010. 1 page.

[32] Danvers Historical Society. 1946. The Historical Collections of the Danvers Historical Society, Volume 34. 10 pages.

[33] Massachusetts Department of Environmental Quality Engineering (MADEQE). 1984. Memorandum Regarding Danvers – Creese & Cook Site Investigation. 8 March. 3 pages.

[34] SP, Inc. 1984. Engineering Report for Danversport Tanning Co., including May 1984 Subsurface Hazardous Waste Investigation at Crane River Real Estate Trust and December 1985 Appendix. May. 73 pages.

[35] State Board of Health of Massachusetts. 1911. Forty Second Annual Report (for the year 1910), Public Document No. 34. Available (PDF) from http://books.google.com. Internet accessed 5 January 2010. 3 pages.

[36] Massachusetts Department of Environmental Quality Engineering (MADEQE). 1985. Danvers – Site Inspection Report on Danversport/Creese & Cook Tannery. 12 March. 16 pages.

[37] Essex Registry of Deeds South District. 1950. Plan Showing Easement for 8-inch Sanitary Sewer to Clinton Avenue, Plan Book 80, Plan 100. Available from http://www.salemdeeds.com/plan_images.asp?book=80&page=100&searchtype=plan_bookpage. October. Internet accessed 15 January 2010. 1 page.

[38] U.S. Environmental Protection Agency (EPA). 1980. Memorandum regarding citizen complaint for Creese & Cook Tannery to MADEQE. 5 October. 2 pages.

REFERENCES

Ref.
No. Description of the Reference

[39] Massachusetts Department of Environmental Quality Engineering (MADEQE). 1981. Danvers: Creese & Cook Tannery – Beamhouse sludge disposal. 11 February. 4 pages.

[40] U.S. Environmental Protection Agency (EPA). 1981. Potential Hazardous Waste Site Identification and Preliminary Assessment (PA), Site Number MA-00980. 4 pages.

[41] Mace, B. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START), 2012. Project Note: Surface Water Pathway (SWP) Target Distance Limit (TDL) description and flow rate calculation for the Creese & Cook Tannery (Former) site. 23 July. 9 pages.

[42] Massachusetts Department of Environmental Quality Engineering (MADEQE). 1985. Letter to Rivers Edge Realty Trust, RE: Danvers – Former Creese & Cook Tannery Site. 16 May. 3 pages.

[43] Poole, B. SP, Inc. 1986. Letter Report RE: Danversport Tanning. 10 September. 8 pages.

[44] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Memorandum to the Creese & Cook Tannery (Former) Site File Re: Detected Chromium and Dioxin Results in Equipment Blanks associated with soil and sediment samples collected from the Creese & Cook Site, Danvers, Essex County Massachusetts. 30 July. 69 page.

[45] Scesny, C. Weston Solutions, Inc., Superfund Technical Assistance and Response Team III (START). 2012. Project Note: To identify the sample nomenclature used throughout the Creese & Cook Tannery (Former) HRS documentation Record. 26 July. 6 pages

[46] Poole, B. SP Engineering, Inc. 1990. Letter to Water Street Realty Trust RE: Stabilization Project – Status Report. 30 July. 2 pages.

[47] R.E.W. Environmental Consultants. 1995. Initial Site Characterization, Creese & Cook Tannery, Danvers, Massachusetts, Massachusetts General Law Chapter 21E, Implementing Regulations 310 CMR 40.000. July. 108 pages.

[48] SP Engineering, Inc. 1994. Chapter 21E Site Assessment, 25 Clinton Avenue, Danvers, MA. April. 108 pages.

[49] Poole, B. SP, Inc. 1990. Letter to Mr. Tracy Flagg, Danvers Board of Health RE: Crane River Project. 28 February. 7 pages.

[50] Macri, L. 2012. Letter to N. Smith (EPA New England), RE: Case No. 42048. SDG No. A3XC3. Creese & Cook Co. (Former) 1. Dioxins/Furans in Soil.. 1 March. 74 pages.

[51] Macri, L. 2011. Letter to C. Clark (U.S. EPA Region), RE: Case No. 41343. SDG No. A3X25. Creese & Cook Co. (Former) 1. Dioxins/Furans in Soil. 25 August. 61 pages.

[52] Macri, L. 2011. Letter to C. Clark (U.S. EPA Region 1), RE: Case No. 41343. SDG No. A3TS9. Creese & Cook Co. (Former) 1. Dioxins/Furans in Soil.. 23 August. 68 pages.

REFERENCES

Ref.
No. Description of the Reference

[53] Macri, L. 2011. Letter to C. Clark (U.S. EPA Region 1), RE: Case No. 41202. SDG No. A3TT9. Creese & Cook Co. (Former) 2. Dioxins/Furans in Soil.. 7 July. 81 pages.

[54] Macri, L. 2011. Letter to C. Clark (U.S. EPA Region 1), RE: Case No. 41202. SDG No. A3TW7. Creese & Cook Co. (Former) 2. Dioxins/Furans in Soil.. 11 July. 77 pages.

[55] Macri, L. 2011. Letter to C. Clark (U.S. EPA Region 1), RE: Case No. 41202. SDG No. A3TX5. Creese & Cook Co. (Former) 2. Dioxins/Furans in Soil. 19 July. 76 pages.

[56] Macri, L. 2011. Letter to C. Clark (U.S. EPA Region 1), RE: Case No. 41202. SDG No. A3TW5. Creese & Cook Co. (Former) 2. Dioxins/Furans in Soil. 14 July. 79 pages.

[57] Burton, J. (START). 2012. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 42047. SDG No. MA3XC3. Creese & Cook Co. (Former) 1. Metals in soil. TDD No. 09-11-0005. 13 February. 62 pages.

[58] Burton, J. (START). 2011. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 41341. SDG No. MA3X28. Creese & Cook Co. (Former) 1. Metals in Soil. TDD No. 09-11-0005. 7 October. 51 pages.

[59] Burton, J. (START). 2011. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 41341. SDG No. MA3TS9. Creese & Cook Co. (Former) 1. Metals in Soil. TDD No. 09-11-0005. 6 October. 54 pages.

[60] Burton, J. (START). 2011. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 41202. SDG No. MA3TT9. Creese & Cook Co. (Former) 2. Metals in Soil. TDD No. 10-03-0005. 8 August. 59 pages.

[61] Burton, J. (START). 2011. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 41202. SDG No. MA3TW0. Creese & Cook Co. (Former) 2. Arsenic and Chromium in Soil. TDD No. 10-03-0005. 8 August. 47 pages.

[62] Burton, J. (START). 2011. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 41202. SDG No. MA3TX3. Creese & Cook Co. (Former) 2. Metals in Soil. TDD No. 10-03-0005. 25 August. 67 pages.

[63] Burton, J. (START). 2011. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 41202. SDG No. MA3TX4. Creese & Cook Co. (Former) 2. Arsenic and Chromium in Soil. TDD No. 10-03-0005. 11 August. 42 pages.

[64] Burton, J. (START). 2011. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 41202. SDG No. MA3TX5. Creese & Cook Co. (Former) 2. Metals in Soil. TDD No. 10-03-0005. 29 August. 57 pages.

[65] Macri, L. 2011. Letter to C. Clark (U.S. EPA Region 1), RE: Case No. 41343. SDG No. A3TT5. Creese & Cook Co. (Former) 1. Dioxins/Furans in Soil. 15 August. 74 pages.

REFERENCES

Ref. No. Description of the Reference

[66] Macri, L. 2011. Letter to N. Smith (U.S. EPA Region 1), RE: Case No. 41343. SDG No. A3TT7. Creese & Cook Co. (Former) 1. Dioxins/Furans in Soil. 15 August. 67 pages.

[67] Macri, L. 2012. Letter to N. Smith (U.S. EPA New England), RE: Case No. 42048. SDG No. A3XE6. Creese & Cook Co. (Former) 1. Dioxins/Furans in Sediment. 2 March. 82 pages.

[68] Burton, J. (START). 2011. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 41342. SDG No. MA3WM1. Creese & Cook Co. (Former) 1. Metals in Sediment. TDD No. 09-11-0005. 4 October. 57 pages.

[69] Burton, J. (START). 2011. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 41342. SDG No. MA3WT8. Creese & Cook Co. (Former) 1. Metals in Sediment. TDD No. 09-11-0005. 3 October. 54 pages.

[70] Burton, J. (START). 2012. Letter to N. Smith (U.S. EPA Region 1 – New England), RE: Case No. 42047. SDG No. MA3XE0. Creese & Cook Co. (Former) 1. Metals in Sediment. TDD No. 09-11-0005. 26 January. 44 pages.

[71] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Dioxin/Furan Analytical Data, RE: Case 42048. SDG A3XC3. TDD No. 11-12-0002. 15 March. 154 pages.

[72] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Dioxin/Furan Analytical Data, Case 41343. SDG A3X25. TDD No. 11-12-0002. 22 March. 116 pages.

[73] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Dioxin/Furan Analytical Data, Case 41343. SDG A3TS9. TDD No. 11-12-0002. 23 March. 134 pages.

[74] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 2, RE: Adjusted Values for Dioxin/Furan Analytical Data, Case 41202. SDG A3TT9. TDD No. 11-12-0002. 15 March. 154 pages.

[75] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 2, RE: Adjusted Values for Dioxin/Furan Analytical Data, Case 41202. SDG A3TW7. TDD No. 11-12-0002. 26 March. 149 pages.

[76] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 2, RE: Adjusted Values for Dioxin/Furan Analytical Data, Case 41202. SDG A3TX5. TDD No. 11-12-0002. 23 March. 129 pages.

REFERENCES

Ref.
No. Description of the Reference

[77] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 2, RE: Adjusted Values for Dioxin/Furan Analytical Data, Case 41202. SDG A3TW5. TDD No. 11-12-0002. 27 March. 144 pages.

[78] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Total Metals Data, Case 42047. SDG MA3XC3. TDD No. 11-12-0002. 1 March. 158 pages.

[79] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Total Metals Data, Case 41341. SDG MA3X28. TDD No. 11-12.0002. 15 March. 114 pages.

[80] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Total Metals Data, Case 41341. SDG MA3TS9. TDD No. 11-12-0002. 15 March. 140 pages.

[81] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 2, RE: Adjusted Values for Total Metals Data, Case 41202. SDG MA3TT9. TDD No. 11-12-0002. 8 March. 154 pages.

[82] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 2, RE: Adjusted Values for Total Metals Data, Case 41202. SDG MA3TW0. TDD No. 11-12-0002. 9 March. 107 pages.

[83] Lambert, T. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 2, RE: Adjusted Values for Total Metals Data, Case 41202. SDG MA3TX3. TDD No. 11-12-0002. 16 March. 142 pages.

[84] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 2, RE: Adjusted Values for Total Metals Data, Case 41202. SDG MA3TX4. TDD No. 11-12-0002. 9 March. 93 pages.

[85] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 2, RE: Adjusted Values for Total Metals Data, Case 41202. SDG MA3TX5. TDD No. 11-12-0002. 19 March. 125 pages.

[86] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Dioxin/Furan Analytical Data, Case 41343. SDG A3TT5. TDD No. 11-12-0002. 22 March. 137 pages.

REFERENCES

Ref. No. | Description of the Reference

[87] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Dioxin/Furan Analytical Data, Case 41343. SDG A3TT7. TDD No. 11-12-0002. 19 March. 129 pages.

[88] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Dioxin/Furan Analytical Data, Case 42048. SDG A3XE6. TDD No. 11-12-0002. 21 March. 121 pages.

[89] Lambert, T. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Total Metals Data, Case 41342. SDG MA3WM1. TDD No. 11-12-0002. 13 March. 149 pages.

[90] Lambert, T. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Total Metals Data, Case 41342. SDG MA3WT8. TDD No. 11-12-0002. 13 March. 122 pages.

[91] Burton, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2012. Project Note, Creese & Cook Co. (Former) 1, RE: Adjusted Values for Total Metals Data, Case 42047. SDG MA3XE0. TDD No. 11-12-0002. 29 February. 145 pages.

[92] Poole, B. SP Engineering, Inc. 1991. Letter to Mr. Steve Johnson, MADEP RE: Completion of Stabilization Project. 21 February. 4 pages.

[93] R.E.W. Environmental Consultants. 1995. Immediate Response Action Plan, Arsenic & Chromium, Creese & Cook Tannery, Danvers, Massachusetts. September. 16 pages.

[94] Massachusetts Department of Environmental Protection (MassDEP). 2012. Searchable Site List. Available from http://public.dep.state.ma.us/SearchableSites/Site_Info.asp?textfield_RTN=3-0000303. Internet accessed 10 July. 1 page.

[95] Stone & Webster Environmental Technology & Services (Stone & Webster). 1996. Site Inspection Prioritization (SIP) Report. October. 49 pages.

[96] Reference Number Reserved.

[97] R.E.W. Environmental Consultants. 1997. Volume I Supplemental Site Characterization, Former Creese & Cook Tannery Beamhouse, 25 Clinton Avenue, Danvers, Massachusetts. 20 June. 52 pages.

[98] R.E.W. Environmental Consultants, Inc. (REW). 1997. Letter Report RE: Imminent Hazard Evaluation for Area C at the Former Creese & Cook Tannery, 25 Clinton Avenue, Danvers, Massachusetts, Tier 1B, RTN 3-12711. 18 March. 32 pages.

REFERENCES

Ref.
No. Description of the Reference

[99] Geomega. 1997. Memorandum, Results of Bioavailability Experiment. 5 March. 5 pages.

[100] R.E.W. Environmental Consultants, Inc. 1997. Site Summary Profile and Release Abatement Measure Plan, Former Creese & Cook Tannery Beamhouse, 25 Clinton Avenue, Danvers, Massachusetts, RTN 3-0303. 26 June. 36 pages.

[101] R.E.W. Environmental Consultants, Inc. 1997. Phase III Selection of Comprehensive Remedial Actions, Remedial Action Plan, Phase IV Remedy Implementation Plan, Former Creese & Cook Tannery Beamhouse, 25 Clinton Avenue, Danvers, Massachusetts. 20 August. 43 pages.

[102] Leathernet, Leather Industry Worldwide. 2012. Tanning. Available from http://www.leathernet.com/tanning.htm. Internet accessed 21 June. 2 pages.

[103] R.E.W. Environmental Consultants, Inc. 1998. Supplemental Phase III Selection of Comprehensive Remedial Actions, Remedial Action Plan, Phase IV Remedy Implementation Plan, Former Creese & Cook Tannery Beamhouse, 25 Clinton Avenue, Danvers, Massachusetts. 3 April. 157 pages.

[104] U.S. Environmental Protection Agency (EPA). 2008. Reregistration Eligibility Decision for Pentachlorophenol. 25 September. 103 pages.

[105] U.S. Department Of Health And Human Services, Agency for Toxic Substances and Disease Registry. 2001. Toxicological Profile for Pentachlorophenol. September. 316 pages.

[106] Warren, D. R.E.W. Environmental Consultants, Inc. 2001. Letter RE: Synopsis Sediment Testing in the Porter River, Danvers River, Crane River, and Waters River, Danvers, Massachusetts. 19 November. 63 pages.

[107] Dalton, D.L., Leather International Magazine. 2008. New Generation Fungicide for the Leather Industry. Available from http://www.leathermag.com/news/fullstory.php/aid/13476/New_generation_fungicide_for_the_leather_industry. 31 October. 3 pages

[108] Massachusetts Department of Environmental Protection (MassDEP). 2004. Notice of Responsibility & Designation of Interim Deadline; MGL c. 21E & 310 CMR 40.0000 to Orchard Farm Trust, RE: Danvers – Former Creese & Cook Tannery, 25 Clinton Avenue RTNs 3-0303 & 3-12711. 16 July. 3 pages.

[109] Town of Danvers. 2010. Official Property Record Card for 55 Clinton Avenue, Map 059, Lot 002B. Danvers Tax Assessors Office, obtained 21 January. 2 pages.

[110] U.S. Department Of Health And Human Services, Agency for Toxic Substances and Disease Registry. 1998. Toxicological Profile for Chlorinated Dibenzo-p-Dioxins December. 712 pages.

[111] World Bank, International Finance Corporation. 2007. Environmental, Health, and Safety

REFERENCES

Ref.
No. Description of the Reference

Guidelines for Tanning and Leather Finishing. Available from http://www1.ifc.org/wps/wcm/connect/de6c3d00488556f2bb14fb6a6515bb18/Final%2B-%2BTanning%2Band%2BLeather%2BFinishing.pdf?MOD=AJPERES&id=1323152378134. 30 April. 21 pages.

[112] W&C, Inc. (W&C). 2006. MCP Immediate Response Action Plan Modification, Former Creese & Cook Tannery, 25 Clinton Avenue, Danvers, MA, RTN 3-0303 & 3-12711. 9 November. 75 pages.

[113] W&C, Inc. (W&C). 2006. MCP Immediate Response Action Status Report, Former Creese & Cook Tannery, 25 Clinton Avenue, Danvers, MA, RTN 3-0303 & 3-12711. 14 December. 147 pages.

[114] Massachusetts Department of Environmental Protection. 2006. Massachusetts Department of Environmental Protection (MassDEP) 2006 BWSC-101 Release Log Form, Oral Notification of Asbestos in Demolition Debris and assignment of RTN 3-26474. 14 December. 4 pages.

[115] Fisher, B. 1991. Journal of Pesticide Reform, Pentachlorophenol: Toxicology and Environmental Fate. Spring. 4 pages.

[116] OSPAR Commission. 2001 (2004 Update). Hazardous Substance Series, Pentachlorophenol. 31 pages.

[117] Massachusetts Department of Environmental Protection . 2009. Notice of Responsibility RE: Former Creese & Cook Tannery, 55 Clinton Avenue, Danvers, MA, RTNs 3-0303, 3-12711, & 3-26474 to Orchard Farm Trust. 4 June. 4 pages.

[118] Massachusetts Office of Attorney General (AG). 2009. Press Release. RE: AG Files Suit Against Owner of Contaminated Site in Danvers. 12 June. (Available from http://www.mass.gov/ago/news-and-updates/press-releases/2009/attorney-general-martha-coakleys-office-files-1.html. Internet accessed 5 January 2010). 2 pages.

[119] Massachusetts Office of Attorney General (AG). 2009. Press Release RE: Attorney General Martha Coakley Obtains Preliminary Injunction Against Owner of Contaminated Site in Danvers. 25 June. (Available from http://www.mass.gov/ago/news-and-updates/press-releases/2009/ag-obtains-preliminary-injunction-against.html. Internet accessed 14 January 2010). 1 page.

[120] W&C, Inc. (W&C). 2007. Letter RE: Fence Requirement at Former Creese & Cook Tannery, 25 Clinton Avenue, Danvers, MA, RTN 3-0303 & 3-12711. 13 June. 1 page.

[121] MassDEP (Massachusetts Department of Environmental Protection). 2008. Letter to Orchard Farm Trust RE: Danvers – Former Creese & Cook Tannery, 55 Clinton Avenue, 5 September 2008 Enforcement Conference. 10 September. 6 pages.

[122] ProScience Analytical Services, Inc. 2008. Letter Report of Asbestos Analytical Results to MassDEP, Wilmington, MA. 10 October. 5 pages.

REFERENCES

Ref.
No. Description of the Reference

[123] SP, Inc. 1987. Tannery Waste Solidification Project, Crane River West Condominiums, 25 Clinton Avenue, Danvers, MA 01923. October. 40 Pages.

[124] SP, Inc. 1988. Tannery Waste Solidification Project, Crane River West Condominiums, 25 Clinton Avenue, Danvers, MA 01923. March. 72 pages.

[125] Massachusetts Department of Environmental Protection (MassDEP). 1991. Letter to S.P. Engineering, Inc. RE: Danvers – Former Creese & Cook Tannery, Clinton Ave., DEP Case No. 3-0303. 17 April. 3 pages.

[126] Massachusetts Department of Environmental Protection (MassDEP). 1995. Memorandum for the Record, SUBJECT: Danvers, RTN 3-0303, Creese & Cook Tannery - 25 Clinton Ave. 6 November. 6 pages.

[127] Massachusetts Department of Environmental Protection (MassDEP). 1998. Notice of the Need to Conduct an Immediate Response Action and Interim Deadlines. 20 January. 4 pages.

[128] Reference Number Reserved.

[129] Geological Field Services, Inc. (GFS). 2005. Letter to MassDEP RE: Limited Assessment of Wetland Resource Areas, Former Creese & Cook Tannery, 23 Clinton Ave, Danvers. RTNs 3-0303 and 3-12711, Tier IC Permit #W054230. 6 June. 128 pages.

[130] Reference Number Reserved.

[131] W&C, Inc. (W&C). 2007. *MCP Immediate Response Action Status Report, Former Creese & Cook Tannery, 25 Clinton Ave, Danvers, MA*. RTN 3-12711 & 3-26474. 16 August. 218 pages.

[132] W&C, Inc. (W&C). 2007. Letter to MassDEP, SUBJECT: Tier I Major Permit Modification and Extension Application, 25 Clinton Avenue, Danvers, MA, RTN 3-0303 & 3-12711, Tier I Permit No. 104028. 25 June. 36 pages.

[133] Town of Danvers. 2007. Letter Application. RE: EPA Brownfields Assessment Grant, FY 2008. 11 October. 21 pages.

[134] Massachusetts Department of Environmental Protection (MassDEP). 2008. Meeting Attendance Sheet, Enforcement Conference – Former Creese & Cook Tannery. 5 September. 1 page.

[135] Decoulos, James J., Decoulos & Company- 2009. Email Letter Re: Former Creese & Cook beam house site, 25 Clinton Avenue, Danvers; MassDEP RTNs 3-12711, 3-26474 and Commonwealth v. Decoulos, Suffolk Superior Court Civil Action No. 09-2439-E. 30 December. 12 pages.

[136] Reference Number Reserved.

REFERENCES

Ref.
No. Description of the Reference

[137] MassDEP (Massachusetts Department of Environmental Protection). 2008. RE: Danvers – Former Creese & Cook Tannery, 55 Clinton Avenue, Request for Property Access. 22 September. 2 pages.

[138] Reference Number Reserved.

[139] Massachusetts Department of Environmental Protection (MassDEP). 2006. Memorandum. RE: Danvers/Creese & Cook Tannery, DEP RTN 3-0303, Technical Evaluation. 19 May. 6 pages.

[140] U.S. Environmental Protection Agency. 1996. *Using Qualified Data to Document an Observed Release and Observed Contamination.* November. 18 pages.

[141] U.S. Environmental Protection Agency. 2009. Analytical Services Branch, Statement of Work for Analysis of Chlorinated Dibenzo-p-dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs), Multi-Media, Multi-Concentration, DLM02.2. December. Excerpt. 4 pages.

[142] U.S. Environmental Protection Agency. 2010. Contract Laboratory Program, Statement of Work for Inorganic Superfund Methods, (Multi-Media, Multi-Concentration), ISM01.2. January. Excerpt. 3 pages

[143] Massachusetts Department of Environmental Protection (MassDEP). 2007. IRA Conditional Approval Letter and Designation of Interim Deadlines 3-12711 & 3-26474 to Orchard Farm Trust. 11 January. 5 pages.

[144] Massachusetts Department of Environmental Protection (MassDEP). 2007. *Report, North Shore Coastal Watersheds 2002 Water Quality Assessment Report*. Report Number 93-AC-2. March. 198 pages.

[145] Massachusetts Division of Watershed Management. 2010. Massachusetts Year 2010 Integrated List of Waters, *Proposed Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act.* April. 157 pages.

[146] State of Massachusetts. 314 CMR 4.00: Division Of Water Pollution Control, Massachusetts Surface Water Quality Standards. 19 pages.

[147] Massachusetts Department of Environmental Protection (MassDEP). Draft Pathogen TMDL for the North Coastal Watershed. 84 pages.

[148] Massachusetts Department of Environmental Protection (MassDEP). 1995. Memorandum for the Record, Re: Danvers, RTN 3-0303, Creese & Cook Tannery – 25 Clinton Ave, 6 November. 6 pages.

[149] Massachusetts Division of Marine Fisheries, Department of Fish and Game. 2008. Technical Report TR-33, An Evaluation of the Use of Egg Transfers and Habitat Restoration to Establish an Anadromous Rainbow Smelt Spawning Population. July. 19 pages.

REFERENCES

Ref.
No. Description of the Reference

[150] Massachusetts Division of Marine Fisheries, Department of Fish and Game. 2006. Technical Report TR-30, Rainbow smelt (*Osmerus mordax*) spawning habitat on the Gulf of Maine coast of Massachusetts. December. 180 pages.

[151] Kelly, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START). 2011. Project Note. Documentation of Fishing in the Crane River. TDD No. 09-11-0005. 9 August. 2 pages.

[152] Kelly, J. Weston Solutions, Inc., Superfund Technical Assessment and Response Team III (START), 2011. Project Note: Documentation of Fishing in the Crane River. 9 August. 1 page.

[153] SP, Inc. 1984. Subsurface Hazardous Waste Investigations at Crane River Real Estate Trust, 26 Water Street, Danvers, MA. 29 October. 23 pages.

[154] U.S. Environmental Protection Agency. 1981. Review of RCRA Permit Part A (with attached maps). 16 June. 4 pages.

[155] Town of Danvers Office of Human Services. 1980. Report of Alleged Major Code Violations, 33 Water Street. 31 January. 2 pages.

[156] Southern Essex District Registry of Deeds. 1987. Master Deed, Crane River Condominium (East), Plan Book 9131, Plan 491. 13 August. 24 pages.

[157] Massachusetts Department of Environmental Protection (MassDEP). 2012. Reportable Release Lookup, Available at http://public.dep.state.ma.us/SearchableSites/Search.asp. Internet accessed 5 April. 6 pages.

[158] Massachusetts Department of Environmental Protection (MassDEP). 1995. Supplemental Risk Reduction Transmittal Form. 24 Water Street, Danvers, MA. 6 February. 219 pages.

[159] Haley & Aldrich, Inc. 1999. Phase II Comprehensive Site Assessment, Former Manufactured Gas Plant Site, 19 & 21 Merrill Street, Danvers, MA. RTN 3-11970. September. 662 pages.

[160] Tighe & Bond. 2010. Release Abatement Measure Plan, Crane River Seawall Repair Project, Danvers, Massachusetts. August. 101 pages.

[161] TetraTech. 2011. Phase II – Comprehensive Site Assessment and Phase III Evaluation of Comprehensive Remedial Action Alternatives, Route-128 at High Street, Danvers, Massachusetts. 2 December. 138 pages.

[162] Tetra Tech. 2011. *Phase I Initial Site Investigation and Tier Classification, Route-128 at High Street, Danvers, Massachusetts*. 16 July. 852 pages.

[163] Hornok, G. Weston Solutions, Inc., Superfund Technical Assistance and Response Team III (START). 2012. Project Note, Creese & Cook (Former). Distances between Surface Soil Sample locations and residential buildings. 27 March. 7 pages.

REFERENCES

Ref. No. Description of the Reference

[164] Agency for Toxic Substances & Disease Registry (ATSDR). 2010. *Public Health Assessment for the Mohawk Tannery Site, Nashua, New Hampshire*. 19 April. 32 pages.

[165] Agency for Toxic Substances & Disease Registry (ATSDR). 2010. *Public Health Assessment for Pownal Tannery, Pownal, Vermont.* 31 March. 17 pages.

[166] Food and Agricultural Industry. 1997. Section 9.15, Leather Tanning. June. Available from http://www.epa.gov/ttnchie1/ap42/ch09/final/c9s15.pdf. Excerpt. 5 pages.

[167] Blacksmith Institute. *World's Worst Pollution Problems Report 2010*. Top Six Toxic Threats. 76 pages.

[168] Agency for Toxic Substances & Disease Registry (ATSDR). National Drinking Water Regulations, Technical Fact Sheet on Barium. Excerpt. 4 pages.

[169] Baker, D. International Labour Organization's Encyclopedia of Occupational Health and Safety. Excerpt, Chapter 88. Tanning and Leather Finishing. Available at http://www.ilo.org/safework_bookshelf/english?content&nd=857171045. Internet accessed on 9 April 2012. 5 pages.

[170] Patriot Properties, Inc. 2010. Town of Danvers Property Card.

[171] Nuss, J.M., ARCADIS BBL. 2007. Class A-3 Partial Response Action Outcome Statement, Class C-1 Partial Response Action Outcome Statement and Activity and Use Limitation, Former Danvers Manufactured Gas Plant. 12 June. 22 pages.

[172] Wright, W. Town of Danvers Department of Health & Inspections. 1977. Report of Alleged Major Code Violation. 4 January. 2 pages.

[173] National Archives and Records Administration (NARA). 2002. U.S. Code, Title 42: The Public Health and Welfare, Chapter 103: Comprehensive Environmental Response, Compensation, And Liability Act Of 1980 (Superfund), Section sections 9601 - 9675. 176 pages.

SITE SUMMARY – Creese & Cook Tannery (Former)

The Creese & Cook Tannery (Former) facility is located along the east and west banks of the Crane River in Danvers, Essex County, MA, along Clinton Avenue, Cheever and Water Streets (see Figures 1 and 2) [6; 7; 18; 109]. The geographic coordinates of the Creese & Cook Tannery (Former) site, as measured from the approximate location where the steam water/pedestrian footbridge joins the eastern side of the former facility [Source Number (No.) 4], are 42° 33' 11.2" north latitude and 70° 55' 36.2" west longitude (see Figures 1 and 2) [5-7]. According to available file documentation, from approximately the early 1900s to 1981, a leather tannery was operated under the name of Creese & Cook Company (Co.) on the east and west banks of Crane River on the facility properties [17, pp. 1-3; 30; 31; 32, p. 6; 36, p. 1; 37; 129, pp. 106-128; 135, pp. 4, 7].

The Creese & Cook Tannery (Former) site consists of four sources [two pile sources (Leather Scrap Pile and the Upland Pile), one surface impoundment source (Former Lagoons), and one contaminated soil source (Water Street/MBTA Source)], which were documented and sampled as part of the EPA SR of the Creese & Cook Co. (Former) 1 property and the EPA SI of the Creese & Cook Co. (Former) 2 property (see Figure 2) [see Source Characterization sections of this HRS Documentation Record]. These sources have been documented to contain six dioxin/furan congeners (1,2,3,6,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 1,2,3,4,6,7,8-HpCDD; 2,3,7,8-TCDF; 2,3,4,6,7,8-HxCDF; and 1,2,3,4,6,7,8-HpCDF) and four total metals (arsenic, barium, chromium, and mercury) (see Source Characterization sections of this HRS Documentation Record). As part of this HRS Documentation Record, a release of five dioxin/furan congeners (1,2,3,6,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 2,3,7,8-TCDF; 2,3,4,6,7,8-HxCDF; and 1,2,3,4,6,7,8-HpCDF) and two total metals (chromium and mercury) from on-site sources to the surface water pathway (the adjacent Crane River) has been documented (see Surface Water Overland/Flood Migration Pathway section of this HRS Documentation Record). Within the zone of documented contamination attributable to the site, the Crane River is documented to be fished for human consumption, contain 1.287 miles of wetlands frontage and be a Clean Water Act protected water body. In addition, an area of observed contamination (Area A) associated with a condominium property (a portion of Source No. 4) has been documented, and 52 Level I Targets identified (see Soil Exposure Pathway section of this HRS Documentation Record).

Facility Operations

In early 1903, the Creese & Cook Co. was established at 33 Water Street (east side of the Crane River) with the construction of a new tannery factory building [32, p. 6]. Background information indicates that a large settling tank was built under the building with direct flow of all liquid waste to the river (here assumed to be the Crane River) [32, p. 6]. A 1910 annual report to the Board of Health of Massachusetts concerning treatment of liquid (settling tank) waste, prior to discharge into the Crane River, included an estimate of up to 60,000 gallons of waste per day from the Creese & Cook Tannery facility [35, p. 2]. In about 1906, the Creese & Cook Co. began production of colored leathers, first using a vegetable tan and then switching to the chrome process for both colored and black leathers [32, p. 7]. Operations on the east side of the Crane River continued to expand up until 1914, when a new brick beamhouse was constructed, located across the Crane River (west side) at 55 Clinton Avenue and next to the old Endicott burying ground, also known as the Endicott-Russell Family Cemetery [11, p. 21; 18; 31; 32, pp. 7-8]. A footbridge was constructed to provide for foot traffic between the two operations as well as to provide a means for which steam electric power and water would travel between the main plant to the new beamhouse [32, p. 8]. Throughout operations on both sides of the Crane River, the Creese & Cook Co. employed chrome tanning techniques to make their patented Cresco waterproof leather, and Spartan Calf leather [32, p. 8]. In 1981, Creese & Cook Co. went bankrupt and leased the facility to the Danversport Tanning Co. [33, p. 1]. The Danversport Tanning Co. ceased tanning operations at the property in spring 1983 [33, p. 1]. During the end of tannery operations by the Danversport Tanning Company, wastewater

generation was approximately 235,000 gallons per day (and up to an estimated 400,000 gallons per day during maximum production), which discharged to a municipal sewer system after neutralization [34, p. 7].

According to a MA Department of Environmental Quality Engineering (DEQE) representative in a 1984 site walk summary, operations at the Creese & Cook Co. facility properties included beamhouse operations at the Clinton Avenue parcel, where raw hides were brought, dechemicalized, and treated to remove hair [33, p. 1]. Once the hides were processed, they were sent to the main building (east side of the Crane River), where they were dyed and cut [33, p. 1]. The beamhouse had four concrete settling basins which, during operations, contained waste material such as hair, skin, chrome, and sulfides [33, p. 1]. According to reports, prior to 1975 the liquid effluent was discharged directly to the Crane River, while after 1975 the effluent and sludge were deposited to the municipal sewer and on-site lagoons [33, p. 1; 35, pp. 2-3; 39, p. 2; 43, p. 1; 112, p. 5; 139, p. 1].

A summary, provided by Woodard & Curran (W&C) in 2006, indicated that Creese & Cook Co. operated a tannery on portions of both sides of the Crane River [113, p. 5]. The report indicated that tanning and finishing was performed on the eastern side of the river, while beamhouse operations (consisting of initial treatment, dehairing, and bating) occurred on the western side of the Crane River [113, p. 5]. W&C summarized the typical leather tanning operations as follows: 'Initial treating and dehairing operations for tanning typically involve soaking the skins to treat them for infestation and to prepare the skins for mechanical removal of hair. Soaking was typically done with either organic acid solutions or arsenic solutions. These solutions frequently contained phthalates, which were added as a penetrant. Phthalates were also used in the finishing process in lacquers to aid in penetration into the chromed skins. Final dehairing typically involves scraping of the skins in the presence of a strong basic solution or oxidant solution. Bating is primarily a pH adjusting step to neutralize and soften the skins prior to chroming, and was accomplished in an adjusting bath. All of the solution baths would have accumulated solids and/or lost their strength after a period of time, and would have been discharged to on-site lagoons prior to replenishing the baths. Discharge from dehairing and bating operations was directed to on-site lagoons located to the east of the beamhouse, before decanting into the Crane River through a subsurface discharge pipe' [113, p. 5].

In July 1981, Creese & Cook Co. went bankrupt and the property was rented to Danversport Tannery, who operated on the facility until 1983 [33, p. 1].

Facility Investigations

Available documentation (see Table 1 below) indicates that one investigation was completed while the facility was operational (EPA Preliminary Assessment). Subsequent investigations completed for the potentially responsible party (PRP) by SP, Inc. from May 1984 to June 1992 dealt with the initial characterization of the facility (both eastern and western banks of the Crane River), the development of plans to remove documented raw waste materials on the western facility property in preparation for redevelopment, the construction of an on-site containment cell northwest of the former beamhouse to contain waste materials from the western facility property, post-construction sampling of areas formerly containing waste materials which were excavated during construction of the containment cell, and characterization of the former beamhouse. Additional investigations were completed for the PRP, after construction of the containment cell, to document areas of hazardous substances that still remained that would require action if the western facility property were to be redeveloped for use as a condominium. In addition, an EPA Site Inspection Prioritization (SIP) was conducted of the western facility following closure. Citing inaction on the part of the property owner to take the necessary steps to protect the public and clean up the hazardous waste on the western facility property, the State of MA Attorney General's office filed a suit in June 2009 [118; 119]. An EPA Site Reassessment (SR) of the western portion of the

property was initiated in November 2009, while EPA Preliminary Assessment (PA) and Site Inspection (SI) studies of the eastern facility were initiated in March 2010. The following table lists investigations and inspections mentioned above that occurred at the former Creese & Cook Co. facility and will be referenced briefly in the summary below. Unless otherwise noted, the investigation and/or reconnaissance was performed on the western facility parcel.

TABLE 1: Summary of Previous Investigations

Company/ Agency	Investigation	Document Date	Task	Samples Collected	Hazardous Substances Detected	References
EPA	Preliminary Assessment	1981	Site Recon/Respond to Complaint	N/A	Chromium (suspected)	39, pp. 3-4; 40, pp. 1-4
SP, Inc.	Initial Site Investigation {on behalf of PRP}	May 1984	Site Reconnaissance/ Sample collection	Test pits, soil, ground water, seeps, and abandoned tank and container contents	Chromium Lead VOCs H_2S	34, pp. 13-19; 36, p. 2-3
SP, Inc.	Initial Site Investigation (eastern facility properties) {on behalf of PRP}	October 1984	Subsurface Hazardous Waste Investigation	Soil	Arsenic Chromium Mercury	153
				ground water	VOC	153
MA DEQE	Site Investigation/ Updated Preliminary Assessment	March 1985	Further investigation of property for redevelopment	N/A	N/A	36, pp. 2-3; 42, p. 1-2
SP, Inc.	Supplemental Investigation {on behalf of PRP}	December 1985	Evaluate options for land development/ collect samples	Soil/waste	Chromium	34, p. 35-39
				Ground water/ seeps	Arsenic	
				Sediment	Chromium	
SP, Inc.	Site Investigation {on behalf of PRP}	September 1986	Investigation of lagoons/collect samples	Soil	Chromium	43, p. 4-8
SP, Inc.	Construction/ Removal Actions {on behalf of PRP}	Dec. 1989 to June 1990	Construction of on-site containment cell/ excavation of waste and sludge	N/A	N/A	46, p. 1; 48, p. 11; 123, p. 3
SP, Inc.	Well Installation {on behalf of PRP}	February to March 1990	Sample collection following installation	Ground water/Seep	Lead Chromium	48, pp. 6, 13-23, 43; 49, p. 1;
SP, Inc.	Chapter 21E Site Assessment {on behalf of PRP}	April 1990	Post-Excavation Sample Collection	Soil	Lead Chromium	48, pp. 49-50;

TABLE 1: Summary of Previous Investigations (Continued)						
Company/ Agency	**Investigation**	**Date**	**Task**	**Samples Collected**	**Hazardous Substances Detected**	**References**
SP, Inc	Chapter 21E Site Assessment- Beamhouse {on behalf of PRP}	June 1992	Sample Collection	Soil, wipe, and pit debris samples	Chromium	48, pp. 24-30
REW Environmental Consultants	Initial Site Characterization {on behalf of PRP}	July 1995	Satisfy MCP and subsurface investigation	Soil	TPH VOCs ABN Arsenic Chromium	47, p. 13, 30-33
REW Environmental Consultants	Supplemental Sampling Event {on behalf of PRP}	August 1995	Delineate horizontal extent of arsenic-contaminated soil	Soil	Arsenic Chromium	93, pp. 4, 6
MassDEP	Site Inspection	November 1995	Documentation of Site Conditions	N/A	N/A	126, pp. 1-5
Stone and Webster	EPA Site Inspection Prioritization	October 1996	Review of Source Areas/Collection of samples	Surface Water	Arsenic, Chromium, Lead, Mercury	95, pp. 4-20, 26-33
				Sediment	Arsenic, Barium, Cadmium, Chromium, Lead, Mercury	
REW Environmental Consultants	Supplemental Site Characterization {on behalf of PRP}	June 1997	Collect soil samples, determine impacts to ground water, and evaluate exposure	Soil	Arsenic	97, pp. 11, 24-25
	Supplemental Sampling Event {on behalf of PRP}	Dec. 1997 to Jan. 1998	Sample collection/ borings	Soil and ground water	Arsenic	103, pp. 15, 18;
	Supplemental Sampling Event {on behalf of PRP}	September 2001	Sample Collection for Danvers Board of Health	Sediment	Sulfides Arsenic, Barium, Cadmium, Chromium, Lead, Mercury	106, pp. 2-4, 8
GFS	Sampling Event {on behalf of PRP}	April 2005	Sample Collection along Crane River	Sediment	Arsenic	129, pp. 2, 5, 8

TABLE 1: Summary of Previous Investigations (Concluded)						
Company/ Agency	**Investigation**	**Date**	**Task**	**Samples Collected**	**Hazardous Substances Detected**	**References**
W&C	Revised Immediate Response Actions/ Imminent Hazard Evaluation {on behalf of PRP}	November 2006	Sample Collection	Soil	Arsenic, Chromium, Dioxins, Hexavalent Cr	112, pp. 12-13, 19-24; 113, pp. 10-12, 19-43
				Sediment	Arsenic Dioxins	
				Building Debris	Asbestos	
	Supplemental Sampling Event {on behalf of PRP}	June 2007	Assess contaminant concentrations in uplands	Soil	Arsenic	131, pp. 6-9
MassDEP	Determination of Asbestos-Containing Materials	September 2008	Samples collected from beamhouse demolition debris	Building Debris (Black mastic)	Chrysotile fibers	122; 137
Weston Solutions, Inc. START	EPA Site Reassessment	April 2010 to December 2011, August 2012	On-site reconnaissances; Samples collected from source areas and the Crane River	Soils	Arsenic, Barium, Chromium, Mercury, Dioxin/furan congeners	15, pp. 5-8, 39-98
				Sediments	Chromium, Mercury, Dioxin/furan congeners	15, pp. 5-8, 104-111
Weston Solutions, Inc. START	EPA Site Inspection (eastern facility properties)	August 2010 to April 2011, July 2012	On-site reconnaissances; Samples collected from source areas	Soils	Arsenic, Barium, Chromium, Mercury, Dioxin/furan congeners	16, pp. 5, 9, 23-143

EPA = Environmental Protection Agency.
MA DEQE = Massachusetts Department of Environmental Quality and Engineering.
MassDEP = Massachusetts Department of Environmental Protection.
PRP = Potentially Responsible Party.
MCP = Massachusetts Contingency Plan.
VOC = Volatile Organic Compound. H_2S = Hydrogen Sulfide.
TPH = Total Petroleum Hydrocarbon. ABN = Acid Base Neutral.
N/A = Not Applicable.

Numerous investigations and inspections were conducted at the facility after construction of the on-site containment cell in 1990 (see above summary table). These activities, portions of which are summarized in the above table, focused on the following: the presence of hazardous substances, including chromium, within the beamhouse on the west side of the Crane River; contamination, including arsenic and chromium, still existing in the two landfill areas and former sludge lagoons after construction of the on-site containment cell; the existence of hazardous substances, including arsenic and chromium, in other

areas planned for housing development on the west side of the Crane River; plans for containment of the documented hazardous waste upon redevelopment of the facility on the west side of the Crane River into condominiums; removal of documented waste and contaminated soils from areas on the facility property; adherence to the Massachusetts Contingency Plan (MCP) and the protection of populations from contamination that was present on the facility; site-related contamination, including arsenic, chromium, and dioxins, within the Crane River sediments and surface water; the discovery of dioxin-contaminated soils on the facility; and the presence of asbestos-containing material (ACM) within debris from the demolished beamhouse [47, pp. 13-17, 26-33, 108; 48, pp. 24-30, 49-50; 92, p. 2; 93, pp. 3-6, 16; 94; 95, pp. 4-36; 97, pp. 11-13, 19-20, 24-25, 48-50; 98, pp. 1-32; 99; 100, pp. 18-27; 101, pp. 29-35; 103, pp. 5-13, 15-18, 21, 23-26, 100-118; 106, pp. 2-4, 8; 108; 112, pp. 8-12, 19; 113, pp. 10-12; 114; 117-120; 121, pp. 1-3; 122; 125, p. 1; 127, pp. 1-3; 129, pp. 1-5, 8; 131, pp. 13, 36-50; 132, p. 25; 133-134; 137; 139; 143, p. 1-5].

The most recent investigations of the Creese & Cook Tannery (Former) facility were an EPA SI on the eastern side of the Crane River and an EPA SR on the western side. Activities performed as part of the EPA SI involved source sampling which documented hazardous substances in both surface and subsurface soils [16]. Activities conducted as part of the EPA SR included source sampling as well as the sampling of Crane River sediments [15].

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: Leather Scrap Pile

Number of Source: Source No. 1

Source Type: Pile

Description and Location of Source:

Leather Scrap Pile (Pile - Source No. 1) is located on the former facility property located on the western side of the Crane River, depicted on the Town of Danvers, MA Tax Assessor's Map No. 59, as Lot No. 2B (see Figure 2) [6 p. 1; 17, p. 3; 170]. Source No. 1 is located on the northern portion of the facility property, adjacent to the Crane River (see Figure 2) [11, p. 17]. The geographic coordinates of the Leather Scrap Pile, as measured from its approximate center, are 42° 33′ 19.5″ north latitude and 70° 55′ 50.3″ west longitude (see Figures 1 and 2) [20].

As part of an on-site reconnaissance conducted during the EPA SR on 2 November 2011, the Leather Scrap Pile was observed [11, p. 17]. The leather scraps were observed to be protruding from the riverbank; and protruding from a soil pile extending from the fenced Former Landfill Area B to the Crane River and the northeastern property marker [11, p. 17; 22]. Leather scraps were observed eroding out of the bank of the river and depositing directly into the river sediments [11, p. 17; 22]. The location of exposed leather scraps was mapped using a global positioning system (GPS) unit to define the areal extent of the pile, which covers 7,534 square feet (ft^2) [11, pp. 17-18; 21].

The Leather Scrap Pile is located northwest of the area referred to as Former Landfill Area B (see Figure 2) [11, p. 17; 13, pp. 5, 31-32, 45-46]. As part of an appendix to the Engineering Report completed by SP, Inc. in May 1984, a trenching test pit (Trench No. 7) excavated as part of the investigation indicated the presence of leather scraps [34, pp. 1, 44-45 (Appendix Figures 5 and 6)]. A sample of leather scraps collected as part of the monitoring well installation within Trench No. 7 indicated the presence of elevated concentrations of arsenic and chromium (reference indicates that the sample collected from Trench No. 7 is mislabelled as Trench No. 6) [34, pp. 40, 45, 48 (Appendix Table 3)]. Based on observations made during on-site reconnaissances as part of the EPA SI, the removal conducted at Former Landfill Area B created a depression covered with a coarse gravel-type material [11, pp. 1-2, 11]. As part of the June 1997 Supplemental Site Characterization Report completed by R.E.W. Environmental Consultants (REW), an area described as being associated with Landfill Area B, in the wooded area north of the cemetery, contained remnants consisting of leather scraps and organic debris on the surface to a depth of five feet below ground surface [97, pp. 38-39]. REW indicated that the area of the Leather Scrap Pile, on the bank of the Crane River, measured approximately 40 feet long, 25 feet wide, and was 4 feet thick, and required further remedial action [97, p. 39]. In addition, REW concluded that this area appeared to correspond with the extent of excavation and/or cleanup by SP, Inc. (SP) in 1990 (here assumed to be the On-Site Containment Cell construction) [97, p. 39]. A Supplemental Phase IV Report completed by REW indicates the presence of solid waste consisting of hide scraps in the wooded portion of Landfill Area B [103, p. 5]. A 16 August 2007 Massachusetts Contingency Plan Immediate Response Action Status Report figure completed by W&C after the removal action for Landfill Area B, indicated the presence of 'Area B tannery wastes designated for off-site disposal' in the area of the Leather Scrap Pile [131, p. 58 (Figure 3)].

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

- Source Samples:

On 5 December 2011, as part of the EPA SR, source sampling activities for the Leather Scrap Pile were conducted [11, pp. 20-24; 13, pp. 36-41]. The source samples were collected in accordance with the EPA-approved Site-Specific Quality Assurance Project Plan (QAPP), dated 18 April 2011, and the Site-Specific QAPP Addendum, dated 22 November 2011 [8, pp. 32, 34-37; 9, pp. 2-3, 8 (Figure 3), 11-12; 13, p. 37]. As part of the Leather Scrap Pile characterization, seven source samples (SO-56, SO-57, SO-58, SO-59, SO-60, SO-61, SO-70) were collected from various locations throughout the pile (see Figure 3a) [11, pp. 22, 25; 13, pp. 38-39, 67-68, 70].

Table 2 – Source Sample Description

Sample ID	Sample Description	Reference
SO-56	Dark brown, silt, trace fine-to-coarse sand, trace debris (metal and leather scraps), trace organics.	26, p. 28
SO-57	Reddish brown, organic rich (leather and organic fibers) silt.	26, p. 29
SO-58/ SO-70	Dark brown, organic rich (organic fibers, rootlets) silt, trace fine-to-medium sand, leather scraps.	26, p. 30
SO-59	Dark brown silt, some fine-to-coarse sand, little organics, trace clay.	26, p. 31
SO-60	Brown, organic rich silt, little fine-to-coarse sand, trace debris (chalky-like substance), dark purple leather scraps	26, p. 32
SO-61	Dark brown silt and fine-to-coarse sand, little organics, trace debris (metal), trace fine gravel, little organics	26, p. 33

The seven source samples (SO-56, SO-57, SO-58, SO-59, SO-60, SO-61, and SO-70) were submitted to Contract Laboratory Program (CLP) laboratories for dioxin/furan analyses following DLM02.2, and for total metals analysis following ISM01.3 [11, pp. 22, 25, 27; 13, pp. 38-39, 45, 67-68, 70; 28, p. 11; 29, p. 7; 45; 50, pp. 1, 5-6, 8; 57, pp. 1, 13-15; 71, pp. 6-7, 16-21, 24, 108-119, 124-125; 78, pp. 5-7, 16-18, 20, 91-96, 101]. Chains-of-custody (COCs) for all source samples collected as part of the 2011 EPA SR and presented in this HRS Documentation Record are provided in References 28 and 29. The applicable COC sections for the Source No. 1 samples and all corresponding sample identifiers are provided in available COC, field notes reference documentation, and sample crosswalk [11, pp. 22, 25; 13, pp. 38-39, 67-68, 70; 26, pp. 28-33; 28, p. 11; 29, p. 7; 45]. The dioxin/furan analytical results were manually validated at a stage 4 level in accordance with the criteria specified in the USEPA SOW DLM02.2 and EPA Region I's Environmental Services Assistance Team (ESAT) Dioxin/Furan Data Validation SOP ESAT-01-0007 [50, p. 1]. The total metals analytical data were evaluated on a Tier II level in accordance with the Region I Tiered Organic and Inorganic Data Validation Guidelines dated November 2008 [57, p. 1]. The validation of dioxin/furan and total metals analytical results was conducted independently by designated chemists who were not involved in the sample collection and HRS evaluation [11, pp. 22, 25, 27; 13, pp. 38-39, 45, 67-68, 70; 50, pp. 1-3; 57, pp. 1-8]. For the purposes of the Source No. 1 evaluation and the HRS documentation record, analytical results of seven source samples confirm the presence of the following hazardous substances: six dioxin/furan congeners (1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,4,6,7,8-HpCDF) and four total metals (arsenic, barium, chromium, and mercury) (see Table 3 of this HRS documentation record). Source No. 1 has been documented to contain hazardous substances as defined by the HRS [1, p. 51586; 173, pp. 493, 500-501].

Among the seven selected source samples: 1,2,3,6,7,8-HxCDD was detected at a maximum concentration of 20,200 nanograms per kilogram (ng/Kg) in source sample SO-70; 1,2,3,7,8,9-HxCDD was detected at a maximum concentration of 2,650 ng/Kg in source sample SO-70; 1,2,3,4,6,7,8-HpCDD was detected at a maximum concentration of 769,000 ng/Kg in source sample SO-70; 2,3,7,8-TCDF was detected at a maximum concentration of 12.4 ng/Kg in source sample SO-61; 2,3,4,6,7,8-HxCDF was detected at a maximum concentration of 1,360 ng/Kg in source sample SO-70; 1,2,3,4,6,7,8-HpCDF was detected at a maximum concentration of 136,000 ng/Kg in source sample SO-70; arsenic was detected at a maximum concentration of 565 milligrams per kilogram (mg/Kg) in source sample SO-60; barium was detected at a maximum concentration of 1,020 mg/Kg in source sample SO-57; chromium was detected at a maximum concentration of 20,500 mg/Kg in source sample SO-58; and mercury was detected at a maximum concentration of 9.3 mg/Kg in source sample SO-57 [13, pp. 38-39, 67-68, 70; 50, pp. 5-6, 8; 57, pp. 13-15; 71, pp. 16-21, 24, 108-119, 124-125; 78, pp. 16-18, 20, 91-96].

Table 3 - Hazardous Substances Associated with Source No. 1

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration		Sample-Adjusted CRQL		Reference
SO-56	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	1,170	ng/Kg	5.15	ng/Kg	11, p. 22; 13, pp. 38-39, 67; 50, p. 5; 71, pp. 1-2, 16, 108-109; 78, p. 16
			1,2,3,7,8,9-HxCDD	None	288	ng/Kg	5.15	ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	30,400	ng/Kg	258	ng/Kg	
			2,3,7,8-TCDF	None	4.41	ng/Kg	1.03	ng/Kg	
			2,3,4,6,7,8-HxCDF	None	181	ng/Kg	5.15	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	5,180	ng/Kg	258	ng/Kg	
			Arsenic	None	100	mg/Kg	1.4	mg/Kg	11, p. 22; 13, pp. 38-39, 67; 57, p. 13; 78, pp. 1-2, 8, 16, 91
			Barium	None	80.2	mg/Kg	27.6	mg/Kg	
			Chromium	None	7,330	mg/Kg	6.9	mg/Kg	
			Mercury	None	0.40	mg/Kg	0.14	mg/Kg	
SO-57	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	3,280	ng/Kg	102	ng/Kg	11, p. 22; 13, pp. 38, 67; 50, p. 5; 71, pp. 1-2, 17, 110-111; 78, p. 16
			1,2,3,7,8,9-HxCDD	None	396	ng/Kg	102	ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	122,000	ng/Kg	509	ng/Kg	
			2,3,4,6,7,8-HxCDF	None	386	ng/Kg	102	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	29,500	ng/Kg	102	ng/Kg	
			Arsenic	None	42.6	mg/Kg	2	mg/Kg	11, p. 22; 13, pp. 38, 67; 57, p. 14; 78, pp. 1-2, 9, 16, 92
			Barium	None	1,020	mg/Kg	40.2	mg/Kg	
			Chromium	None	13,900	mg/Kg	20.1	mg/Kg	
			Mercury	None	9.3	mg/Kg	0.6	mg/Kg	

Table 3 - Hazardous Substances Associated with Source No. 1 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration		Sample-Adjusted CRQL		Reference
SO-58	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	16,000	ng/Kg	133	ng/Kg	11, p. 22; 13, pp. 38, 67; 50, p. 5; 71, pp. 1-2, 18, 112-113; 78, p. 17
			1,2,3,7,8,9-HxCDD	None	1,890	ng/Kg	133	ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	607,000	ng/Kg	2,653	ng/Kg	
			2,3,4,6,7,8-HxCDF	None	1,190	ng/Kg	133	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	113,000	ng/Kg	2,653	ng/Kg	
			Barium	None	496	mg/Kg	54.1	mg/Kg	11, p. 22; 13, pp. 38, 67; 57, p. 14; 78, pp. 1-2, 9, 17, 93
			Chromium	None	20,500	mg/Kg	27	mg/Kg	
			Mercury	None	5.4	mg/Kg	0.54	mg/Kg	
SO-59	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	1,380	ng/Kg	4.94	ng/Kg	11, pp. 22, 25; 13, pp. 39, 68; 50, p. 6; 71, pp. 1-2, 19, 114-115; 78, p. 17
			1,2,3,7,8,9-HxCDD	None	192	ng/Kg	4.94	ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	29,400	ng/Kg	247	ng/Kg	
			2,3,7,8-TCDF	None	6.66	ng/Kg	0.987	ng/Kg	
			2,3,4,6,7,8-HxCDF	None	149	ng/Kg	4.94	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	4,480	ng/Kg	247	ng/Kg	
			Arsenic	None	93.9	mg/Kg	1.6	mg/Kg	11, pp. 22, 25; 13, pp. 39, 68; 57, p. 14; 78, pp. 1-2, 9, 17, 94
			Barium	None	274	mg/Kg	31.8	mg/Kg	
			Chromium	None	4,020	mg/Kg	15.9	mg/Kg	
			Mercury	None	0.37	mg/Kg	0.16	mg/Kg	
SO-60	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	4,850	ng/Kg	60.5	ng/Kg	11, p. 22; 13, pp. 39, 68; 50, p. 6; 71, pp. 1-2, 20, 116-117; 78, p. 18
			1,2,3,7,8,9-HxCDD	None	889	ng/Kg	60.5	ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	191,000	ng/Kg	1209	ng/Kg	
			2,3,4,6,7,8-HxCDF	None	426	ng/Kg	60.5	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	34,200	ng/Kg	1,209	ng/Kg	
			Arsenic	None	565	mg/Kg	1.4	mg/Kg	11, p. 22; 13, pp. 39, 68; 57, p. 14; 78, pp. 1-2, 9, 18, 95
			Chromium	None	1,140	mg/Kg	1.4	mg/Kg	
			Mercury	None	1.9	mg/Kg	0.14	mg/Kg	

Table 3 - Hazardous Substances Associated with Source No. 1 (Concluded)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-61	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	735 ng/Kg	39.3 ng/Kg	11, p. 22; 13, pp. 39, 68; 50, p. 6; 71, pp. 1-2, 21, 118-119; 78, p. 18
			1,2,3,7,8,9-HxCDD	None	196 ng/Kg	39.3 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	17,700 ng/Kg	196 ng/Kg	
			2,3,7,8-TCDF	None	12.4 ng/Kg	7.86 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	126 ng/Kg	39.3 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	3,930 ng/Kg	39.3 ng/Kg	
			Arsenic	None	93.4 mg/Kg	1.4 mg/Kg	11, p. 22; 13, pp. 39, 68; 57, p. 14; 78, pp. 1-2, 9, 18, 96
			Barium	None	127 mg/Kg	27.5 mg/Kg	
			Chromium	None	1,230 mg/Kg	1.4 mg/Kg	
			Mercury	None	0.34 mg/Kg	0.14 mg/Kg	
SO-70	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	20,200 ng/Kg	122 ng/Kg	11, p. 22; 13, pp. 38, 70; 50, p. 8; 71, pp. 1-2, 24, 124-125; 78, p. 20
			1,2,3,7,8,9-HxCDD	None	2,650 ng/Kg	122 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	769,000 ng/Kg	6,082 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	1,360 ng/Kg	122 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	136,000 ng/Kg	6,082 ng/Kg	
			Barium	None	491 mg/Kg	56 mg/Kg	11, p. 22; 13, pp. 38, 70; 57, p. 15; 78, pp. 1-2, 10, 20, 101
			Chromium	None	17,500 mg/Kg	28 mg/Kg	
			Mercury	None	4.8 mg/Kg	0.28 mg/Kg	

CRQL = Contract Required Quantitation Limit.
ng/Kg = Nanograms per kilogram. mg/Kg = Milligrams per kilogram.
HxCDD= Hexachlorodibenzodioxin. HpCDD= Heptachlorodibenzodioxin.
TCDF = Tetrachlorodibenzofuran. HxCDF= Hexachlorodibenzofuran.
HpCDF= Heptachlorodibenzofuran.

* = An explanation for the direction of bias is provided in Reference 71, Table 3 and Reference 78.

List of Hazardous Substances Associated with Source

1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
2,3,7,8-TCDF
2,3,4,6,7,8-HxCDF
1,2,3,4,6,7,8-HpCDF
Arsenic
Barium
Chromium
Mercury

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

On-site observations indicated that no portion of Source No. 1 has a maintained engineered cover or complete runoff control management system [11, p. 26]. No report of a natural or man-made liner was documented during source sampling activities [11, p. 26]. As part of an on-site reconnaissance conducted as part of the EPA SR on 2 November 2011, leather scraps were observed to be protruding from the bank; and protruding from a soil pile extending from the fenced border of Landfill Area B to the Crane River and the northeastern property marker [11, p. 17; 22]. Leather scraps were observed eroding out of the bank of the river and depositing into the river sediments [11, p. 17; 22]. Therefore, Source No. 1 does not have full containment, and the source yields a containment value of 10 [1, p. 51596 (Table 3-2)].

Table 4 - Hazardous Substances Available to Pathways

Containment Description	Containment Factor	References
Gas release to air: NS	NS	
Particulate release to air: NS	NS	
Release to ground water: NS	NS	
Release via overland migration and/or flood: Based on the lack of liner, a maintained engineered cover, and any complete run-on control and runoff management systems, a Containment Factor Value of 10 has been assigned for release to the Surface Water Pathway for Source No. 1.	10	1, p. 51609 (Table 3-2); 11, pp. 26; 22

NS = Not Scored.

2.4.2 HAZARDOUS WASTE QUANTITY

2.4.2.1 Hazardous Waste Quantity

The Hazardous Waste Quantity for Source No. 1 was assigned based on the Area Factor Value of a "pile" source type [1, p. 51591, Table 2-5, Section 2.4.2.1.4]. The Hazardous Constituent Quantity, Hazardous Wastestream Quantity, and Volume Values were not evaluated for Source No. 1 because insufficient information was available [1, pp. 51590-51591 (Sections 2.4.2.1.1 and 2.4.2.1.2, Table 2-5)].

2.4.2.1.1 Hazardous Constituent Quantity

Description

The hazardous constituent quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source is not known and cannot be estimated with reasonable confidence [1, pp. 51590-51591 (Section 2.4.2.1.1)]. There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 1 with reasonable confidence.

Table 5 – Hazardous Constituent Quantity		
Hazardous Substance	**Constituent Quantity (pounds)**	**References**
NS (insufficient information)		

NS = Not Scored.

Sum (pounds):

Hazardous Constituent Quantity Assigned Value: Not Scored

2.4.2.1.2 Hazardous Wastestream Quantity

Description

The hazardous wastestream quantity for Source No. 1 could not be adequately determined according to the HRS Final Rule requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence [1, p. 51591 (Section 2.4.2.1.2)]. There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, Annual reports, etc.) available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate the hazardous wastestream quantity for Source No. 1 with reasonable confidence.

Table 6 – Hazardous Wastestream Quantity		
Hazardous Wastestream	**Wastestream Quantity (pounds)**	**References**
NS (insufficient information)		

NS = Not Scored.

Sum (pounds):

Sum of Wastestream Quantity/5,000 [1, p. 51591 (Table 2-5)]:

Hazardous Wastestream Quantity Assigned Value: Not Scored

2.4.2.1.3 Volume

Description

The volume for Source No. 1 could not be adequately determined according to the HRS requirements because insufficient historical and current waste sampling data are available to adequately calculate the volume of the source (or the volume of the area of observed contamination) associated with the source with reasonable confidence [1, p. 51591 (Section 2.4.2.1.3)]. Insufficient historical or current sampling data are available to adequately estimate the depth of waste material within the source. Therefore, there is insufficient information to adequately calculate or estimate the volume for Source No. 1 with reasonable confidence.

Table 7 – Volume			
Source Type	**Description (# drums or dimensions)**	**Units (yd^3)**	**References**
NS			

NS = Not Scored.

The volume of a "pile" source, in cubic yards (yd^3), is divided by 2.5 to assign a volume assigned value to the source [1, p. 51591 (Table 2-5)].

Volume Assigned Value: 0

2.4.2.1.4 Area

Description

Based on sampling results and observations of the material contained within Source No. 1 (Leather Scrap Pile), the areal extent of the source defined as part of this source characterization was documented using GPS (see Figure 2) [11, p. 17; 21]. Based on the information recorded using GPS as part of the EPA SR, the area of the Leather Scrap Pile (Source No. 1) was determined to be approximately 7,115 ft^2 (see Figure 2) [11, p. 17; 21].

Table 8 – Area		
Source Type	**Units (ft^2)**	**References**
Pile	7,115	Figure 2; 11, p. 17; 21

The area of a "pile" source, in ft^2, is divided by 13 to assign an area assigned value to the source [1, p. 51591 (Table 2-5)].

Sum (ft^2): 7,115

Equation for Assigning Value (1, p. 51591, Table 2-5): 7,115 ÷ 13 = 547.31

Area Assigned Value: 547.31

2.4.2.1.5 Source Hazardous Waste Quantity Value

The Hazardous Waste Quantity Value for Source No. 1 was assigned based on the Area Factor Value (547.31) [1, p. 51591 (Table 2-5)]. The Hazardous Constituent Quantity, Hazardous Wastestream Quantity, and Volume Values were not evaluated for Source No. 1 because insufficient information was available [1, pp. 51590-51591 (Sections 2.4.2.1.1 and 2.4.2.1.2, Table 2-5)].

Highest HWQ value assigned from Ref. 1, Table 2-5: 547.31

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: Upland Pile

Number of Source: Source No. 2

Source Type: Pile

Description and Location of Source:

The Upland Pile (Pile - Source No. 2) is located on the former facility property located on the western side of the Crane River, depicted on the Town of Danvers, MA Tax Assessor's Map No. 59, as Lot No. 2B (see Figure 2) [6, p. 1; 17, p. 3; 170]. Source No. 2 is located on the northwestern portion of the facility property, adjacent to the former beamhouse building footprint (see Figure 2) [11, p. 12]. The geographic coordinates of the Upland Pile, as measured from its approximate center, are 42° 33′ 15.4″ north latitude and 70° 55′ 51.6″ west longitude (see Figures 1 and 2) [20].

Based on observations as part of the EPA SR, the Upland Pile source is a fenced area which contains piled soil material [11, p. 12; 13, pp. 100-101, 103]. The pile was observed to be steep-sided with small shrubs and grasses growing on the pile [11, p. 12; 13, p. 101].

Available file information does not indicate the source of the piled material referred to here as the Upland Pile, but site plan maps dating to 6 March 1998 and depicting sampling performed in 1996 indicate an area of piled material [97, pp. 45 (Exhibit C), 49 (Table 2); 103, p. 24 (Exhibit A); 113, pp. 19 (Figure 2)]. Previous sampling of the Upland Pile source indicated the presence of arsenic, chromium, and dioxin/furan congeners [113, pp. 10-11, 19 (Figure 2), 22 (Table 2), 32 (Table 3); 131, pp. 18 (Table 1), 20-30 (Table 3)].

The estimated area and volume of the Upland Pile was not found in available documentation. Based on sampling results and observations of the piled material that constitutes Source No. 2 (Upland Pile), the areal extent of the base of the source pile defined as part of this source characterization was documented using GPS (see Figure 2) [11, p. 13; 21]. Based on the information recorded as part of the EPA SR, the area contained by the Upland Pile (Source No. 2) was determined to be approximately 6,009 ft^2 (see Figures 2 and 3a) [11, p. 13; 21].

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

- Source Samples:

On 23 May 2011, as part of the EPA SR, source sampling activities of the Upland Pile were conducted [11, pp. 9-14; 13, pp. 21-27]. The source samples were collected in accordance with the EPA-approved Site-Specific QAPP, dated 18 April 2011 [8, pp. 32, 34-37; 9, pp. 2-3, 8 (Figure 3), 11-12; 13, pp. 21-22]. As part of the Upland Pile characterization, six source samples (SO-02, SO-03, SO-04, SO-05, SO-05B, and SO-25) were collected from various locations throughout the pile (see Figure 3a) [11, p. 12-13; 13, pp. 25-26, 59-60, 65].

Table 9 – Source Sample Description		
Sample ID	**Sample Description**	**Reference**
SO-02	Brown, silt and fine sand, trace medium-to-coarse sand, trace clay, trace medium-to-coarse sand.	26, p. 2
SO-03	Dark brown, silt, little fine sand, trace organics, trace clay, trace medium-to-coarse sand.	26, p. 3
SO-04	Dark brown, silt, some fine gravel, little fine-to-coarse sand, trace clay.	26, p. 4
SO-05/ SO-25	Dark brown, silt, trace fine gravel, trace fine-to-coarse sand.	26, p. 5
SO-05B	Light brown, fine-to-coarse sand, little silt.	26, p. 6

The six source samples (SO-02, SO-03, SO-04, SO-05, SO-05B, and SO-25) were submitted to CLP laboratories for dioxin/furan analyses following DLM02.2, and total metals analysis following ISM01.2 [11, p. 12-13, 14; 13, p. 25-27, 59-60, 65; 28, pp. 5-8; 29, pp. 5-6; 45; 51, pp. 1, 4, 7; 52, pp. 1, 4; 58, pp. 1, 11; 59, pp. 1, 11; 72, pp. 5-6, 10-11, 18, 84-87, 93; 73, pp. 5, 9-11, 92-93, 96-99; 79, pp. 9-10, 13, 70-71, 80; 80, pp. 9-10, 81, 83-84]. Chains-of-custody (COCs) for all source samples collected as part of the 2011 EPA SR and presented in this HRS Documentation Record are provided in References 28 and 29. The applicable COC sections for the Source No. 2 samples and all corresponding sample identifiers are provided in available COC, field notes reference documentation, and sample crosswalk [11, p. 12-13; 13, p. 25-26, 59-60, 65; 26, pp. 2-6;28, pp. 5-8; 29, pp. 5-6; 45]. The dioxin/furan analytical results were manually validated at a stage 4 level in accordance with the criteria specified in the USEPA SOW DLM02.2 and EPA Region I's ESAT Dioxin/Furan Data Validation SOP ESAT-01-0007 [51, p. 1; 52, p. 1]. The total metals analytical data were evaluated on a Tier II level in accordance with the Region I Tiered Organic and Inorganic Data Validation Guidelines dated November 2008 [58, p. 1; 59, p. 1]. The validation of dioxin/furan and total metals analytical results was conducted independently by designated chemists who were not involved in the sample collection and HRS evaluation [11, p. 13, 14; 13, p. 25-27, 59-60, 65; 51, pp. 1-3; 52, pp. 1-3; 58, pp. 1-6; 59, pp. 1-6]. For the purposes of the Source No. 2 evaluation and this HRS documentation record, analytical results of six source samples confirm the presence of the following hazardous substances: five dioxin/furan congeners (1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,4,6,7,8-HxCDF, and 1,2,3,4,6,7,8-HpCDF) and three total metals (arsenic, chromium, and mercury). Source No. 2 has been documented to contain hazardous substances as defined by the HRS [1, p. 51586; 173, pp. 493, 500-501].

Among the six selected source samples: 1,2,3,6,7,8-HxCDD was detected at a maximum concentration of 274 ng/Kg in source sample SO-02; 1,2,3,7,8,9-HxCDD was detected at a maximum concentration of 380 ng/Kg in source sample SO-03; 1,2,3,4,6,7,8-HpCDD was detected at a maximum concentration of 9,000 ng/Kg in source sample SO-02; 2,3,4,6,7,8-HxCDF was detected at a maximum concentration of 199 ng/Kg in source sample SO-03; 1,2,3,4,6,7,8-HpCDF was detected at a maximum concentration of 961 ng/Kg in source sample SO-02; arsenic was detected at a maximum concentration of 214 mg/Kg in source sample SO-25; chromium was detected at a maximum concentration of 2,360 mg/Kg in source sample SO-03; and mercury was detected at a maximum concentration of 1.3 mg/Kg in source sample SO-25 [51, p. 4; 52, p. 4; 58, p. 12; 59, p. 11; 72, pp. 5, 6, 10, 84-85; 73, pp. 5, 10, 96-97; 79, pp. 13, 80; 80, pp. 9, 83].

Table 10 - Hazardous Substances Associated with Source No. 2

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-02	Soil	5/23/11	1,2,3,6,7,8-HxCDD	Low	274 J (274) ng/Kg	5.15 ng/Kg	11, p. 13; 13, pp. 25-26, 59; 51, pp. 4; 72, pp. 1-3, 5, 10, 84-85
			1,2,3,7,8,9-HxCDD	Low	71.2 J (71.2) ng/Kg	5.15 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	Low	9,000 J (9,000) ng/Kg	30.9 ng/Kg	
			2,3,4,6,7,8-HxCDF	Low	25.5 J (25.5) ng/Kg	5.15 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	Low	961 J (961) ng/Kg	5.15 ng/Kg	
			Arsenic	Unknown	93.1 J (53.5) mg/Kg	0.9 mg/Kg	11, p. 13; 13, pp. 25-26, 59; 58, pp. 11; 72, p. 5; 79, pp. 1-2, 9, 70
			Chromium	High	356 EB (276) mg/Kg	0.9 mg/Kg	
			Mercury	None	0.20 mg/Kg	0.11 mg/Kg	
SO-03	Soil	5/23/11	1,2,3,6,7,8-HxCDD	Unknown	1,570 J EB (157) ng/Kg	7.07 ng/Kg	11, p. 13; 13, pp. 25-26, 59; 52, p. 4; 73, pp. 1-2, 5, 10, 96-97
			1,2,3,7,8,9-HxCDD	Low	380 J (380) ng/Kg	7.07 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	Unknown	51,000 J EB (5,100) ng/Kg	177 ng/Kg	
			2,3,4,6,7,8-HxCDF	Low	199 J (199) ng/Kg	7.07 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	Unknown	2,810 J EB (281) ng/Kg	177 ng/Kg	
			Arsenic	Low	160 J (160) mg/Kg	0.8 mg/Kg	11, p. 13; 13, pp. 25-26, 59; 59, p. 11; 73, p. 5; 80, pp. 1-2, 9, 83
			Chromium	None	2360 mg/Kg	8.2 mg/Kg	
			Mercury	None	0.26 mg/Kg	0.12 mg/Kg	
SO-04	Soil	5/23/11	1,2,3,6,7,8-HxCDD	Unknown	890 J EB (89) ng/Kg	6.41 ng/Kg	11, p. 12-13; 13, pp. 25-26, 59; 52, p. 4; 73, pp. 1-2, 5, 11, 98-99
			1,2,3,7,8,9-HxCDD	Low	203 J (203) ng/Kg	6.41 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	Unknown	27,100 J EB (2,710) ng/Kg	96.1 ng/Kg	
			2,3,4,6,7,8-HxCDF	Low	93.9 J (93.9) ng/Kg	6.41 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	Unknown	2,130 J EB (213) ng/Kg	6.41 ng/Kg	
			Arsenic	Low	198 J (198) mg/Kg	1.1 mg/Kg	11, p. 12; 13, pp. 25-26, 59; 59, p. 11; 73, p. 5; 80, pp. 1-2, 10, 84
			Chromium	None	1560 mg/Kg	5.4 mg/Kg	
			Mercury	None	0.29 mg/Kg	0.11 mg/Kg	

Table 10 - Hazardous Substances Associated with Source No. 2 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-05	Soil	5/23/11	1,2,3,6,7,8-HxCDD	Low	141 J (141) ng/Kg	6.21 ng/Kg	11, p. 12; 13, pp. 25-26, 60; 51, p. 4; 72, pp. 1-3, 5, 11, 86-87
			1,2,3,7,8,9-HxCDD	Low	51.6 J (51.6) ng/Kg	6.21 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	Low	4,350 J (4,350) ng/Kg	18.6 ng/Kg	
			2,3,4,6,7,8-HxCDF	Low	11.5 J (11.5) ng/Kg	6.21 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	Low	287 J (287) ng/Kg	6.21 ng/Kg	
			Arsenic	Unknown	320 J (184) mg/Kg	2.4 mg/Kg	11, p. 12; 13, pp. 25-26, 60; 58, p. 11; 72, p. 5; 79, pp. 1-2, 10, 71
			Chromium	High	325 EB (252) mg/Kg	0.8 mg/Kg	
			Mercury	None	1.1 mg/Kg	0.11 mg/Kg	
SO-05B	Soil	5/23/11	1,2,3,7,8,9-HxCDD	Low	12.1 J (12.1) ng/Kg	4.85 ng/Kg	11, p. 12; 13, pp. 25-26, 60; 52, pp. 4; 73, pp. 1-2, 5, 9, 92-93
			1,2,3,4,6,7,8-HpCDD	Unknown	1,730 J EB (173) ng/Kg	9.70 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	Unknown	103 J EB (10.3) ng/Kg	4.85 ng/Kg	
			Chromium	None	85.2 mg/Kg	0.7 mg/Kg	11, p. 12; 13, pp. 25-26, 60; 59, p. 11; 73, p. 5; 80, pp. 1-2, 9, 81

Table 10 - Hazardous Substances Associated with Source No. 2 (Concluded)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-25	Soil	5/23/11	1,2,3,6,7,8-HxCDD	Low	134 J (134) ng/Kg	6.23 ng/Kg	11, p. 12; 13, pp. 25-26, 65; 51, p. 7; 72, pp. 1-3, 6, 18, 94-95
			1,2,3,7,8,9-HxCDD	Low	38.2 J (38.2) ng/Kg	6.23 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	Low	4,560 J (4,560) ng/Kg	18.7 ng/Kg	
			2,3,4,6,7,8-HxCDF	Low	9.29 J (9.29) ng/Kg	6.23 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	Low	255 J (255) ng/Kg	6.23 ng/Kg	
			Arsenic	Unknown	373 J (214) mg/Kg	2.6 mg/Kg	11, p. 12; 13, pp. 25-26, 65; 58, pp. 12; 72, p. 6; 79, pp. 1-2, 13, 80
			Chromium	High	301 EB (233) mg/Kg	0.9 mg/Kg	
			Mercury	None	1.3 mg/Kg	0.12 mg/Kg	

CRQL = Contract Required Quantitation Limit.
ng/Kg = Nanograms per kilogram.
mg/Kg = Milligrams per kilogram.
HxCDD= Hexachlorodibenzodioxin.
HpCDD= Heptachlorodibenzodioxin.
HpCDF= Heptachlorodibenzofuran.
HxCDF= Hexachlorodibenzofuran.

J = The associated numerical value is an estimated quantity [51, pp. 4, 7; 52, p. 4; 58, pp. 11-12; 59, p. 11; 141, p. B-20; 142, pp. B-23-24].
EB = The associated compound or element was detected in rinsate blank samples collected for quality control [44; 52, p. 4; 58, p. 11-12]. The potential contribution for carryover from non-dedicated sampling equipment has been evaluated. In most cases, the concentration of the analyte or compound observed in a sample is significantly greater than the concentration observed in the associated equipment blank. Therefore, the sample data can be used with a high degree of certainty to confirm the presence of the substance in the samples. [44].
* = An explanation for the direction of bias is provided in Reference 72, Table 3 and Reference 73, Table 3.
( ) = For hazardous substance concentrations, denotes concentration of the compound or element following adjustment. Based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination*, for HRS purposes it is not required to adjust qualified source data. Although the fact sheet was not intended for application to source data, the bias of these data has been considered to demonstrate that even after consideration of the impact of the bias, the substances are present above detection and that the contaminants are present in the soil due to a release [140, pp. 4-8].

List of Hazardous Substances Associated with Source

1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
2,3,4,6,7,8-HxCDF
1,2,3,4,6,7,8-HpCDF
Arsenic
Chromium
Mercury

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

On-site observations indicated that no portion of Source No. 2 has a maintained engineered cover or complete runoff control management system [11, p. 26]. No report of a natural or man-made liner was documented during source sampling activities [11, p. 26]. Therefore, Source No. 2 does not have full containment, and the source yields a containment value of 10 [1, p. 51596 (Table 3-2)].

Table 11 - Hazardous Substances Available to Pathways

Containment Description	Containment Factor	References
Gas release to air: NS	NS	
Particulate release to air: NS	NS	
Release to ground water: NS	NS	
Release via overland migration and/or flood: Based on the lack of liner, a maintained engineered cover, and any complete run-on control and runoff management systems, a Containment Factor Value of 10 has been assigned for release to the Surface Water Pathway for Source No. 2.	10	1, p. 51609 (Table 3-2); 11, p. 26

NS = Not Scored.

2.4.2 HAZARDOUS WASTE QUANTITY

2.4.2.1 Hazardous Waste Quantity

The Hazardous Waste Quantity for Source No. 2 was assigned based on the Area Factor Value of a "pile" source type [1, p. 51591, Table 2-5, Section 2.4.2.1.4]. The Hazardous Constituent Quantity, Hazardous Wastestream Quantity, and Volume values were not evaluated for Source No. 2 because insufficient information was available [1, pp. 51590-51591 (Sections 2.4.2.1.1 and 2.4.2.1.2, Table 2-5)].

2.4.2.1.1 Hazardous Constituent Quantity

Description

The hazardous constituent quantity for Source No. 2 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source is not known and cannot be estimated with reasonable confidence [1, pp. 51590-51591 (Section 2.4.2.1.1)]. There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 2 with reasonable confidence.

Table 12 – Hazardous Constituent Quantity		
Hazardous Substance	**Constituent Quantity (pounds)**	**References**
NS (insufficient information)		

NS = Not Scored.

Sum (pounds):

Hazardous Constituent Quantity Assigned Value: Not Scored

2.4.2.1.2 Hazardous Wastestream Quantity

Description

The hazardous wastestream quantity for Source No. 2 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence [1, p. 51591 (Section 2.4.2.1.2)]. There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, Annual reports, etc.) available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate the hazardous wastestream quantity for Source No. 2 with reasonable confidence.

Table 13 – Hazardous Wastestream Quantity		
Hazardous Wastestream	**Wastestream Quantity (pounds)**	**References**
NS (insufficient information)		

NS = Not Scored.

Sum (pounds):

Sum of Wastestream Quantity/5,000 [1, p. 51591 (Table 2-5)]:

Hazardous Wastestream Quantity Assigned Value: Not Scored

2.4.2.1.3 Volume

Description

The volume for Source No. 2 could not be adequately determined according to the HRS Final Rule requirements because insufficient historical and current waste sampling data are available to adequately calculate the volume of the source (or the volume of the area of observed contamination) associated with the source with reasonable confidence [1, p. 51591 (Section 2.4.2.1.3)]. Insufficient historical or current sampling data are available to adequately estimate the depth of waste material within the source. Therefore, there is insufficient information to adequately calculate or estimate the volume for Source No. 2 with reasonable confidence.

Table 14 – Volume			
Source Type	**Description (# drums or dimensions)**	**Units (yd^3)**	**References**
NS			

NS = Not Scored.

The volume of a "pile" source, in yd^3, is divided by 2.5 to assign a volume assigned value to the source [1, p. 51591 (Table 2-5)].

Volume Assigned Value: 0

2.4.2.1.4 Area

Description

Based on sampling results and observations of the piled material contained within Source No. 2 (Upland Pile), the areal extent of the source defined as part of this source characterization was documented using GPS (see Figure 2) [11, p. 13; 21]. Based on the information recorded as part of the EPA SR, the area of the Upland Pile (Source No. 2) was determined to be approximately 6,009 ft^2 (see Figure 2) [11, p. 13; 21].

Table 15 – Area		
Source Type	**Units (ft^2)**	**References**
Pile	6,009	Figure 2, 11, p. 13; 21

The area of a "pile" source, in ft^2, is divided by 13 to assign an area assigned value to the source [1, p. 51591 (Table 2-5)].

Sum (ft^2): 6,009

Equation for Assigning Value [1, p. 51591 (Table 2-5)]: 6,009÷ 13 = 462.23

Area Assigned Value: 462.23

2.4.2.1.5 Source Hazardous Waste Quantity Value

The Hazardous Waste Quantity Value for Source No. 2 was assigned based on the Area Factor Value (462.23) [1, p. 51591 (Table 2-5)]. The Hazardous Constituent Quantity, Hazardous Wastestream Quantity, and Volume Values were not evaluated for Source No. 2 because insufficient information was available [1, pp. 51590-51591 (Sections 2.4.2.1.1 and 2.4.2.1.2, Table 2-5)].

Highest HWQ value assigned from Ref. 1, Table 2-5: 462.23

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: Former Lagoons

Number of Source: Source No. 3

Source Type: Surface Impoundment

Description and Location of Source:

The Former Lagoons (Surface Impoundment - Source No. 3) are located on the facility property located on the western bank of the Crane River, depicted on the Town of Danvers, MA Tax Assessor's Map No. 59, as Lot No. 2B (see Figure 2) [6, p. 1; 17, p. 3; 170]. Source No. 3 is located on the southeastern portion of the parcel, in proximity to the Crane River (see Figure 2) [11, p. 11]. The geographic coordinates of the Former Lagoons, as measured from its approximate center, are 42° 33′ 13.0″ north latitude and 70° 55′ 45.8″ west longitude (see Figures 1 and 2) [20].

Based on observations as part of the EPA SR, the Former Lagoons source is a fenced area which contains bermed material in a square shape, outlining a depression [11, p. 11]. Based on previous descriptions and figures of the facility, it appears the central berm, which divided the Former Lagoons into two surface impoundments, is no longer present and may have been removed during on-site containment cell construction in 1990 [11, pp. 11; 34, p. 4; 36, p. 2; 46, p. 1; 48, p. 11; 113, p. 19; 123; 124]. The Former Lagoon area appeared overgrown with small trees and shrubs, and contains piping that appears to have been previously used during use of the surface impoundments [11, p. 11].

The two former wastewater filtration lagoons, referred in reports as Area C, are located approximately 160 feet east of the site building and in proximity to the Crane River (see Figure 2) [98, p. 1]. A letter report completed by SP indicated that the two lagoons were used as final settling ponds after the prescreening and primary sedimentation of the raw wastewater produced in the beam and tan process [43, p. 1]. The final effluent was discharged directly to the Crane River before 1950 [35, pp. 2; 39, p. 2; 43, p. 1; 112, p. 5]. W&C indicated that this discharge was directed to the Crane River via a subsurface discharge pipe [113, p. 5]. Observations during the EPA SR indicated the presence of a discharge pipe from the Former Lagoons into the Crane River [11, p. 2]. A complaint, filed with the Town of Danvers Department of Health & Inspections, indicated that in January 1977, liquid waste from the lagoons was released to the Crane River [172, pp. 1-2]. The roughly 40′ x 100′ twin lagoons had four 4-inch pipes, each to diffuse influent, and one 2-inch pipe for discharge to the river [43, p. 1]. According to SP, the lagoons appeared to have been scraped periodically and the accumulated sludge disposed of in the landfills on site (assumed to be Former Landfill Areas A and B) [43, p. 1]. In addition, SP asserted that the lagoons were cleaned before they were abandoned in April 1981, when all plant wastewater entered into the municipal system [40, p. 4; 43, p. 1]. Based on sampling, SP initially estimated approximately 300 yd^3 of sludge waste in the Old Lagoons (assumed to be the Former Lagoons source) when they were abandoned in 1981 [40, p. 4; 124, p. 20]. During the early part of 1990, SP excavated, treated/stabilized, and backfilled tannery wastes/contaminated soils from Landfill Areas A and B and Lagoons 1 and 2 (Area C), into the constructed lined on-site containment cell [46, p. 1; 47, p. 7]. An estimated total of 5,000 yd^3 of excavated tannery waste and sludge was backfilled into the containment cell [47, p. 7].

Investigations of the Former Lagoons after excavation completed as part of the on-site containment cell construction indicated elevated levels of arsenic, hexavalent chromium, and chlorinated dioxins [93, pp. 3-4, 11-16; 98 pp. 2, 9-11; 113, pp. 7, 20-33 (Tables 2 and 3)]. Based on the follow-up investigations of

the Former Lagoons, REW estimated that an area of approximately 26,500 ft^2 and volume of approximately 79,500 ft^3 (2,944 yd^3) was impacted from the Former Lagoon wastes [97, p. 40]. Based on GPS measurements collected as part of the EPA SR and site plans from W&C, an area of approximately 130 ft by 130 ft (16,900 ft^2) is fenced off as an imminent hazard area [11, p. 16; 131, p. 57 (Figures 2)].

Based on the sampling results of soils that have been impacted by materials from the surface impoundment and observations of bermed earthen material defining Source No. 3 (Former Lagoons), the areal extent of the source, defined as part of this source characterization, was documented using GPS (see Figure 2) [11, pp. 16, 26; 21]. Based on the information recorded as part of the EPA SR, the area of the Former Lagoons (Source No. 3) was determined to be approximately 14,615 ft^2 (see Figure 2) [11, pp. 16, 26; 21].

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

- Background Concentrations:

The Former Lagoons (Source No. 3) are a surface impoundment source type. The soil materials contained within Source No. 3 have become impacted through migration of wastes once contained within the Former Lagoons and are therefore compared against background surface and subsurface soil samples, which were collected as part of the EPA SR [11, p. 26; 13, pp. 23, 30, 45; 26, pp. 24-25, 36-37]. Comparison to background soil sample concentrations is presented to ensure that hazardous substance concentrations in soil/source samples are clearly greater then background soil concentrations. On 5 December 2011, as part of the EPA SR of the Creese & Cook Co. (Former) 1 facility, background soil sampling activities were conducted [11, pp. 21, 23, 26; 13, pp. 36-41]. The background surface and subsurface soil samples were collected in accordance with the EPA-approved Site-Specific QAPP, dated 18 April 2011, and the Site-Specific QAPP Addendum, dated 22 November 2011 [8, pp. 29, 50; 9, pp. 2-3, 8 (Figure 3), 11; 13, p. 36]. Two background surface soil samples (SO-52 and SO-53) and two background subsurface soil samples (SO-64 and SO-65) were collected from an area directly adjacent to the exterior side of the granite stone wall, marking the Russell and Endicott Cemetery (listed to be located at 25 Clinton Avenue) [11, pp. 21, 23; 13, pp. 37-38, 40, 66, 69]. The samples were collected to document potential background soil concentrations in natural materials in the vicinity of the site [11, pp. 21, 23; 13, pp. 37-38, 40]. The samples were collected from an area presumed to be outside the influence of the waste disposal practices at the tannery, since the Russell and Endicott Cemetery predates the tannery operations [11, pp. 23; 13, pp. 37-38]. START personnel noted grave markers dating back to the mid-1700s (including Mrs. Margaret Endicott – 1759 and Capt. Samuel Endicott - 1766) [11, pp. 21; 13, pp. 37-38].

The background soil samples were collected from the similar depth intervals as the soil/source samples presented in the Source No. 3 Characterization [26, pp. 17-21, 24-27, 36, 37]. Background soil samples were collected within 6 months of and during the same sampling event as the release samples presented as part of the Former Lagoons characterization [11, pp. 21, 23; 13, pp. 37-38, 40]. Reconnaissance observations during the time period between sampling events did not indicate any change to the secured/fenced source area identified here as Source No. 3 [11, pp. 10; 13, p. 44]. Background soil samples and Source No. 3 source samples were composed of similar matrix materials [11, pp. 26; 13, pp. 37-38, 40; 26, pp. 17-21, 24-27, 36, 37].

Table 16 – Background Soil Sample Description		
Sample ID	**Sample Description**	**Reference**
SO-52	Brown-to-orange brown, silt and fine-to-coarse sand, trace fine gravel, trace organics.	26, p. 24
SO-53	Brown, silt and fine-to-medium sand, trace fine-to-medium gravel, trace clay, trace organic.	26, p. 25
SO-64	Light brown, fine-to-coarse sand, some silt, trace fine-to-medium gravel, trace organics.	26, p. 36
SO-65	Medium-to-light brown, fine-to-coarse sand, some silt, trace organics.	26, p. 37

Background soil samples SO-53 and SO-64 were submitted to CLP laboratories for dioxin/furan analysis following DLM02.2 and for total metals analysis following ISM01.3, while background soil samples SO-52 and SO-65 were submitted to a CLP laboratory only for total metals analysis following ISM01.3 [11, pp. 21, 23; 13, pp. 36-38, 40, 66, 69; 28, pp. 5, 7-8; 29, pp. 5-7; 50, p. 1; 57, p. 1; 78, pp. 5, 7]. COCs for all background soil samples collected as part of the 2011 EPA SR and presented in this HRS Documentation Record are provided in References 28 and 29. The applicable COC sections for the background soil samples and all corresponding sample identifiers are provided in available COC, field notes reference documentation, and sample crosswalk [11, pp. 21, 23; 13, pp. 36-38, 40, 66, 69; 26, pp. 24-25, 36-37; 28, p. 11; 29, p. 7; 45]. The dioxin/furan analytical results were manually validated at a stage 4 level in accordance with the criteria specified in the USEPA SOW DLM02.2 and EPA Region I's ESAT Dioxin/Furan Data Validation SOP ESAT-01-0007 [50, p. 1; 78, pp. 5, 7]. The total metals analytical data were evaluated on a Tier II level in accordance with the Region I Tiered Organic and Inorganic Data Validation Guidelines dated November 2008 [57, p. 1; 78, pp. 5, 7]. The validation of dioxin/furan and total metals analytical results was conducted independently by designated chemists who were not involved in the sample collection and HRS evaluation [11, pp. 21, 23; 13, pp. 36-38, 40, 66, 69; 50, pp. 1-3; 57, pp. 1-8]. As part of the Source No. 3 characterization, the following dioxin/furan congeners and total metals are presented: 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, arsenic, chromium, and mercury. Based on an examination of the two background soil samples submitted for dioxin/furan analysis and the four background soil samples submitted for total metals analysis, the highest numerical background value concentrations are presented in Table 17 and used for comparison. See below for further evaluation of background concentrations utilized in this HRS evaluation.

Table 17 - Hazardous Substances Associated with Background Samples							
Sample ID	**Sample Type**	**Date**	**Hazardous Substance**	**Bias***	**Hazardous Substance Concentration**	**Sample-Adjusted CRQL**	**Reference**
SO-64	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	0.752 U ng/Kg	5.04 ng/Kg	11, p. 23; 13, pp. 40, 69; 50, p. 7; 71, pp. 1-2, 13, 123; 78, p. 7
SO-64	Soil	12/5/11	1,2,3,7,8,9-HxCDD	None	0.772 U ng/Kg	5.04 ng/Kg	11, p. 23; 13, pp. 40, 69; 50, p. 7; 71, pp. 1-2, 13, 123; 78, p. 7

Table 17 - Hazardous Substances Associated with Background Samples (Concluded)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-53	Soil	12/5/11	1,2,3,4,6,7,8-HpCDD	None	21.2 ng/Kg	4.81 ng/Kg	11, p. 21; 13, pp. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107; 78, p. 5
SO-53	Soil	12/5/11	1,2,3,4,6,7,8-HpCDF	None	1.77 J (1.77) ng/Kg	4.81 ng/Kg	11, p. 21; 13, pp. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107; 78, p. 5
SO-52	Soil	12/5/11	Arsenic	None	11.4 mg/Kg	1.2 mg/Kg	11, p. 21; 13, pp. 37-38, 66; 57, p. 13; 78, pp. 1-2, 8, 11, 87
SO-52	Soil	12/5/11	Chromium	None	17.3 mg/Kg	1.2 mg/Kg	11, p. 21; 13, pp. 37-38, 66; 57, p. 13; 78, pp. 1-2, 8, 11, 87
SO-53	Soil	12/5/11	Mercury	None	0.040 J (0.040) mg/Kg	0.12 mg/Kg	11, p. 21; 13, pp. 38, 66; 57, p. 13; 78, pp. 1-2, 5, 11, 88

mg/Kg = Milligrams per kilogram.
ng/Kg = Nanograms per kilogram.
HpCDD= Heptachlorodibenzodioxin.
CRQL = Contract Required Quantitation Limit.
HxCDD= Hexachlorodibenzodioxin.
HpCDF= Heptachlorodibenzofuran.

U = The compound or element was analyzed for, but not detected. The associated numerical value is the sample-adjusted CRQL [141, p. B-21].
J = The associated numerical value is an estimated quantity [50, p. 4; 57, p. 11; 141, p. B-20; 142, pp. B-23-24].
* = An explanation for the direction of bias is provided in Reference 71, Table 3 and Reference 78.
( ) = For hazardous substance concentrations, denotes concentration of the compound or element following adjustment. Based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination,* for HRS purposes it is not required to adjust qualified source data. Although the fact sheet was not intended for application to source data, it has been applied in this situation to demonstrate the relative increase in contamination in the source samples over background levels and that the contaminants are present in the soil due to a release [140, pp. 4-8].

Based on an examination of the two background soil samples submitted for dioxin/furan analysis and the four background soil samples submitted for total metals analysis, the highest numerical background value concentrations are presented in Table 17 and used for comparison. Dioxin congeners 1,2,3,6,7,8-HxCDD and 1,2,3,7,8,9-HxCDD were non-detect and are therefore documented above background levels when the source sample concentration equals or exceeds the highest presented sample-adjusted CRQL [1, p. 51589 (Table 2-3)]. Dioxin/furan congeners 1,2,3,4,6,7,8-HpCDD and 1,2,3,4,6,7,8-HpCDF were detected in background soil samples. The background concentration of 1,2,3,4,6,7,8-HpCDD exceeded the sample-adjusted CRQL, and is considered above background when the source sample concentration is three times

or more above the background concentration [1, p. 51589 (Table 2-3)]. Furan congener 1,2,3,4,6,7,8-HpCDF was detected at a concentration below the sample-adjusted CRQL [1, p. 51589 (Table 2-3)]. The furan congener 1,2,3,4,6,7,8-HpCDF is considered above background when the source sample concentration is three times or more above the background concentration [1, p. 51589 (Table 2-3)]. Arsenic and chromium were detected in background soil samples above the sample-adjusted CRQL, and are considered above background when the source sample concentration is three times or more above the background concentration [1, p. 51589 (Table 2-3)]. Barium was detected in background soil samples at a concentration below the sample-adjusted CRQL and is considered above background when the source sample concentration is three times or more above the background concentration [1, p. 51589 (Table 2-3)]. Mercury was detected at a concentration below the sample-adjusted CRQL, and is considered above background when the source sample concentration is three times or more above the background concentration [1, p. 51589 (Table 2-3)].

- Source Samples:

On 23 May 2011 and 5 December 2011, as part of the EPA SR, soil/source sampling activities of the Former Lagoons were conducted [11, pp. 9-15, 20-24; 13, pp. 21-28, 36-41]. The soil/source samples were collected in accordance with the EPA-approved Site-Specific QAPP, dated 18 April 2011, and the Site-Specific QAPP Addendum, dated 22 November 2011 [8, pp. 32, 34-37; 9, pp. 2-3, 8 (Figure 3), 11-12; 13, pp. 21, 37]. As part of Former Lagoons characterization, eight source samples (SO-16, SO-17, SO-18, SO-19, SO-20, SO-26, SO-54, and SO-55) were collected from various locations throughout the surface impoundment (see Figure 3a) [11, pp.21, 23; 13, pp. 22-24, 40].

Table 18 – Soil/Source Sample Description

Sample ID	Sample Description	Reference
SO-16	Medium-to-dark brown, fine-to-coarse sand, trace fine gravel, trace silt, trace clay.	26, p. 17
SO-17	Dark brown, fine-to-coarse sand, little silt, trace fine gravel, trace clay.	26, p. 18
SO-18	Dark brown, coarse sand and coarse gravel, trace silt.	26, p. 19
SO-19	Brown-to-dark brown, fine-to-coarse sand, trace clay, trace silt, trace fine gravel.	26, p. 20
SO-20/ SO-26	Brown-to-dark brown, fine-to-coarse sand, some fine-to-coarse gravel, little silt, trace clay, trace organics.	26, p. 21
SO-54	Dark brown, fine-to-coarse sand and silt, trace organics, trace fine gravel.	26, p. 26
SO-55	Dark brown, silt and clay, little fine-to-coarse sand, trace organics.	26, p. 27

Six of the eight soil/source samples (SO-16, SO-17, SO-18, SO-19, SO-20, and SO-26) were submitted to CLP laboratories for dioxin/furan analyses following DLM02.2, and for total metals analysis following ISM01.2 [11, pp. 11-14; 13, p. 22-24, 29, 63-65; 28, pp. 5, 7-8; 29, pp. 5-6; 51, pp. 1, 6; 52, pp. 1, 7-8; 58, pp. 1, 11-12; 59, pp. 1, 12-13; 72, pp. 5-6, 15-17, 91-93; 73, pp. 6, 19-21, 109-110, 113; 79, pp. 12-13, 75-77; 80, pp. 14-15, 92-93, 96]. Source samples SO-54 and SO-55 were submitted to CLP laboratories for total metals analysis only, following ISM01.3 [11, pp. 23, 27; 13, p. 29, 40, 66-67; 29, pp. 7; 57, p. 1, 13; 78, pp. 8, 15, 89-90]. COCs for all source samples collected as part of the 2011 EPA SR and presented in this HRS Documentation Record are provided in References 28 and 29. The applicable COC sections for the Source No. 3 samples and all corresponding sample identifiers are provided in available COC, field notes reference documentation, and sample crosswalk [11, pp. 11-13, 23; 13, pp. 22-24, 40, 63-67; 26, pp. 17-21, 26-27; 28, pp. 5, 7-8; 29, pp. 5-7; 45]. The dioxin/furan analytical results were manually validated at a stage 4 level in accordance with the criteria specified in the USEPA SOW

DLM02.2 and EPA Region I's ESAT Dioxin/Furan Data Validation SOP ESAT-01-0007 [51, p. 1; 52, p. 1]. The total metals analytical data were evaluated on a Tier II level in accordance with the Region I Tiered Organic and Inorganic Data Validation Guidelines dated November 2008 [57, p. 1; 58, p. 1; 59, p. 1]. The validation of dioxin/furan and total metals analytical results was conducted independently by designated chemists who were not involved in the sample collection and HRS evaluation [11, pp. 11-13; 13, p. 22-24, 29, 63-65; 51, pp. 1-3; 52, pp. 1-2; 58, pp. 1-6; 59, pp. 1-6]. For the purposes of the Source No. 3 evaluation and this HRS documentation record, analytical results of eight source samples confirm the presence of the following hazardous substances: four dioxin/furan congeners (1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, and 1,2,3,4,6,7,8-HpCDF) and three total metals (arsenic, chromium, and mercury). Source No. 3 has been documented to contain hazardous substances as defined by the HRS [1, p. 51586; 173, pp. 493, 500-501].

Among the eight selected soil/source samples: 1,2,3,6,7,8-HxCDD was detected at a maximum concentration of 124 J ng/Kg in soil/source sample SO-18; 1,2,3,7,8,9-HxCDD was detected at a maximum concentration of 49.8 J ng/Kg in soil/source sample SO-18; 1,2,3,4,6,7,8-HpCDD was detected at a maximum concentration of 1,190 J ng/Kg in soil/source sample SO-18; 1,2,3,4,6,7,8-HpCDF was detected at a maximum concentration of 57.2 JEB ng/Kg in soil/source sample SO-20; arsenic was detected at a maximum concentration of 147 mg/Kg in soil/source sample SO-16; chromium was detected at a maximum concentration of 218 mg/Kg in soil/source sample SO-55; and mercury was detected at a maximum concentration of 0.23 mg/Kg in soil/source sample SO-18 [13, pp. 22-24, 40, 63-67; 51, p. 6; 58, p. 12; 59, p. 12; 72, pp. 5, 6, 15, 16, 91-92; 73, p. 6; 79, pp. 12, 76; 80, pp. 14, 92].

Table 19 - Hazardous Substances Associated with Source No. 3

Sample ID	Sample Type	Date	Hazardous Substance [1]	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-16	Soil	5/23/11	1,2,3,7,8,9-HxCDD	Low	5.22 J (5.22) ng/Kg	5.20 ng/Kg	11, pp. 12; 13, pp. 22-24, 63; 52, p. 7; 73, pp. 1-2, 6, 19, 109
			Arsenic	None	147 mg/Kg	0.8 mg/Kg	11, pp. 12; 13, pp. 22-24, 63; 59, p. 12; 73, p. 6; 80, pp. 1-2, 14, 92
			Chromium	None	55.3 mg/Kg	0.8 mg/Kg	
SO-17	Soil	5/23/11	1,2,3,6,7,8-HxCDD	Low	19.9 J (19.9) ng/Kg	5.27 ng/Kg	11, pp. 12; 13, pp. 24, 63; 51, p. 6; 72, pp. 1-2, 5, 15, 91
			1,2,3,7,8,9-HxCDD	Low	5.41 J (5.41) ng/Kg	5.27 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	Low	517 J (517) ng/Kg	5.27 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	Low	36.5 J (36.5) ng/Kg	5.27 ng/Kg	
			Arsenic	Unknown	103 J (59.2) mg/Kg	0.7 mg/Kg	11, pp. 12; 13, pp. 24, 63; 58, p. 11; 72, p. 5; 79, pp. 1-2, 12, 75
			Chromium	High	70 EB (54.3) mg/Kg	0.7 mg/Kg	

Table 19 - Hazardous Substances Associated with Source No. 3 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance [1]	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-18	Soil	5/23/11	1,2,3,6,7,8-HxCDD	Low	124 J (124) ng/Kg	5.57 ng/Kg	11, pp. 11; 13, pp. 23, 63; 51, p. 6; 72, pp. 1-2, 6, 16, 92
			1,2,3,7,8,9-HxCDD	Low	49.8 J (49.8) ng/Kg	5.57 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	Low	1,190 J (1,190) ng/Kg	5.57 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	Low	31 J (31) ng/Kg	5.57 ng/Kg	
			Arsenic	Unknown	63.4 J (36.4) mg/Kg	0.9 mg/Kg	11, pp. 11; 13, pp. 23, 63; 58, p. 12; 72, p. 6; 79, pp. 1-2, 12, 76
			Chromium	High	70.3 EB (54.5) mg/Kg	0.9 mg/Kg	
			Mercury	None	0.23 mg/Kg	0.1 mg/Kg	
SO-19	Soil	5/23/11	1,2,3,6,7,8-HxCDD	Low	5.94 J (5.94) ng/Kg	5.57 ng/Kg	11, pp. 11; 13, pp. 23, 63; 51, p. 6; 72, pp. 1-2, 6, 17, 93
			1,2,3,4,6,7,8-HpCDD	Low	270 J (270) ng/Kg	5.57 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	Low	16 J (16) ng/Kg	5.57 ng/Kg	
			Arsenic	Unknown	94.6 J (54.4) mg/Kg	0.8 mg/Kg	11, pp. 11; 13, pp. 23, 63; 58, p. 12; 72, p. 6; 79, pp. 1-2, 13, 77
SO-20	Soil	5/23/11	1,2,3,7,8,9-HxCDD	Low	7.13 J (7.13) ng/Kg	5.23 ng/Kg	11, pp. 11; 13, pp. 22-23, 64; 52, p. 7; 73, pp. 1-2, 6, 20, 110
			1,2,3,4,6,7,8-HpCDD	Unknown	858 J EB (85.8) ng/Kg	5.23 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	Unknown	57.2 J EB (5.72) ng/Kg	5.23 ng/Kg	
			Arsenic	None	83.2 mg/Kg	0.7 mg/Kg	11, pp. 11; 13, pp. 22-23, 64; 59, p. 12; 73, p. 6; 80, pp. 1-2, 14, 93
			Chromium	None	173 mg/Kg	0.7 mg/Kg	
SO-26	Soil	5/23/11	1,2,3,7,8,9-HxCDD	Low	6.13 J (6.13) ng/Kg	5.31 ng/Kg	11, pp. 11; 13, pp. 22-23, 65; 52, p. 8; 73, pp. 1-2, 6, 21, 113
			1,2,3,4,6,7,8-HpCDD	Unknown	762 J EB (76.2) ng/Kg	5.31 ng/Kg	
			Arsenic	None	72.5 mg/Kg	0.7 mg/Kg	11, pp. 11; 13, pp. 22-23, 65; 59, p. 13; 73, p. 6; 80, pp. 1-2, 15, 96
			Chromium	None	160 mg/Kg	0.7 mg/Kg	

Table 19 - Hazardous Substances Associated with Source No. 3 (Concluded)

Sample ID	Sample Type	Date	Hazardous Substance [1]	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-54	Soil	12/5/11	Arsenic	None	56.8 mg/Kg	1.2 mg/Kg	11, p. 23; 13, pp. 40, 66; 57, p. 13; 78, pp. 1-2, 8, 15, 89
			Chromium	None	71.9 mg/Kg	1.2 mg/Kg	
			Mercury	None	0.16 mg/Kg	0.12 mg/Kg	
SO-55	Soil	12/5/11	Arsenic	None	82.9 mg/Kg	1.5 mg/Kg	11, p. 23; 13, pp. 40, 67; 57, p. 13; 78, pp. 1-2, 8, 15, 90
			Chromium	None	218 mg/Kg	1.5 mg/Kg	

ng/Kg = Nanograms per kilogram.
CRQL = Contract Required Quantitation Limit.
HpCDF = Heptachlorodibenzofuran.
mg/Kg = Milligrams per kilogram.
HxCDD = Hexachlorodibenzodioxin.
HpCDD = Heptachlorodibenzodioxin.

J = The associated numerical value is an estimated quantity [51, p. 6; 52, pp. 7-8; 58, pp. 11-12; 72, pp. 15-17, 91-93; 73, pp. 19-21, 109-111; 79, pp. 12-13, 75-77; 141, p. B-20; 142, pp. B-23-24].
EB = The associated compound or element was detected in rinsate blank samples collected for quality control [52, pp. 7-8; 58, pp. 11-12; 73, pp. 19-21, 109-111; 79, pp. 12, 75-76]. The potential contribution for carryover from non-dedicated sampling equipment has been evaluated. In most cases, the concentration of the analyte or compound observed in a sample is significantly greater than the concentration observed in the associated equipment blank. Therefore, the sample data can be used with a high degree of certainty to confirm the presence of the substance in the samples [44].
* = An explanation for the direction of bias is provided in Reference 72, Table 3; Reference 73, Table 3; Reference 78; Reference 79, Table 3; and Reference 80, Table 3.
( ) = For hazardous substance concentrations, denotes concentration of the compound or element following adjustment. Based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination*, for HRS purposes it is not required to adjust qualified source data. Although the fact sheet was not intended for application to source data, it has been applied in this situation to demonstrate the relative increase in contamination in the source samples over background levels and that the contaminants are present in the soil due to a release [140, pp. 4-8].

List of Hazardous Substances Associated with Source

1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
1,2,3,4,6,7,8-HpCDF
Arsenic
Chromium
Mercury

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

On-site observations indicated that no portion of Source No. 3 has a maintained engineered cover or complete runoff control management systems [11, p. 26]. No report of a natural or man-made liner was documented during source sampling activities [11, p. 26]. Therefore, Source No. 3 does not have full containment, and the source yields a containment value of 10 [1, p. 51596 (Table 3-2)].

Table 20 - Hazardous Substances Available to Pathways

Containment Description	Containment Factor	References
Gas release to air: NS	NS	
Particulate release to air: NS	NS	
Release to ground water: NS	NS	
Release via overland migration and/or flood: Based on the lack of liner, a maintained engineered cover, and any complete run-on control and runoff management systems, a Containment Factor Value of 10 has been assigned for release to the Surface Water Pathway for Source No. 3.	10	1, p. 51596 (Table 3-2); 11, p. 26

NS = Not Scored.

2.4.2 HAZARDOUS WASTE QUANTITY

2.4.2.1 Hazardous Waste Quantity

The Hazardous Waste Quantity for Source No. 3 was assigned based on the Area Factor Value of a "surface impoundment" source type [1, p. 51591, Table 2-5, Section 2.4.2.1.4]. The Hazardous Constituent Quantity, Hazardous Wastestream Quantity, and Volume values were not evaluated for Source No. 3 because insufficient information was available [1, pp. 51590-51591 (Sections 2.4.2.1.1, 2.4.2.1.2, and 2.4.2.1.3 Table 2-5)].

2.4.2.1.1 Hazardous Constituent Quantity

Description

The hazardous constituent quantity for Source No. 3 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source is not known and cannot be estimated with reasonable confidence [1, pp. 51590-51591 (Section 2.4.2.1.1)]. There is insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 3 with reasonable confidence.

Table 21 – Hazardous Constituent Quantity		
Hazardous Substance	**Constituent Quantity (pounds)**	**References**
NS (insufficient information)		

NS = Not Scored.

Sum (pounds):

Hazardous Constituent Quantity Assigned Value: Not Scored

2.4.2.1.2 Hazardous Wastestream Quantity

Description

The hazardous wastestream quantity for Source No. 3 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence [1, p. 51591 (Section 2.4.2.1.2)]. There is insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, Annual reports, etc.) available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate the hazardous wastestream quantity for Source No. 3 with reasonable confidence.

Table 22 – Hazardous Wastestream Quantity		
Hazardous Wastestream	**Wastestream Quantity (pounds)**	**References**
NS (insufficient information)		

NS = Not Scored.

Sum (pounds):

Sum of Wastestream Quantity/5,000 [1, p. 51591 (Table 2-5)]:

Hazardous Wastestream Quantity Assigned Value: Not Scored

2.4.2.1.3 Volume

Description

The volume for Source No. 3 could not be adequately determined according to the HRS requirements because insufficient historical and current waste sampling data are available to adequately calculate the volume of the source (or the volume of the area of observed contamination) associated with the source with reasonable confidence [1, p. 51591 (Section 2.4.2.1.3)]. Insufficient historical or current sampling data are available to adequately estimate the depth of waste material within the source. Therefore, there is insufficient information to adequately calculate or estimate the volume for Source No. 3 with reasonable confidence.

Table 23 – Volume			
Source Type	**Description (# drums or dimensions)**	**Units (yd^3)**	**References**
NS			

NS = Not Scored.

The volume of a "pile" source, in yd^3, is divided by 2.5 to assign a volume assigned value to the source [1, p. 51591 (Table 2-5)].

Volume Assigned Value: 0

2.4.2.1.4 Area

Description

Based on sampling results of soils that have been impacted by materials from the surface impoundment and observations of bermed earthen material defining Source No. 3 (Former Lagoons), the areal extent of the source defined as part of this source characterization was documented using GPS (see Figure 2) [11, p. 26; 21]. Based on the information recorded as part of the EPA SR, the area of the Former Lagoons (Source No. 3) was determined to be approximately 14,615 ft^2 (see Figure 2) [11, p. 26; 21].

Table 24 – Area		
Source Type	**Units (ft^2)**	**References**
Surface Impoundment	14,615	Figure 2, 11, p. 26; 21

The area of a "surface impoundment" source, in ft^2, is divided by 13 to assign an area assigned value to the source [1, p. 51591 (Table 2-5)].

Sum (ft^2): 14,615

Equation for Assigning Value [1, p. 51591 (Table 2-5)]: 14,615 ÷ 13 = 1,124.23

Area Assigned Value: 1,124.23

2.4.2.1.5 Source Hazardous Waste Quantity Value

The Hazardous Waste Quantity Value for Source No. 3 was assigned based on the Area Factor Value (1,124.23) [1, p. 51591 (Table 2-5)]. The Hazardous Constituent Quantity, Hazardous Wastestream Quantity, and Volume Values were not evaluated for Source No. 3 because insufficient information was available [1, pp. 51590-51591 (Sections 2.4.2.1.1, 2.4.2.1.2, 2.4.2.1.3, Table 2-5)].

Highest HWQ value assigned from Ref. 1, Table 2-5: 1,124.23

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: Water Street/MBTA Source

Number of Source: Source No. 4

Source Type: Contaminated Soil

Description and Location of Source:

The Water Street/MBTA Source (Contaminated Soil - Source No. 4) is located on the former Creese & Cook Tannery facility property located at 33 Water Street and identified on the Town of Danvers, MA Tax Assessor's Map No. 59, as Crane River East Condominiums (Lot No. 72), and a Boston and Maine Railroad parcel [7; 17, p. 2]. The geographic coordinates of the Water Street/MBTA Source, as measured from its approximate center, are 42° 33′ 10.91″ north latitude and 70° 55′ 34.6″ west longitude (see Figures 1 and 2) [20].

Limited information was found in available documentation concerning the Water Street/MBTA Source area. In early 1903, the Creese & Cook Co. was established at the 33 Water Street property with the construction of the original tannery building [32, p. 6]. In 1904, two large four-story wooden wings were added to the main building [32, p. 7]. In about 1906, the company employed a chrome process for both colored and black leathers [32, p. 7]. Between the years 1908 and 1914, three more additions were added to the business, including a brick store house and hide house in 1908, a five-story brick building in 1910, and a brick beamhouse in 1914, which was located across the Crane River next to the old Endicott burying ground (here assumed to be the Endicott-Russell Family Cemetery) [32, pp. 7]. Due to odor complaints regarding the tannery process, water supply and quality issues with the on-site wells, and a right-of-way access granted by the State through the 33 Water Street property along the Crane River for a proposed electric railroad, Creese & Cook Co. needed to move or expand their tannery operation [32, p. 8]. In 1911, Creese & Cook Co. bought the land rights from the Clinton Avenue property to a pump house at Ash and Purchase Streets, where water from Brown Pond (Crane River) was pumped to a water tank adjacent to the new beamhouse [154, p. 4].A footbridge built across the Crane River connecting the beamhouse with the main plant was planned to carry steam pipes, electric power, and processing water [32, p. 7]. In 1914, the Creese & Cook Co. completed construction of the new brick beamhouse [32, p. 7]. According to W&C, beamhouse operations, including treatment, dehairing, and bating of skins prior to chroming and finishing, occurred on the portion of the facility located on the western shore of the Crane River [113, p. 5]. Tanning and finishing activities were performed at the original facility located on the opposite (eastern shore) side of the river [113, p. 5].

From 1914 to 1981, Creese & Cook Co. operated a leather tannery on the properties; however, details of the operations that continued to be conducted at the 33 Water Street facility were not found in available documentation [32, p. 7; 33, p.1].

On 31 January 1980, the Town of Danvers Office of Human Services received a complaint regarding buffing dust being emitted from a stack at the 33 Water Street facility and settling onto the Water Street bridge and ice in the Crane River immediately downstream of the bridge [155, pp. 1].

In 1983, a fire damaged portions of the 33 Water Street tannery buildings and a connecting wood building was torn down [153, p. 8].

On 7 December 1983, Creese & Cook Co. (Mr. George Hebb, President and Treasurer) sold the Creese & Cook Co. property, including the lots at 33 Water Street, 55 Clinton Avenue, and 20 Cheever Street, to the Crane River Realty Trust (Emmanuel Papanickolas, Trustee) [41].

An investigation report completed in 1984 was found in available documentation regarding the eastern Creese & Cook Tannery facility property, which includes the Water Street/MBTA Source. The 29 October 1984 Subsurface Hazardous Waste Investigation completed by SP, Inc., indicated that the parcel contained gravel fill around the buildings [153, p. 7]. As part of the Subsurface Hazardous Waste Investigation, SP advanced four borings (Core Nos. 1 through 4) on the 33 Water Street property [153, p. 21]. Selected soil samples were analyzed for Resource Conservation and Recovery Act (RCRA) 8 metals via extraction procedure (EP) Toxicity, and percent (%) oil and grease by the SP laboratory. The boring logs from the 33 Water Street property indicated the presence of oily topsoil and some building debris [153, p. 19]. Analytical results of the soil samples submitted for RCRA 8 metals via EP Toxicity indicated the presence of the following (maximum concentration in parentheses): arsenic (0.038 mg/L in No. 2); barium (0.3 mg/L in No. 2); chromium (0.08 mg/L in No. 3); and mercury (0.058 mg/L in No. 3) [153, pp. 15].

In August 1987, the 33 Water Street property (Tax Map No. 59, Lot No. 72 [17, p. 3]) was separated from the other lots constituting the former Creese & Cook Tannery facility property, 55 Clinton Avenue (Tax Map No. 59, Lot No. 2B [17, p. 3]) and 20 Cheever Street (Tax Map No. 59, Lot No. 39 [17, p. 3]), with the recording of the Master Deed for the Crane River Condominium (East) with the Essex Registry of Deeds [156]. Note that the MBTA right-of-way access through the 33 Water Street property was granted by the State in circa 1914, as stated above [32, p. 8].

Based on GPS documentation of samples collected to characterize the Water Street/MBTA Source, the estimated area of contaminated soil is 114,099 ft^2 [21].

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

- Background Concentrations:

The Water Street/MBTA Source (Source No. 4) is a contaminated soil source type, and the materials comprising the Water Street/MBTA Source are compared against background surface and subsurface soil samples, which were collected as part of the EPA SR [11, pp. 21, 23; 12, p. 4-17; 13, pp. 37-38, 40, 66, 69; 14, pp. 10-30; 26, pp. 34-35; 27, pp. 4-39, 53-70]. On 5 December 2011, as part of the EPA SR of the Creese & Cook Co. (Former) 1 facility, background soil sampling activities were conducted [11, pp. 20-24; 13, pp. 36-41]. The background surface and subsurface soil samples were collected in accordance with the EPA-approved Site-Specific QAPP, dated 18 April 2011, and the Site-Specific QAPP Addendum, dated 22 November 2011 [8, pp. 29, 50; 9, pp. 2-3, 8 (Figure 3), 11; 13, p. 37]. Two background surface soil samples (SO-52 and SO-53) and two background subsurface soil samples (SO-64 and SO-65) were collected from an area directly adjacent to the exterior side of the granite stone wall, marking the Endicott-Russell Family Cemetery (listed to be located at 25 Clinton Street) [11, pp. 21, 23; 13, pp. 37-38, 40, 53, 56-57, 66, 69, 135]. The samples were collected to document potential background soil concentrations in natural materials in the vicinity of the site [11, pp. 21, 23; 13, p. 40]. The samples were collected from an area presumed to be outside the influence of the waste disposal practices at the tannery since the Endicott-Russell Family Cemetery predates the tannery operations [11, p. 21; 13, p. 38]. START personnel noted grave markers dating back to the mid-1700s (including Mrs. Margaret Endicott - 1759 and Capt. Samuel Endicott - 1766) [11, p. 21; 13, pp. 37-38].

The background soil samples were collected from similar depth intervals as the source samples presented in the Source No. 4 Characterization [26, pp. 24-25, 34-37; 27, pp. 4-39, 53-70]. Samples SO-52 and SO-

53 are shallow background surface soil samples, collected at maximum sampling depths of 24 inches [11, pp. 21, 23, 26-27; 26, p. 24-25] Samples SO-64 and SO-65 are subsurface background soil samples, collected at sampling depths greater than 24 inches [11, pp. 21, 23, 26-27; 26, p. 36-37]. Background soil samples were collected within 7 months of those source samples presented as part of the Water Street/MBTA Source characterization [11, pp. 21, 23; 12, p. 4-17; 13, pp. 37-38; 14, pp. 10-30; 26, pp. 24-25; 34-35; 27, pp. 4-39, 53-70]. Reconnaissance observations during the time period between sampling events did not indicate any changes to the source area identified here as Source No. 4 [11, pp. 5, 16; 13, p. 44]. Background soil samples and Source No. 4 soil/source samples were comprised of similar matrix materials [11, pp. 21, 23; 12, pp. 4-17; 13, pp. 37-38, 40; 14, pp. 10-30; 26, pp. 24-25, 34-37; 27, pp. 4-39, 53-70].

Table 25 – Background Soil Sample Description

Sample ID	Sample Description	Reference
SO-52	Brown-to-orange brown, silt and fine-to-coarse sand, trace fine gravel, trace organics.	26, p. 24
SO-53	Brown, silt and fine-to-medium sand, trace fine-to-medium gravel, trace clay, trace organic.	26, p. 25
SO-64	Light brown, fine-to-coarse sand, some silt, trace fine-to-medium gravel, trace organics.	26, p. 36
SO-65	Medium-to-light brown, fine-to-coarse sand, some silt, trace organics.	26, p. 37

Background soil samples SO-53 and SO-64 were submitted to CLP laboratories for dioxin/furan analysis following DLM02.2 and for total metals analysis following ISM01.3, while background soil samples SO-52 and SO-65 were submitted to a CLP laboratory for total metals analysis only, following ISM01.3 [11, pp. 21, 23, 26-27; 13, p. 37-38, 40, 45, 66, 69; 28, p. 11; 29, p. 7; 50, p. 1, 4, 7; 57, p. 1, 13, 15; 71, pp. 12-13, 107, 123; 78, pp. 11-12, 87-88, 99]. COCs for all source samples collected as part of the 2011 EPA SR and SI and presented in this HRS Documentation Record are provided in References 28 and 29. The applicable COC sections for the background soil samples and all corresponding sample identifiers are provided in available COC, field notes reference documentation, and sample crosswalk [11, pp. 21, 23; 13, pp. 36-38, 40, 66, 69; 26, pp. 24-25, 36-37; 28, p. 11; 29, p. 7; 45]. The dioxin/furan analytical results were validated manually validated at a stage 4 level in accordance with the criteria specified in the USEPA SOW DLM02.2 and EPA Region I's ESAT Dioxin/Furan Data Validation SOP ESAT-01-0007 [50, p. 1]. The total metals analytical data were evaluated on a Tier II level in accordance with the Region I Tiered Organic and Inorganic Data Validation Guidelines dated November 2008 [57, p. 1]. The validation of dioxin/furan and total metals analytical results was conducted independently by designated chemists who were not involved in the sample collection and HRS evaluation [11, pp. 21, 23; 13, pp. 36-38, 40, 66, 69; 50, pp. 1-3; 57, pp. 1-8]. As part of the Source No. 4 characterization, the following dioxin/furan congeners and total metals are presented: 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, arsenic, barium, chromium, and mercury. Based on an examination of the two background soil samples collected and submitted for dioxin/furan analysis and the four background soil samples collected and submitted for total metals analysis, the highest background hazard concentrations for both surface and subsurface background soil samples are presented in Table 28. See below for further evaluation of background concentrations utilized in this section of the HRS evaluation.

Table 26 - Hazardous Substances Associated with Background Soil Samples							
Sample ID	**Sample Type**	**Date**	**Hazardous Substance**	**Bias***	**Hazardous Substance Concentration**	**Sample-Adjusted CRQL**	**Reference**
Shallow Surface Soil Samples							
SO-53	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	0.371 U ng/Kg	4.81 ng/Kg	11, p. 21; 13, pp. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-53	Soil	12/5/11	1,2,3,7,8,9-HxCDD	None	0.425 U ng/Kg	4.81 ng/Kg	11, p. 21; 13, pp. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-53	Soil	12/5/11	1,2,3,4,6,7,8-HpCDD	None	21.2 ng/Kg	4.81 ng/Kg	11, p. 21; 13, pp. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-53	Soil	12/5/11	2,3,7,8-TCDF	None	0.259 EMPC ng/Kg	0.961 ng/Kg	11, p. 21; 13, pp. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-53	Soil	12/5/11	2,3,4,6,7,8-HxCDF	None	0.338 U ng/Kg	4.81 ng/Kg	11, p. 21; 13, pp. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-53	Soil	12/5/11	1,2,3,4,6,7,8-HpCDF	None	1.77 J (1.77) ng/Kg	4.81 ng/Kg	11, p. 21; 13, pp. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-52	Soil	12/5/11	Arsenic	None	11.4 mg/Kg	1.2 mg/Kg	11, p. 21; 13, pp. 37-38, 66; 57, p. 13; 78, pp. 1-2, 11, 87
SO-53	Soil	12/5/11	Barium	None	21.2 J (21.2) mg/Kg	23.6 mg/Kg	11, p. 21; 13, pp. 38, 66; 57, p. 13; 78, pp. 1-2, 11, 88
SO-52	Soil	12/5/11	Chromium	None	17.3 mg/Kg	1.2 mg/Kg	11, p. 21; 13, pp. 37-38, 66; 57, p. 13; 78, pp. 1-2, 11, 87
SO-53	Soil	12/5/11	Mercury	None	0.040 J (0.040) mg/Kg	0.12 mg/Kg	11, p. 21; 13, pp. 38, 66; 57, p. 13; 78, pp. 1-2, 11, 88

Table 26 - Hazardous Substances Associated with Background Soil Samples (Continued)							
Sample ID	**Sample Type**	**Date**	**Hazardous Substance**	**Bias***	**Hazardous Substance Concentration**	**Sample-Adjusted CRQL**	**Reference**
Subsurface Soil Samples							
SO-64	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	0.752 U ng/Kg	5.04 ng/Kg	11, p. 23; 13, pp. 40, 69; 50, p. 7; 71, pp. 1-2, 13, 123
SO-64	Soil	12/5/11	1,2,3,7,8,9-HxCDD	None	0.772 U ng/Kg	5.04 ng/Kg	11, p. 23; 13, pp. 40, 69; 50, p. 7; 71, pp. 1-2, 13, 123
SO-64	Soil	12/5/11	1,2,3,4,6,7,8-HpCDD	None	9.66 ng/Kg	5.04 ng/Kg	11, p. 23; 13, pp. 40, 69; 50, p. 7; 71, pp. 1-2, 13, 123
SO-64	Soil	12/5/11	2,3,7,8-TCDF	None	0.169 U ng/Kg	1.01 ng/Kg	11, p. 23; 13, pp. 40, 69; 50, p. 7; 71, pp. 1-2, 13, 123
SO-64	Soil	12/5/11	2,3,4,6,7,8-HxCDF	None	0.345 U ng/Kg	5.04 ng/Kg	11, p. 23; 13, pp. 40, 69; 50, p. 7; 71, pp. 1-2, 13, 123
SO-64	Soil	12/5/11	1,2,3,4,6,7,8-HpCDF	None	1.15 ng/Kg	5.04 ng/Kg	11, p. 23; 13, pp. 40, 69; 50, p. 7; 71, pp. 1-2, 13, 123
SO-64	Soil	12/5/11	Arsenic	High	7.1 J (7.1) mg/Kg	1.2 mg/Kg	11, p. 23; 13, pp. 40, 69; 57, p. 15; 78, pp. 1-2, 12, 99
SO-64	Soil	12/5/11	Barium	None	14.0 J (14.0) mg/Kg	24.2 mg/Kg	11, p. 23; 13, pp. 40, 69; 57, p. 15; 78, pp. 1-2, 12, 99
SO-64	Soil	12/5/11	Chromium	None	16.9 mg/Kg	1.2 mg/Kg	11, p. 23; 13, pp. 40, 69; 57, p. 15; 78, pp. 1-2, 12, 99

Table 26 - Hazardous Substances Associated with Background Soil Samples (Concluded)							
Sample ID	**Sample Type**	**Date**	**Hazardous Substance**	**Bias***	**Hazardous Substance Concentration**	**Sample-Adjusted CRQL**	**Reference**
Subsurface Soil Samples							
SO-64	Soil	12/5/11	Mercury	None	0.11 J (0.11) mg/Kg	0.12 mg/Kg	11, p. 23; 13, pp. 40, 69; 57, p. 15; 78, pp. 1-2, 12, 99

CRQL = Contract Required Quantitation Limit.
ng/Kg = Nanograms per kilogram. mg/Kg = Milligrams per kilogram.
HxCDD= Hexachlorodibenzodioxin. HpCDD= Heptachlorodibenzodioxin.
TCDF = Tetrachlorodibenzofuran. HxCDF= Hexachlorodibenzofuran.
HpCDF= Heptachlorodibenzofuran.

U = The compound or element was analyzed for, but not detected. The associated numerical value is the sample-adjusted CRQL [50, p. 7; 57, p. 11; 141, p. 3].
J = The associated numerical value is an estimated quantity [50, p. 4; 57, p. 11; 141, p. 2; 142, pp. 23-24].
EMPC = Estimated Maximum Possible Concentration based on a failure of the ion abundance ratio. The EMPC is a worst case estimate of the sample concentration that the signal would represent if it did meet all the identification criteria [141, p. D-4].
* = An explanation for the direction of bias is provided in Reference 71, Table 3 and Reference 78.
( ) = For hazardous substance concentrations, denotes concentration of the compound or element following adjustment. Based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination*, for HRS purposes it is not required to adjust qualified source data. Although the fact sheet was not intended for application to source data, it has been applied in this situation to demonstrate the relative increase in contamination in the source samples over background levels and that the contaminants are present in the soil due to a release [140, pp. 4-8].

Based on an examination of the two background soil samples submitted for dioxin/furan analysis and the four background soil samples submitted for total metals analysis, the highest comparative numerical background value concentrations are presented in Table 28 and used for comparison.

Dioxin/furan congeners 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, and 2,3,4,6,7,8-HxCDF in background surface soil samples, and 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 2,3,7,8-TCDF, and 2,3,4,6,7,8-HxCDF in background subsurface soil samples were non-detect. Therefore, a soil/source sample is considered significantly above background when the comparative soil/source sample concentration equals or exceeds the sample-adjusted CRQL [1, p. 51589 (Table 2-3)].

Dioxin congener 1,2,3,4,6,7,8-HpCDD was detected in background surface and subsurface soil samples at a concentration exceeding the sample-adjusted CRQL; therefore, the dioxin congener is considered significantly above background when the soil/source sample concentration is three times or more above the background concentration [1, p. 51589 (Table 2-3)]. In addition, arsenic and chromium were each detected in background surface and subsurface soil samples at a concentration exceeding the sample-adjusted CRQL; therefore, the two total metals are considered significantly above background when the comparative soil/source sample concentration is three times or more above the background concentration. [1, p. 51589 (Table 2-3)].

Furan congener 1,2,3,4,6,7,8-HpCDF was detected in the background surface soil sample at a concentration below the sample-adjusted CRQL [1, p. 51589 (Table 2-3)]. This furan congener is considered above background when the comparative surface soil/source sample concentration is three time or more above the background concentration, as using the sample-adjusted CRQL for comparison would provide a lower background threshold value [1, p. 51589 (Table 2-3)]. In addition, barium and mercury were each detected in background surface and subsurface soil samples at concentrations below the sample-adjusted CRQL [1, p. 51589 (Table 2-3)]. Barium in both surface and subsurface soil/source samples and mercury in subsurface soil/source samples are each considered above background when the comparative soil/source sample concentration is three times or more above the background concentration, as using the sample-adjusted CRQL for comparison would provide a lower background threshold value [1, p. 51589 (Table 2-3)]. Mercury in surface soil/source samples is considered above background when the comparative soil/source sample concentration is three times or more above the background concentration, as using the sample-adjusted CRQL for comparison would provide the same comparison value [1, p. 51589 (Table 2-3)].

Furan congeners 2,3,7,8-TCDF, in surface background soil sample, and 1,2,3,4,6,7,8-HpCDF, in background subsurface soil sample, were each detected at concentrations below the sample-adjusted CRQL. These furan congeners are considered above background when the source sample concentration is greater than the sample-adjusted CRQL, as three times the detected sample concentration is below the sample-adjusted CRQL [1, p. 51589 (Table 2-3)]. This approach provides the highest possible comparison value.

- Source Samples:

On 18 through 22 April 2011, as part of the EPA SI of the Creese & Cook Co. (Former) 2 property and on 5 December 2011, as part of the EPA SR of the Creese & Cook Co. (Former) 1 property, soil/source sampling activities of the Water Street/MBTA Source were conducted [11, pp. 20-24; 12, pp. 4-17; 13, p. 36-41; 14, pp. 10-30]. All soil source samples were collected in accordance with the EPA-approved Site-Specific QAPP for the Creese & Cook Co. (Former) 2, dated 21 January 2011, and/or the EPA-approved Site-Specific QAPP for the Creese & Cook Co. (Former) 1 property, dated 18 April 2011, and the Site-Specific QAPP Addendum, dated 22 November 2011 [8, pp. 34-37; 9, pp. 2-3, 11-12; 10, pp. 39-41; 13, pp. 36-41; 14, pp. 10-30]. As part of the Water Street/MBTA Source characterization, 49 soil/source samples (SS-02A, SS-02C, SB-02, SS-03A, SB-03, SS-04A, SS-04C, SS-05A, SS-05C, SB-05A, SS-06A, SS-07A, SS-07C, SB-07A, SS-08A, SS-08C, SB-08A, SB-08B, SS-09A, SS-09C, SB-09A, SB-09B, SS-10A, SS-11A, SB-11A, SB-11B, SS-12A, SS-12C, SB-12A, SS-18A, SS-18C, SS-20A, SS-20C, SS-21A, SS-22A, SS-22C, SS-23A, SS-24A, SS-24C, SS-25A, SS-25C, SS-26A, SS-26C, SS-33A, SS-33C, SB-33A, SS-35A, SO-62, and SO-63) were collected from various locations throughout the contaminated soil source (see Figure 3b) [11, pp. 23-25; 12, pp. 4-17; 13, pp. 39-40, 69; 14, pp. 10-30].

Table 27 – Soil/Source Sample Description

Sample ID	Sample Description	Reference
SS-02A	Brown, fine-to-coarse sand, some fine-to-coarse gravel (rocks), debris (metal slag, leather, and brick), trace silt, and trace roots.	27, p. 4
SS-02C	Combination of two distinct intervals: Interval 1 = medium brown, fine-to-coarse sand, little debris (brick, glass, concrete), some silt, and trace clay; Interval 2 = light-to-medium brown, fine-to-coarse sand and silt, little clay, trace fine gravel, trace debris (brick fragments, concrete, and tile).	27, p. 5

Table 27 – Soil/Source Sample Description (Continued)		
Sample ID	**Sample Description**	**Reference**
SB-02	Combination of two distinct intervals: Interval 1 = saturated, medium brown, fine-to-coarse sand and silt, some debris (brick and metal), trace clay; Interval 2 = saturated, black, fine-to-coarse sand, some fine-to-medium gravel, little silt, and trace clay.	27, p. 6
SS-03A	Black, fine-to-medium gravel and fine-to-coarse sand, trace silt, trace clay, and trace debris (concrete).	27, pp. 7-8
SB-03	Combination of three distinct intervals: Interval 1 = saturated, reddish brown-to-brown, fine-to-coarse sand and fine gravel, trace silt, and trace clay; Interval 2 = brown, coarse gravel; Interval 3 = medium brown-to-dark brown, clay and silt, little organics (roots, matted vegetation), trace fine sand.	27, p. 9
SS-04A	Brown, fine-to-medium sand and silt, trace fine-to-coarse gravel, and trace organics.	27, p. 10
SS-04C	As brown, fine sand, some silt, little fine-to-coarse gravel (up to 5-inch cobble), trace debris (brick, plastic, glass, ceramic, and slag), and trace organics.	27, p. 11
SS-05A	Light brown-to-brown, fine-to-coarse gravel (up to 10-inch cobble), little fine-to-coarse sand, trace silt.	27, p. 12
SS-05C	Combination of two distinct intervals: Interval 1 = dark brown, fine-to-coarse sand and silt, some debris (concrete, brick, and tile), trace fine gravel, and trace organics (roots); Interval 2 = cinnamon brown-to-brown, fine-to-coarse sand and silt, trace gravel, trace debris (cinder ash, clunkers, and brick fragments), and trace clay.	27, p. 13
SB-05A	Combination of four distinct intervals: Interval 1 = brick; Interval 2 = cinnamon brown-to-brown, fine-to-coarse sand and silt, little fine-to-medium gravel; Interval 3 = dark brown, silt, little fine sand, trace debris (glass); Interval 4 = dark brown, silt and fine-to-coarse sand, little fine-to-medium gravel, trace organics.	27, p. 14
SS-06A	Combination of two distinct intervals: Interval 1= dark brown to black, fine-to-coarse sand and silt, some fine-to-medium gravel, trace clay, trace debris (brick), trace organics (roots); Interval 2= reddish brown to medium brown, fine-to-medium sand, some silt, trace fine gravel.	27, pp. 16-17
SS-07A	Dark brown, sand and silt and organics (roots and grass), trace fine gravel	27, pp. 20-21
SS-07C	Combination of two distinct intervals: Interval 1 = brown, fine-to-medium sand and silt, little debris (brick, concrete, and glass); Interval 2 = brown fine-to-medium sand and silt, little debris (brick and concrete), trace coarse sand, and trace fine gravel.	27, p. 21
SB-07A	Combination of two distinct intervals: Interval 1 = dark brown, fine-to-coarse sand and silt, little debris (concrete, brick, possible mortar), trace clay, and trace fine gravel; Interval 2 = medium brown, fine-to-coarse sand, some silt, and trace gravel.	27, p. 22
SS-08A	Light brown, fine-to-medium sand, little silt, little fine-to-coarse gravel, trace roots.	27, p. 24
SS-08C	Dark brown, silt and sand, some debris (concrete and brick fragments).	27, p. 25
SB-08A	Black, coarse sand and silt, little fine gravel, trace clay, trace medium gravel, and containing a petroleum-like odor.	27, p. 26
SB-08B	Combination of two distinct intervals: Interval 1 = grey silt, little clay, little fine sand, trace fine gravel, and trace coarse sand; Interval 2 = dark grey clay and silt, little fine sand.	27, p. 27

Table 27 – Soil/Source Sample Description (Continued)		
Sample ID	**Sample Description**	**Reference**
SS-09A/ SS-33A	As light brown-to-brown, fine-to-coarse sand, little fine-to-coarse gravel, trace silt, and trace organics.	27, p. 28
SS-09C/ SS-33C	Combination of two distinct intervals: Interval 1 = medium-to-dark brown, fine-to-medium gravel and fine-to-coarse sand, some silt, trace clay, and trace debris (brick); Interval 2 = grey, fine-to-medium gravel (concrete debris, brick), little silt, little fine-to-coarse sand.	27, p. 29
SB-09A	Combination of two distinct intervals: Interval 1 = medium brown, silt and fine-to-coarse sand, little clay, trace gravel; Interval 2 = medium brown, fine-to-coarse sand and silt, little fine gravel, and little clay.	27, p. 30
SB-09B	Combination of two distinct intervals: Interval 1 = light brown-to-medium brown, silt, little clay, little fine-to-coarse sand, with inclusions of fine sand; Interval 2 = light brown-to-grey, silt, little clay.	27, p. 30
SS-10A	Combination of two distinct intervals: Interval 1 = dark brown-to-greyish black, fine-to-coarse sand, some silt, trace debris (brick); Interval 2 = black silt, some fine-to-coarse sand, little debris (burned materials, apparent roofing and tar material), trace gravel, and contained a petroleum-like/creosote-like odor throughout the interval.	27, p. 31-33
SS-11A	Combination of two distinct intervals: Interval 1 = dark brown silt, trace fine-to-coarse sand, trace debris (glass), trace organics (rootlets); Interval 2 = dark brown, fine-to-coarse sand and silt, some fine-to-medium gravel, little debris (brick, ash material, clinkers), trace clay, and was moist.	27, p. 34
SB-11A	Combination of three distinct intervals: Interval 1 = wet, debris which included red and brown crushed brick, white-to-cream-colored mortar, and black burnt charred wood with fibrous material; Interval 2 = saturated, dark brown-to-black, silt and fine-to-coarse sand, little debris (mortar, brick, and wood); Interval 3 = saturated, black, organics (wood).	27, p. 35
SB-11B	Combination of two distinct intervals: Interval 1 = blue-grey, clay; Interval 2 = black-to-blue-grey, clay, trace black organic material.	27, p. 36
SS-12A	Dark brown silt and debris (glass, brick, wood, metal, and ash), trace fine-to-coarse sand, and trace rootlets.	27, p. 37
SS-12C	As moist, dark brown, fine-to-coarse sand, little clay, little silt, little debris (glass, rope, wood, ceramic fragments, and metal debris), and trace fine-to-coarse gravel.	27, p. 38
SB-12A	Combination of two distinct intervals: Interval 1 = medium brown-to-dark brown, fine-to-coarse sand and fine-to-medium gravel, some silt, little debris (glass, metal, brick, tile); Interval 2 = blue-grey, clay.	27, p. 39
SS-18A	Light brown, sand.	27, p. 53
SS-18C	Combination of two distinct intervals: Interval 1 = light brown, fine-to-coarse sand, some gravel (up to 2-inch rock), trace debris (brick and mortar); Interval 2 = moist, dark brown, gravel (up to ¼-inch), little sand.	27, p. 54
SS-20A	Dark brown, fine-to-coarse sand and gravel (up to 5-inch cobble), and trace organics (roots and mulch).	27, p. 57
SS-20C	Dark brown, fine-to-coarse sand and gravel (up to 3-inch cobble), and trace organics.	27, p. 58

Table 27 – Soil/Source Sample Description (Concluded)		
Sample ID	**Sample Description**	**Reference**
SS-21A	Brown, fine-to-medium sand, some silt, trace gravel (up to 1-inch, brick debris), and trace organics.	27, p. 59
SS-22A	Light brown, clay, some silt, trace fine sand, trace fine-to-coarse gravel, and trace organics.	27, p. 61
SS-22C	Light brown, fine sand and silt, trace fine gravel, and trace organics.	27, p. 62
SS-23A/ SS-35A	Dark brown, fine-to-medium sand and silt, some clay, trace fine-to-coarse gravel, trace debris and plastic, and trace organics.	27, p. 63
SS-24A	Dark brown, fine sand and silt, some debris (leather and plastic), trace fine-to-coarse gravel, trace clay, and trace organics.	27, p. 65
SS-24C	Dark brown, fine sand and silt, trace gravel, trace clay, trace debris (plastic), and trace organics.	27, p. 66
SS-25A	Dark brown, fine-to-coarse sand, little gravel (up to 1-inch rock, plastic, leather debris, possible coal slag), trace organics.	27, p. 67
SS-25C	Dark brown, fine-to-coarse sand, little gravel (up to 1.5-inch rock, plastic, leather, and glass), trace organics.	27, p. 68
SS-26A	Dark brown-to-black, fine-to-coarse sand, little gravel (up to 1-inch cobble, leather, glass, metal), trace organics.	27, p. 69
SS-26C	Combination of two distinct intervals: Interval 1 = dark brown-to-black, fine-to-coarse sand, little gravel (up to 2-inch rock, leather, glass), trace organics (roots and reeds); Interval 2 = orange-brown, gravel (up to 2-inch rock).	27, p. 70
SO-62	Dark brown, organic-rich silt, little fine-to-coarse sand, trace fine gravel.	26, p. 34
SO-63	Dark brown, silt and fine-to-coarse sand, little organics, trace fine-to-medium gravel, trace clay.	26, p. 35

Thirty-three of the 49 soil/source samples (SS-02A, SB-02, SS-03A, SB-03, SS-04A, SS-05A, SB-05A, SS-06A, SS-07A, SB-07A, SS-08A, SB-08A, SB-08B, SS-09A, SB-09A, SB-09B, SS-10A, SS-11A, SB-11A, SB-11B, SS-12A, SB-12, SS-18A, SS-20A, SS-21A, SS-22A, SS-23A, SS-24A, SS-25A, SS-26A, SS-33A, SB-33A, SS-35A) were submitted to CLP laboratories for dioxin/furan analyses following DLM02.2, and for total metals analysis following ISM01.2 [12, pp. 5-16; 14, pp. 14-25; 28, pp. 13, 15, 17, 19; 29, pp. 9, 15-16, 23-24, 26-27; 45; 53, p. 1, 4-6, 8; 54, p. 1, 4-5, 7-8; 55, p. 1, 4, 6; 56, p. 1, 4-8; 60, p. 1, 11-13; 62, p. 1, 12-14; 64, p. 1, 11-13; 74, pp. 12-14, 19, 24, 112-114, 119, 124; 75, pp. 11-16, 21, 23, 106-111, 116, 118; 76, pp. 9-10, 14-15, 95-96, 101-102; 77, pp. 9-12, 14-15, 17, 20-21, 104-107, 109-110, 112-113, 116; 81, pp. 11-13, 16-17, 19-20, 84-88, 93, 95-96, 100-101; 85, pp. 9-10, 12-15, 76-77, 79, 84, 86, 88-90]. Two of the 49 soil/source samples (SO-62 and SO-63) were submitted to CLP laboratories for dioxin/furan analyses following DLM02.2, and for total metals analysis following ISM01.3 [11, pp. 20-24; 13, p. 39-40, 57, 69; 28, p. 11; 29, p. 7; 50, p. 1, 7; 57, p. 1, 4; 70, pp. 22-23, 120-122; 78, pp. 19, 77-78]. Fourteen of the 49 soil/source samples (SS-02C, SS-04C, SS-05C, SS-07C, SS-08C, SS-09C, SS-12C, SS-18C, SS-20C, SS-22C, SS-24C, SS-25C, SS-26C, and SS-33C) were submitted to a CLP laboratory for total metals analysis only, following ISM01.2 [12, pp. 5-16; 14, p. 14-25; 29, pp. 13, 20; 45; 61, p. 1, 8-10; 63, p. 1, 8-9; 82, pp. 11-12, 64, 66-67, 69-70, 77, 79; 84, pp. 9, 55-56, 58, 60-62, 66]. COCs for all soil/source samples collected as part of the 2011 EPA SR and SI and presented in this HRS Documentation Record are provided in References 28 and 29. The applicable COC sections for the Source No. 4 samples and all corresponding sample identifiers are provided in available COC, field notes reference documentation, and sample crosswalk [11, pp. 23-25; 12, pp. 4-16; 13, pp. 39-40, 69; 14, pp. 12-17, 19-21, 23-25, 28; 26, pp. 34-35; 27, pp. 4-14, 16-17, 20-39; 28, pp. 11, 13, 15, 17, 19; 29, pp. 7, 9, 13, 15-16, 20, 23-24, 26-27, 29; 45]. The dioxin/furan analytical results were manually

validated at a stage 4 level in accordance with the criteria specified in the USEPA SOW DLM02.2 and EPA Region I's ESAT Dioxin/Furan Data Validation SOP ESAT-01-0007 [53, p. 1, 4-6, 8; 54, p. 1, 4-5, 7-8; 55, p. 1, 4, 6; 56, p. 1, 4-8; 60, p. 1, 11-13; 62, p. 1, 12-14; 64, p. 1, 11-13]. The total metals analytical data were evaluated on a Tier II level in accordance with the Region I Tiered Organic and Inorganic Data Validation Guidelines dated November 2008 [50, p. 1, 7; 53, p. 1, 4-6, 8; 54, p. 1, 4-5, 7-8; 55, p. 1, 4, 6; 56, p. 1, 4-8; 57, p. 1, 14; 60, p. 1, 11-13; 62, p. 1, 12-14; 63, p. 1, 8-9; 64, p. 1, 11-13]. The validation of dioxin/furan and total metals analytical results was conducted independently by designated chemists who were not involved in the sample collection and HRS evaluation [11, pp. 23-25; 12, pp. 4-17; 13, pp. 39-40, 69; 14, pp. 10-30;50, pp. 1-3; 53, pp. 1-3; 54, pp. 1-3; 56, pp. 1-3; 57, pp. 1-8; 60, pp. 1-7; 61, pp. 1-4; 62, pp. 1-8; 63, pp. 1-4; 64, pp. 1-7]. For the purposes of the Source No. 4 evaluation and this HRS documentation record, analytical results of the 49 soil/source samples confirm the presence of the following hazardous substances: six dioxin/furan congeners (1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,4,6,7,8-HpCDF) and four total metals (arsenic, barium, chromium, and mercury). Source No. 4 has been documented to contain hazardous substances as defined by the HRS [1, p. 51588; 173, pp. 493, 500-501].

Among the 49 selected soil/source samples: 1,2,3,6,7,8-HxCDD was detected at a maximum concentration of 776 ng/Kg in soil/source sample SO-62; 1,2,3,7,8,9-HxCDD was detected at a maximum concentration of 391 ng/Kg in soil/source sample SO-62; 1,2,3,4,6,7,8-HpCDD was detected at a maximum concentration of 21,900 ng/Kg in soil/source sample SO-62; 2,3,7,8-TCDF was detected at a maximum concentration of 8.82 ng/Kg in soil/source sample SS-12A; 2,3,4,6,7,8-HxCDF was detected at a maximum concentration of 126 ng/Kg in soil/source sample SO-62; 1,2,3,4,6,7,8-HpCDF was detected at a maximum concentration of 2,840 ng/Kg in soil/source sample SO-62; arsenic was detected at a maximum concentration of 201 mg/Kg in soil/source sample SB-03; barium was detected at a maximum concentration of 923 mg/Kg in soil/source sample SB-12; chromium was detected at a maximum concentration of 21,300 J mg/Kg in soil/source sample SB-08A; and mercury was detected at a maximum concentration of 7.2 mg/Kg in soil/source sample SS-06A [11, pp. 23-25; 12, pp. 5-16, 13, pp. 39-40, 69; 14, pp. 14-25; 45; 50, p. 7; 53, pp. 4-6, 8; 54, pp. 4-5, 7-8; 55, p. 4, 6; 56, pp. 4-8; 57, p. 14; 60, pp. 11-13; 61, pp. 8-10; 62, pp. 12-14, 63, pp. 8-9; 64, pp. 11-13; 71, pp. 22-23, 120-122; 74, pp. 12-14, 19, 24, 112-114, 119, 124; 75, pp. 11-16, 21, 23, 106-111, 116, 118; 76, pp. 9-10, 14-15, 95-96, 101-102; 77, pp. 9-12, 14-15, 17, 104-107, 109-110, 112-113, 116; 78, pp. 19, 97-98; 80, pp. 13, 20; 81, pp. 11-13, 16-17, 19-20, 84-88, 93, 95-96, 100-101; 82, pp. 11-12, 64, 66-67, 69-70, 77, 79; 83, pp. 11-12, 14-15, 17-20, 91-98, 100-101, 105, 107-108; 84, pp. 9, 55-56, 58, 60-62, 66; 85, pp. 9-10, 12-15, 76-77, 79, 84, 86, 88-90].

Table 28 - Hazardous Substances Associated with Source No. 4

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration		Sample-Adjusted CRQL		Reference
SS-02A	Soil	4/18/11	1,2,3,6,7,8-HxCDD	None	7.61	ng/Kg	4.91	ng/Kg	12, p. 5; 14, pp. 10, 14; 53, p. 4; 74, p. 1-2, 12, 112
			1,2,3,4,6,7,8-HpCDD	None	223	ng/Kg	4.91	ng/Kg	
			2,3,7,8-TCDF	None	3.14	ng/Kg	0.982	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	41.1	ng/Kg	4.91	ng/Kg	
			Barium	None	73.4	mg/Kg	20.7	mg/Kg	12, p. 5; 14, p. 10, 14; 60, p. 11; 81, pp. 1-2, 11, 84
			Chromium	None	94.6	mg/Kg	1.0	mg/Kg	
			Mercury	None	0.23	mg/Kg	0.10	mg/Kg	
SS-02C	Soil	4/18/11	Chromium	Unknown	141 J (109)	mg/Kg	0.9	mg/Kg	12, pp. 5-6; 14, p. 10, 14; 61, p. 8; 82, pp. 1-2, 11, 64
SB-02	Soil	4/18/11	1,2,3,6,7,8-HxCDD	None	6.93	ng/Kg	4.82	ng/Kg	12, pp. 5-6; 14, p. 10, 14; 53, p. 8; 74, pp. 1-2, 24, 124
			1,2,3,4,6,7,8-HpCDD	None	200	ng/Kg	4.82	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	30.3	ng/Kg	4.82	ng/Kg	
			Arsenic	None	39.2	mg/Kg	0.9	mg/Kg	12, pp. 5-6; 14, p. 10, 14; 60, p. 13; 81, pp. 1-2, 19, 100
			Barium	None	91.6	mg/Kg	17.9	mg/Kg	
			Chromium	None	870	mg/Kg	1.8	mg/Kg	
			Mercury	None	0.22	mg/Kg	0.11	mg/Kg	
SS-03A	Soil	4/19/11	1,2,3,7,8,9-HxCDD	None	5.37	ng/Kg	4.10	ng/Kg	12, pp. 6-8; 14, pp. 15-16; 53, p. 4; 74, pp. 1-2, 13, 113
			1,2,3,4,6,7,8-HpCDD	None	687	ng/Kg	4.10	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	77.1	ng/Kg	4.10	ng/Kg	
			Barium	None	86.1	mg/Kg	20.4	mg/Kg	12, pp. 6-8; 14, pp. 15-16; 60, p. 11; 81, pp. 1-2, 12, 85
			Chromium	None	491	mg/Kg	1.0	mg/Kg	
			Mercury	None	0.29	mg/Kg	0.10	mg/Kg	
SB-03	Soil	4/19/11	Arsenic	None	201	mg/Kg	1.6	mg/Kg	12, pp. 6-8; 14, pp. 15-16; 60, p. 13; 81, pp. 1-2, 20, 101
			Chromium	None	58	mg/Kg	0.8	mg/Kg	

Table 28 - Hazardous Substances Associated with Source No. 4 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SS-04A	Soil	4/21/11	1,2,3,6,7,8-HxCDD	None	21.6 ng/Kg	4.82 ng/Kg	12, p. 13; 14, p. 22-24; 56, p. 4; 77, pp. 1-2, 9, 104
			1,2,3,7,8,9-HxCDD	None	5.09 ng/Kg	4.82 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	694 ng/Kg	4.82 ng/Kg	
			2,3,7,8-TCDF	None	5.75 ng/Kg	0.964 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	101 ng/Kg	4.82 ng/Kg	
			Chromium	High	861 J (667) mg/Kg	1.9 mg/Kg	12, p. 13; 14, p. 22-24; 62, p. 13; 83, pp. 1-2, 17, 91
			Mercury	None	0.31 mg/Kg	0.11 mg/Kg	
SS-04C	Soil	4/21/11	Chromium	Unknown	871 J (675) mg/Kg	2.6 mg/Kg	12, pp. 13-14; 14, p. 22-24; 61, p. 8; 82, pp. 1-2, 11, 66
SS-05A	Soil	4/20/11	1,2,3,4,6,7,8-HpCDD	None	141 ng/Kg	4.83 ng/Kg	12, p. 10; 14, p. 19-20; 54, p. 4; 75, pp. 1-2, 11, 106
			1,2,3,4,6,7,8-HpCDF	None	19.9 ng/Kg	4.83 ng/Kg	
			Chromium	None	196 mg/Kg	0.8 mg/Kg	12, p. 10; 14, p. 19-20; 60, p. 11; 81, pp. 1-2, 12, 86
			Mercury	None	0.23 mg/Kg	0.10 mg/Kg	
SS-05C	Soil	4/20/11	Chromium	Unknown	755 J (585) mg/Kg	2.1 mg/Kg	12, pp. 10-11; 14, pp. 19-20; 61, p. 8; 82, pp. 1-2, 11, 67
SB-05A	Soil	4/20/11	Chromium	High	2,930 J (2,270) mg/Kg	8.2 mg/Kg	12, p. 10; 14, pp. 19-21; 62, p. 12; 83, pp. 1-2, 12, 101
			Mercury	None	0.42 mg/Kg	0.12 mg/Kg	
SS-06A	Soil	4/19/11	1,2,3,4,6,7,8-HpCDD	None	1,160 ng/Kg	43.0 ng/Kg	12, pp. 7-8; 14, p. 15-16; 53, p. 5; 74, pp. 1-2, 14, 114
			1,2,3,4,6,7,8-HpCDF	None	134 ng/Kg	43.0 ng/Kg	
			Barium	None	67.8 mg/Kg	15.0 mg/Kg	12, pp. 7-8; 14, p. 15-16; 60, p. 11; 81, pp. 1-2, 13, 87
			Chromium	None	337 mg/Kg	0.7 mg/Kg	
			Mercury	None	7.2 mg/Kg	1.08 mg/Kg	

Table 28 - Hazardous Substances Associated with Source No. 4 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SS-07A	Soil	4/19/11	1,2,3,4,6,7,8-HpCDD	None	885 ng/Kg	36.3 ng/Kg	12, pp. 7-8; 14, p. 15-17; 54, p. 4; 75, p. 1-2, 12, 107
			1,2,3,4,6,7,8-HpCDF	None	96.2 ng/Kg	36.3 ng/Kg	
			Arsenic	None	50 mg/Kg	0.8 mg/Kg	12, pp. 7-8; 14, p. 15-17; 60, p. 11; 81, pp. 1-2, 13, 88
			Chromium	None	623 mg/Kg	2.3 mg/Kg	
			Mercury	None	0.7 mg/Kg	0.11 mg/Kg	
SS-07C	Soil	4/19/11	Chromium	Unknown	1,330 J (1,031) mg/Kg	4.3 mg/Kg	12, pp. 7-8; 14, p. 15-17; 61, p. 8; 82, pp. 1-2, 11, 69
SB-07A	Soil	4/19/11	1,2,3,6,7,8-HxCDD	None	5.94 ng/Kg	4.43 ng/Kg	12, pp. 7-8; 14, p. 15-17; 54, p. 7; 75, pp. 1-2, 21, 116
			1,2,3,4,6,7,8-HpCDD	None	278 ng/Kg	4.43 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	26.7 ng/Kg	4.43 ng/Kg	
			Chromium	High	93.9 J (72.8) mg/Kg	0.9 mg/Kg	12, pp. 7-8; 14, p. 15-17; 62, p. 12; 83, pp. 1-2, 14, 105
			Mercury	None	0.24 mg/Kg	0.11 mg/Kg	
SS-08A	Soil	4/20/11	1,2,3,6,7,8-HxCDD	None	7.78 ng/Kg	4.82 ng/Kg	12, pp. 9-10; 14, pp. 19-20; 54, p. 4; 75, pp. 1-2, 13, 108
			1,2,3,4,6,7,8-HpCDD	None	231 ng/Kg	4.82 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	42.7 ng/Kg	4.82 ng/Kg	
			Chromium	High	93.1 J (72.2) mg/Kg	0.8 mg/Kg	12, pp. 9-10; 14, pp. 19-20; 62, p. 12; 83, pp. 1-2, 11, 92
			Mercury	None	0.15 mg/Kg	0.11 mg/Kg	
SS-08C	Soil	4/20/11	Chromium	None	1,730 mg/Kg	5.2 mg/Kg	12, pp. 9-11; 14, pp. 19-20; 63, p. 8; 84, pp. 1-2, 9, 55
SB-08A	Soil	4/20/11	1,2,3,4,6,7,8-HpCDD	None	74.6 ng/Kg	4.90 ng/Kg	12, pp. 9-11; 14, pp. 19-20; 54, p. 8; 75, pp. 1-2, 23, 118
			1,2,3,4,6,7,8-HpCDF	None	12.5 ng/Kg	4.90 ng/Kg	
			Chromium	High	21,300 J (16,500) mg/Kg	49.0 mg/Kg	12, pp. 9-11; 14, pp. 19-20; 62, p. 13; 83, pp. 1-2, 15, 107

Table 28 - Hazardous Substances Associated with Source No. 4 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration		Sample-Adjusted CRQL		Reference
SB-08B	Soil	4/20/11	Chromium	High	19,100 J (14,800)	mg/Kg	52.1	mg/Kg	12, pp. 9-11; 14, p. 19-20; 62, p. 13; 83, pp. 1-2, 15, 108
SS-09A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDD	None	90.4	ng/Kg	4.83	ng/Kg	12, pp. 12-13; 14, p. 22-23; 55, p. 4; 76, pp. 1-2, 9, 95
			2,3,7,8-TCDF	None	1.62	ng/Kg	0.967	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	14.2	ng/Kg	4.83	ng/Kg	
			Mercury	Unknown	0.7 J (0.38)	mg/Kg	0.10	mg/Kg	12, pp. 12-13; 14, p. 22-23; 64, p. 11; 85, pp. 1-2, 9, 76
SS-09C	Soil	4/21/11	Chromium	Unknown	83.8 J (65.0)	mg/Kg	0.8	mg/Kg	12, pp. 12, 14; 14, p. 22; 61, p. 9; 82, pp. 1-2, 11, 70
SB-09A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDD	None	64	ng/Kg	4.85	ng/Kg	12, pp. 12, 14; 14, p. 22-24; 56, p. 7; 77, pp. 1-2, 20, 113
SB-09B	Soil	4/21/11	Barium	None	70.1	mg/Kg	20.1	mg/Kg	12, pp. 12, 14; 14, p. 22-24; 64, p. 12; 85, pp. 1-2, 13, 86
SS-10A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDD	None	313	ng/Kg	49.1	ng/Kg	12, p. 13; 14, p. 22-24; 56, p. 4; 77, pp. 1-2, 10, 105
			1,2,3,4,6,7,8-HpCDF	None	55.1	ng/Kg	49.1	ng/Kg	
			Barium	None	68.5	mg/Kg	19.2	mg/Kg	12, p. 13; 14, p. 22-24; 62, p. 13; 83, pp. 1-2, 17, 93
			Chromium	High	79.9 J (61.9)	mg/Kg	1.0	mg/Kg	
			Mercury	None	0.39	mg/Kg	0.11	mg/Kg	

Table 28 - Hazardous Substances Associated with Source No. 4 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SS-11A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDF	None	8.02 ng/Kg	4.83 ng/Kg	12, pp. 13-14; 14, p. 22, 25; 56, p. 4; 77, pp. 1-2, 11, 106
			Chromium	High	175 J (136) mg/Kg	0.8 mg/Kg	12, pp. 13-14; 14, p. 22, 25; 62, p. 14; 83, pp. 1-2, 18, 94
			Mercury	None	0.21 mg/Kg	0.11 mg/Kg	
SB-11A	Soil	4/21/11	2,3,7,8-TCDF	None	1.65 ng/Kg	0.955 ng/Kg	12, pp. 13-14; 14, p. 22, 25; 56, p. 8; 77, pp. 1-2, 21, 116
			Arsenic	None	43.7 mg/Kg	1.1 mg/Kg	12, pp. 13-14; 14, p. 25; 64, p. 12; 85, pp. 1-2, 14, 88
			Barium	None	191 mg/Kg	21.1 mg/Kg	
			Chromium	None	780 mg/Kg	2.1 mg/Kg	
SB-11B	Soil	4/21/11	Barium	None	74 mg/Kg	26.3 mg/Kg	12, pp. 13-14; 14, p. 22, 25; 64, p. 12; 85, pp. 1-2, 14, 89
			Chromium	None	57.4 mg/Kg	1.3 mg/Kg	
SS-12A	Soil	4/22/11	1,2,3,6,7,8-HxCDD	None	52.5 ng/Kg	4.84 ng/Kg	12, pp. 15-16; 14, p. 26-28; 55, p. 4; 76, pp. 1-2, 10, 96
			1,2,3,7,8,9-HxCDD	None	25.4 ng/Kg	4.84 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	High	1,000 EB (100) ng/Kg	4.84 ng/Kg	
			2,3,7,8-TCDF	None	8.82 ng/Kg	0.969 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	31.4 ng/Kg	4.84 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	1,050 ng/Kg	4.84 ng/Kg	
			Barium	None	859 mg/Kg	20.2 mg/Kg	12, pp. 15-16; 14, p. 26-28; 64, p. 11; 85, pp. 1-2, 9, 77
			Chromium	None	91.1 mg/Kg	1.0 mg/Kg	
			Mercury	Unknown	0.63 J (0.34) mg/Kg	0.13 mg/Kg	
SS-12C	Soil	4/22/11	Arsenic	None	91.1 mg/Kg	0.9 mg/Kg	12, pp. 15-16; 14, p. 26-28; 63, p. 9; 84, pp.1-2, 9, 56
			Chromium	None	437 mg/Kg	0.9 mg/Kg	

Table 28 - Hazardous Substances Associated with Source No. 4 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SB-12	Soil	4/22/11	1,2,3,6,7,8-HxCDD	None	6.60 ng/Kg	4.83 ng/Kg	12, pp. 15-16; 14, p. 26-28; 55, p. 6; 76, pp. 1-2, 15, 102
			1,2,3,4,6,7,8-HpCDD	None	309 ng/Kg	4.83 ng/Kg	
			2,3,7,8-TCDF	None	2.78 ng/Kg	0.967 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	105 ng/Kg	4.83 ng/Kg	
			Arsenic	None	77.3 mg/Kg	1.3 mg/Kg	12, pp. 15-16; 14, p. 26-28; 64, p. 13; 85, pp. 1-2, 15, 90
			Barium	None	923 mg/Kg	25.6 mg/Kg	
			Chromium	None	173 mg/Kg	1.3 mg/Kg	
			Mercury	None	0.58 mg/Kg	0.12 mg/Kg	
SS-18A	Soil	4/19/11	1,2,3,4,6,7,8-HpCDD	None	105 ng/Kg	52.0 ng/Kg	12, pp. 6, 8; 14, p. 15; 53, p. 6; 74, pp. 1-2, 19, 119
			Chromium	None	72.5 mg/Kg	0.9 mg/Kg	12, pp. 6, 8; 14, p. 15; 60, p. 12; 81, pp. 1-2, 16, 93
			Mercury	None	0.24 mg/Kg	0.11 mg/Kg	
SS-18C	Soil	4/19/11	Chromium	Unknown	272 J (211) mg/Kg	0.9 mg/Kg	12, pp. 6-8; 14, p. 15; 61, p. 9; 82, pp. 1-2, 12, 77
SS-20A	Soil	4/20/11	1,2,3,6,7,8-HxCDD	None	16.1 ng/Kg	4.80 ng/Kg	12, pp. 10-11; 14, p. 19-20; 56, p. 5; 77, pp. 1-2, 12, 107
			1,2,3,4,6,7,8-HpCDD	None	523 ng/Kg	4.80 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	71.1 ng/Kg	4.80 ng/Kg	
			Barium	None	164 mg/Kg	17.2 mg/Kg	12, pp. 10-11; 14, p. 19-20; 62, p. 14; 83, pp. 1-2, 18, 95
			Chromium	High	169 J (131) mg/Kg	0.9 mg/Kg	
			Mercury	None	0.32 mg/Kg	0.10 mg/Kg	
SS-20C	Soil	4/20/11	Chromium	Unknown	216 J (167) mg/Kg	0.9 mg/Kg	12, pp. 10-11; 14, p. 19-20; 61, p. 10; 82, pp. 1-2, 12, 79
SS-21A	Soil	4/20/11	1,2,3,4,6,7,8-HpCDD	None	1,010 ng/Kg	54.4 ng/Kg	12, pp. 9-10; 14, p. 19; 54, p. 5; 75, pp. 1-2, 14, 109
			1,2,3,4,6,7,8-HpCDF	None	132 ng/Kg	54.4 ng/Kg	
			Barium	None	73.6 mg/Kg	20.9 mg/Kg	12, pp. 9-10; 14, p. 19; 60, p. 12; 81, pp. 1-2, 17, 95
			Chromium	None	117 mg/Kg	1.0 mg/Kg	
			Mercury	None	0.47 mg/Kg	0.10 mg/Kg	

Table 28 - Hazardous Substances Associated with Source No. 4 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SS-22A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDD	None	105 ng/Kg	4.72 ng/Kg	12, pp. 12-13; 14, p. 22-24; 56, p. 5; 77, pp. 1-2, 13, 108
			1,2,3,4,6,7,8-HpCDF	None	6.62 ng/Kg	4.72 ng/Kg	
			Barium	None	74.6 mg/Kg	17.9 mg/Kg	12, pp. 12-13; 14, p. 22-24; 64, p. 11; 85, pp. 1-2, 10, 79
			Chromium	None	53.5 mg/Kg	0.9 mg/Kg	
SS-22C	Soil	4/21/11	Chromium	None	72.9 mg/Kg	1.5 mg/Kg	12, pp. 12-14; 14, p. 22-24; 63, p. 8; 84, pp. 1-2, 9, 58
SS-23A	Soil	4/21/11	1,2,3,6,7,8-HxCDD	None	13.2 ng/Kg	4.82 ng/Kg	12, pp. 12-13; 14, p. 22-23; 56, p. 5; 77, pp. 1-2, 14, 109
			1,2,3,4,6,7,8-HpCDD	None	258 ng/Kg	4.82 ng/Kg	
			2,3,7,8-TCDF	None	2.7 ng/Kg	0.965 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	57.8 ng/Kg	4.82 ng/Kg	
			Mercury	None	0.80 mg/Kg	0.11 mg/Kg	12, pp. 12-13; 14, p. 22-23; 62, p. 14; 83, pp. 1-2, 19, 96
SS-24A	Soil	4/21/11	1,2,3,6,7,8-HxCDD	None	768 ng/Kg	75.6 ng/Kg	12, pp. 12-13; 14, p. 22-23; 56, p. 6; 77, pp. 1-2, 15, 110
			1,2,3,7,8,9-HxCDD	None	205 ng/Kg	75.6 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	17,000 ng/Kg	75.6 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	116 ng/Kg	75.6 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	2,440 ng/Kg	75.6 ng/Kg	
			Barium	None	165 mg/Kg	32.5 mg/Kg	12, pp. 12-13; 14, p. 22-23; 62, p. 14; 83, pp. 1-2, 19, 97
			Chromium	High	4430 J (3,430) mg/Kg	16.2 mg/Kg	
			Mercury	None	1.4 mg/Kg	0.16 mg/Kg	
SS-24C	Soil	4/21/11	Chromium	None	152 mg/Kg	1.1 mg/Kg	12, pp. 12, 14; 14, p. 22-23; 63, p. 8; 84, pp. 1-2, 9, 60

Table 28 - Hazardous Substances Associated with Source No. 4 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SS-25A	Soil	4/20/11	1,2,3,6,7,8-HxCDD	None	159 ng/Kg	65.3 ng/Kg	12, pp. 9-10; 14, p. 19; 54, p. 5; 75, pp. 1-2, 15, 110
			1,2,3,7,8,9-HxCDD	None	135 ng/Kg	65.3 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	4,600 ng/Kg	65.3 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	94.5 ng/Kg	65.3 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	970 ng/Kg	65.3 ng/Kg	
			Arsenic	None	45.2 mg/Kg	1.1 mg/Kg	12, pp. 9-10; 14, p. 19; 60, p. 12; 81, pp. 1-2, 17, 96
			Barium	None	71.2 mg/Kg	21.6 mg/Kg	
			Chromium	None	1,030 mg/Kg	3.2 mg/Kg	
			Mercury	None	0.85 mg/Kg	0.14 mg/Kg	
SS-25C	Soil	4/20/11	Arsenic	None	59.4 mg/Kg	1.0 mg/Kg	12, pp. 9, 11; 14, p. 19; 63, p. 8; 84, pp. 1-2, 9, 61
			Chromium	None	596 mg/Kg	2.0 mg/Kg	
SS-26A	Soil	4/19/11	1,2,3,6,7,8-HxCDD	None	382 ng/Kg	61.8 ng/Kg	12, pp. 7-8; 14, p. 15-16; 54, p. 5; 75, pp. 1-2, 16, 111
			1,2,3,7,8,9-HxCDD	None	140 ng/Kg	61.8 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	12,100 ng/Kg	61.8 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	84.8 ng/Kg	61.8 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	1,840 ng/Kg	61.8 ng/Kg	
			Barium	None	173 mg/Kg	20.2 mg/Kg	12, pp. 7-8; 14, p. 15-16; 62, p. 12; 83, pp. 1-2, 11, 98
			Chromium	High	2,770 J (2,150) mg/Kg	10.1 mg/Kg	
			Mercury	None	0.97 mg/Kg	0.13 mg/Kg	
SS-26C	Soil	4/19/11	Arsenic	None	34.5 mg/Kg	0.9 mg/Kg	12, pp. 7-8; 14, p. 15-16; 63, p. 8; 84, pp. 1-2, 9, 62
			Chromium	None	827 mg/Kg	2.8 mg/Kg	
SS-33A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDD	None	145 ng/Kg	4.75 ng/Kg	12, pp. 12-13; 14, p. 22-23; 55, p. 6; 76, pp. 1-2, 14, 101
			1,2,3,4,6,7,8-HpCDF	None	17.8 ng/Kg	4.75 ng/Kg	
			Chromium	None	59.3 mg/Kg	0.9 mg/Kg	12, pp. 12-13; 14, p. 22-23; 64, p. 12; 85, pp. 1-2, 12, 84
SS-33C	Soil	4/21/11	Chromium	None	85.4 mg/Kg	0.7 mg/Kg	12, pp. 12, 14; 14, p. 23; 63, p. 8; 84, pp. 1-2, 9, 66

Table 28 - Hazardous Substances Associated with Source No. 4 (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration		Sample-Adjusted CRQL		Reference
SS-35A	Soil	4/21/11	1,2,3,6,7,8-HxCDD	None	7.92	ng/Kg	4.89	ng/Kg	12, pp. 12-13; 14, p. 22-23; 56, p. 6; 77, pp. 1-2, 17, 112
			1,2,3,4,6,7,8-HpCDD	None	157	ng/Kg	4.89	ng/Kg	
			2,3,7,8-TCDF	None	1.92	ng/Kg	0.979	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	35	ng/Kg	4.89	ng/Kg	
			Mercury	None	0.69	mg/Kg	0.12	mg/Kg	12, pp. 12-13; 14, p. 22-23; 62, p. 14; 83, pp. 1-2, 20, 100
SO-62	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	776	ng/Kg	75.3	ng/Kg	11, pp. 23, 25; 13, pp. 39-40, 69; 50, p. 7; 71, pp. 1-2, 22, 120
			1,2,3,7,8,9-HxCDD	None	391	ng/Kg	75.3	ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	21,900	ng/Kg	75.3	ng/Kg	
			2,3,4,6,7,8-HxCDF	None	126	ng/Kg	75.3	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	2,840	ng/Kg	75.3	ng/Kg	
			Barium	None	114	mg/Kg	36.9	mg/Kg	11, pp. 23, 25; 13, pp. 39-40, 69; 57, p. 14; 78, pp. 1-2, 19, 97
			Chromium	None	10,700	mg/Kg	18.5	mg/Kg	
			Mercury	None	1.3	mg/Kg	0.18	mg/Kg	

Table 28 - Hazardous Substances Associated with Source No. 4 (Concluded)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-63	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	167 ng/Kg	4.87 ng/Kg	11, pp. 23-24; 13, pp. 40, 69; 50, p. 7; 71, pp. 1-2, 23, 121-122
			1,2,3,7,8,9-HxCDD	None	34.8 ng/Kg	4.87 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	3260 ng/Kg	24.3 ng/Kg	
			2,3,7,8-TCDF	None	3.59 ng/Kg	0.973 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	53.8 ng/Kg	4.87 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	829 ng/Kg	4.87 ng/Kg	
			Chromium	None	768 mg/Kg	1.2 mg/Kg	11, pp. 23-24; 13, pp. 40, 69; 57, p. 14; 78, pp. 1-2, 19, 98
			Mercury	None	0.67 mg/Kg	0.12 mg/Kg	

CRQL = Contract Required Quantitation Limit.
ng/Kg = Nanograms per kilogram. mg/Kg = Milligrams per kilogram.
HxCDD= Hexachlorodibenzodioxin.
HpCDD= Heptachlorodibenzodioxin. HxCDF= Hexachlorodibenzofuran.
HpCDF= Heptachlorodibenzofuran. TCDF = Tetrachlorodibenzofuran.

J = The associated numerical value is an estimated quantity [61, p. 3; 62, p. 6; 64, p. 5; 141, p. B-20; 142, pp. B-23-24].
EB = The associated compound or element was detected in rinsate blank samples collected for quality control [55, p. 4; 76, pp. 10, 96]. The potential contribution for carryover from non-dedicated sampling equipment has been evaluated. In most cases, the concentration of the analyte or compound observed in a sample is significantly greater than the concentration observed in the associated equipment blank. Therefore, the sample data can be used with a high degree of certainty to confirm the presence of the substance in the samples [44].
* = An explanation for the direction of bias is provided in Reference 71, Table 3; Reference 74, Table 3; Reference 75, Table 3; Reference 76, Table 3; Reference 77, Table 3; Reference 78; Reference 81, Table 3; Reference 82, Table 3; Reference 83, Table 3; Reference 84, Table 3; and Reference 85, Table 3.
( ) = For hazardous substance concentrations, denotes concentration of the compound or element following adjustment. Based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination*, for HRS purposes it is not required to adjust qualified source data. Although the fact sheet was not intended for application to source data, it has been applied in this situation to demonstrate the relative increase in contamination in the source samples over background levels and that the contaminants are present in the soil due to a release [140, pp. 4-8].

List of Hazardous Substances Associated with Source

1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
2,3,7,8-TCDF
2,3,4,6,7,8-HxCDF
1,2,3,4,6,7,8-HpCDF
Arsenic
Barium
Chromium
Mercury

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

On-site observations indicated that no portion of Source No. 4 has a maintained engineered cover or complete runoff control management systems [11, p. 26;]. No report of a natural or man-made liner was documented during source sampling activities [11, p. 26;]. Therefore, Source No. 4 does not have full containment, and the source yields a containment value of 10 [1, p. 51596 (Table 3-2)].

Table 29 - Hazardous Substances Available to Pathways

Containment Description	Containment Factor	References
Gas release to air: NS	NS	
Particulate release to air: NS	NS	
Release to ground water: NS	NS	
Release via overland migration and/or flood: Based on the lack of liner, a maintained engineered cover, and any complete run-on control and runoff management systems, a Containment Factor Value of 10 has been assigned for release to the Surface Water Pathway for Source No. 4.	10	1, p. 51609 (Table 3-2); 11, p. 26

NS = Not Scored.

2.4.2 HAZARDOUS WASTE QUANTITY

2.4.2.1 Hazardous Waste Quantity

The Hazardous Waste Quantity for Source No. 4 was assigned based on the Area Factor Value of a "contaminated soil" source type [1, p. 51591, Table 2-5, Section 2.4.2.1.4]. The Hazardous Constituent Quantity, Hazardous Wastestream Quantity, and Volume values were not evaluated for Source No. 4 because insufficient information was available [1, pp. 51590-51591 (Sections 2.4.2.1.1 and 2.4.2.1.2, Table 2-5)].

2.4.2.1.1 Hazardous Constituent Quantity

Description

The hazardous constituent quantity for Source No. 4 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source is not known and cannot be estimated with reasonable confidence [1, pp. 51590-51591 (Section 2.4.2.1.1)]. There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 4 with reasonable confidence.

Table 30 – Hazardous Constituent Quantity		
Hazardous Substance	**Constituent Quantity (pounds)**	**References**
NS (insufficient information)		

NS = Not Scored.

Sum (pounds):

Hazardous Constituent Quantity Assigned Value: Not Scored

2.4.2.1.2 Hazardous Wastestream Quantity

Description

The hazardous wastestream quantity for Source No. 4 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence [1, p. 51591 (Section 2.4.2.1.2)]. There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, Annual reports, etc.) available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate the hazardous wastestream quantity for Source No. 4 with reasonable confidence.

Table 31 – Hazardous Wastestream Quantity		
Hazardous Wastestream	**Wastestream Quantity (pounds)**	**References**
NS (insufficient information)		

NS = Not Scored.

Sum (pounds):

Sum of Wastestream Quantity/5,000 [1, p. 51591 (Table 2-5)]:

Hazardous Wastestream Quantity Assigned Value: Not Scored

2.4.2.1.3 Volume

Description

The volume for Source No. 4 could not be adequately determined according to the HRS requirements because insufficient historical and current waste sampling data are available to adequately calculate the volume of the source (or the volume of the area of observed contamination) associated with the source with reasonable confidence [1, p. 51591 (Section 2.4.2.1.3)]. Insufficient historical or current sampling data are available to adequately estimate the depth of waste material within the source. Therefore, there is insufficient information to adequately calculate or estimate the volume for Source No. 4 with reasonable confidence.

Table 32 – Volume			
Source Type	**Description (# drums or dimensions)**	**Units (yd^3)**	**References**
NS			

NS = Not Scored.

The volume of a "contaminated soil" source, in yd^3, is divided by 2,500 to assign a volume assigned value to the source [1, p. 51591 (Table 2-5)].

Volume Assigned Value: 0

2.4.2.1.4 Area

Description

Based on sampling results and observations of the contaminated soil material contained within Source No. 4 (Water Street/MBTA Source), the areal extent of the source defined as part of this source characterization was documented using GPS (see Figure 2) [12, p. 1; 21]. Based on the information recorded as part of the EPA Site Inspection and SR, the area of the Water Street/MBTA Source (Source No. 4) was determined to be approximately 114,099 ft^2 (see Figure 2) [12, p. 1; 21].

Table 33 – Area		
Source Type	**Units (ft^2)**	**References**
Contaminated Soil	114,099	Figure 2, 12, p. 1; 21

The area of a "contaminated soil" source, in ft^2, is divided by 34,000 to assign an area assigned value to the source [1, p. 51591, Table 2-5].

Sum (ft^2): 114,099

Equation for Assigning Value (1, p. 51591, Table 2-5): 114,099 ÷ 34,000 = 3.36

Area Assigned Value: 3.36

2.4.2.1.5 Source Hazardous Waste Quantity Value

The Hazardous Waste Quantity Value for Source No. 4 was assigned based on the Area Factor Value (3.36) [1, p. 51591 (Table 2-5)]. The Hazardous Constituent Quantity, Hazardous Wastestream Quantity, and Volume values were not evaluated for Source No. 4 because insufficient information was available [1, pp. 51590-51591 (Sections 2.4.2.1.1 and 2.4.2.1.2, Table 2-5)].

Highest HWQ value assigned from Ref. 1, Table 2-5: 3.36

SUMMARY OF SOURCE DESCRIPTIONS

Table 34 – Summary of Source Descriptions

Source No.	Source HWQ Value	Source Hazardous Constituent Quantity Complete? (Y/N)	Containment Factor Value by Pathway				
			Ground Water (GW) (Ref. 1, Table 3-2)	Surface Water (SW)*		Air	
				Overland/ flood (Ref. 1, Table 4-2)	GW to SW (Ref. 1, Table 3-2)	Gas (Ref. 1, Table 6-3)	Particulate (Ref. 1, Table 6-9)
1	547.31	N	NS	10	NS	NS	NS
2	462.23	N	NS	10	NS	NS	NS
3	1,124.23	N	NS	10	NS	NS	NS
4	3.36	N	NS	10	NS	NS	NS

HWQ = Hazardous Waste Quantity.
NS = Not Scored.
No. = Number.

Total Source Hazardous Waste Quantity Value: 2,137.13

Other possible sources not scored:

Five source areas which include the Former Landfill Area A, Former Landfill Area B, the On-site Containment Cell, Former Beamhouse/Former Beamhouse Debris, and the 20 Cheever Street Parcel, have been documented as part of the facility operated by the Creese & Cook Co. These sources were not scored as they do not affect the overall Hazardous Waste Quantity because of the lack of information to sufficiently characterize the sources, and therefore they do not impact the overall site score.

Former Landfill Area A:

A Massachusetts Department of Environmental Quality and Engineering (MA DEQE) memorandum dated February 1981, summarizing site conditions during an inspection of the facility, stated that sludge collected in detention basins was disposed of on site [38, p. 1; 39, p. 2]. As part of an Engineering Report completed by SP, the area herein referred to as Former Landfill Area A was described as an area where tanning operations accumulated waste piles consisting primarily of hides and animal scraps [34, pp. 13-14, 18-19, 36-37, 39-45; 97, p. 5]. Former Landfill Area A was described as the area adjacent to the northeast exterior wall of the beamhouse [34, p. 40; 97, p. 5]. Sampling of leather scraps within the Former Landfill Area A indicated the presence of arsenic and chromium [34, pp. 40-46, 48]. A removal action conducted by SP on the facility property excavated material from Former Landfill Area A and secured the material in an On-site Containment Cell [34, p. 4; 36, p. 2; 46, p. 1; 48, p. 11; 97, p. 6; 123; 124]. Subsequent sampling conducted by SP and REW indicated residual arsenic and chromium contamination within the Former Landfill Area A [97, pp. 38, 45]. As part of the EPA SR, Former Landfill Area A was observed to be a forested/low shrub area of uneven ground surface [11, p. 10]. Sampling conducted as part of the EPA SR indicated elevated concentrations of arsenic, chromium, and

dioxin/furan congeners [15]. This source was not scored, as its extent and associated hazardous substance require further investigation and its inclusion into this HRS evaluation would not impact the overall site score.

Former Landfill Area B:

A MA DEQE memorandum dated February 1981, summarizing site conditions during an inspection of the facility, stated that sludge collected in detention basins was disposed of on site [38, p. 1; 39, p. 2]. As part of an Engineering Report completed by SP, the area herein referred to as Former Landfill Area B was described as an area where tanning operations accumulated waste piles consisting primarily of hides and animal scraps [34, pp. 13-14, 18-19, 36-37, 39-45; 97, p. 5]. Former Landfill Area B was described as the area between the Crane River and the existing cemetery (here assumed to be the Endicott- Russell Family Cemetery) [34, p. 40; 97, p. 5]. Waste material was observed at the surface of the former landfill to approximately 16 feet below ground surface [34, p. 40; 97, p. 5]. Sampling of waste material within the Former Landfill Area B indicated the presence of arsenic and chromium [34, pp. 40-46, 48]. A removal action conducted by SP, Inc. on the facility property excavated material from Former Landfill Area B and secured the material in an On-site Containment Cell [34, p. 4; 36, p. 2; 46, p. 1; 48, p. 11; 97, p. 6; 123; 124]. Subsequent sampling conducted by SP and REW indicated residual arsenic and chromium contamination within the Former Landfill Area B [97, pp. 38-39, 45]. In addition, REW investigated an area directly adjacent to the Former Landfill Area B removal which is described later in this evaluation as Source No. 1 (Leather Scrap Pile) [97, p. 38-39]. As part of the EPA SR, Former Landfill Area B was observed to be a depressed area partially covered by gravel, with an elevated sewer line running along the southwestern boundary of the area [11, pp. 1-2, 11]. Sampling conducted as part of the EPA SR indicated elevated concentrations of arsenic, chromium, and dioxin/furan congeners [15]. This source was not scored as its extent and associated hazardous substance require further investigation and its inclusion into this HRS evaluation would not impact the overall site score.

On-site Containment Cell:

In October 1987, SP submitted an initial Tannery Waste Solidification Project plan, and in March 1988 submitted a revised Tannery Waste Solidification Project plan which proposed a remedial action to treat/stabilize identified buried solid and sludge waste and dispose of treated waste in a designed on-site lined and capped containment cell [123, p. 3; 124]. Based on pilot tests conducted with on-site material, the excavated tannery wastes would be chemically fixed with flyash, lime, and cement and a deodorant added to limit odors [123, pp. 15, 27 (Figure 4); 124, p. 23]. Successfully treated waste material would then be backfilled into a 32-mil hyalon lined and capped cell [123, pp. 17-19, 27 (Figure 4); 124, p. 29]. From December 1989 to May 1990, the containment cell area was prepared and constructed, tannery wastes/sludge from Former Landfill Areas A and B and from Lagoons Area C (Former Sludge Lagoons) were excavated, and soils were treated and stabilized, and backfilled into the constructed lined On-site Containment Cell [48, p. 11; 46, p. 1]. Chemical analysis of pre- and post-treated sludge material excavated from Former Landfill Areas A and B and the Former Sludge Lagoons indicated elevated concentrations of arsenic and chromium [48, pp. 12, 52, 54-59]. The final total estimated areas and volumes of tannery wastes moved to the containment cell and final as-built plans of the containment cell were not found in available documentation. A later estimated total of 5,000 yd^3 of excavated tannery waste and sludge backfilled into the containment cell was presented by R.E.W. Environmental Consultants [47, p. 7]. The integrity of the On-site Containment Cell has not been investigated, and it is yet unknown if the waste contained within the structure is releasing to the environment [15]. Therefore, the On-site Containment Cell has not been scored as part of this evaluation.

Former Beamhouse/ Former Beamhouse Debris:

In April 1994, SP completed a Chapter 21E Site Assessment Report for Riversedge Realty Trust [48]. The site assessment report summarized the results of sampling investigations in preparation for demolition of the beamhouse conducted from 28 May to 4 June 1992 and post-demolition sampling of the former beamhouse pits and trenches in March-April 1994. Samples of trenches and pits, as well as wipe samples from the beamhouse walls, indicated the presence of chromium and phenols at elevated concentrations [48, pp. 24-29]. Post-cleanup pit and trench samples still indicated elevated concentrations of chromium [48, p. 30]. The investigation summary is not clear to what level the cleanup was completed. In November 2004, demolition of the former beamhouse reportedly occurred with the demolition debris piles staged on top of the intact floor/foundation [3; 110]. Further sampling of the building debris indicated the presence of ACM, including black mastic on concrete and transite [99; 112, p. 8; 114;122; 137]. Sampling conducted as part of the EPA SR indicated elevated concentrations of arsenic, chromium, and dioxin/furan congeners [SR Report]. This source was not scored as its extent and associated hazardous substance require further investigation and its inclusion into this HRS evaluation would not impact the overall site score.

20 Cheever Street Parcel:

Limited investigations have been conducted on the 20 Cheever Street Parcel which, up until 1987, was part of the facility property [16; 153]. Only one limited site investigation report, completed in 1984, was found in available documentation regarding the parcel. The 29 October 1984 Subsurface Hazardous Waste Investigation completed by SP, described the 20 Cheever Street Parcel as predominantly undisturbed except for the southern edge which contained large amounts of fill [153, p. 7]. Borings advanced as part of the Subsurface Hazardous Waste Investigation completed by SP on the 20 Cheever Street parcel indicated shallow debris and the presence of mercury above laboratory reporting limits [153, pp. 15-23]. Sampling conducted as part of the EPA SI indicated elevated concentrations of arsenic, barium, chromium, mercury, and dioxin/furan congeners [16]. This source was not scored as its extent and associated hazardous substance require further investigation and its inclusion into this HRS evaluation would not impact the overall site score.

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1 GENERAL CONSIDERATIONS

The Creese & Cook Co. (Former) site is located within the Crane River System, which is located in the Beverly Harbor Drainage Area and is part of the North Shore Coastal Watersheds [144, pp. 1, 12, 69, 86]. The Crane River System is comprised of two freshwater streams that flow into Mill Pond in Danvers (Beaver Brook and Crane Brook) with the Crane River flowing from the outlet of Mill Pond [144, p. 79]. The Crane River is a small, freshwater tributary to the Danvers River estuary [149, p. 5]. Source areas associated with former tannery operations at the site are located within the Crane River drainage, designated as segment MA93-41, which extends 0.8 miles from the outlet pump house sluiceway on Purchase Street to the confluence with the Danvers River (see Figures 2, 4a, and 4b) [144, p. 86; 147, p.47]. The Crane River segment MA93-41 is listed as an estuary and designated by the state Integrated List of Waters as a Category 5, which denotes the segment as impaired and requiring one or more Total Maximum Daily Load studies [145, p. 22, 134; 147, p. 33]. In addition, Crane River segment MA93-41 is listed as a class SA water body, which denotes an excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation [146, p. 12; 147, p. 47].

The Creese & Cook Co leather tannery operated on portions of both sides of the Crane River [113, p. 5]. A summary of tannery operations was provided by W&C working on behalf of the property owner, and was as follows: 'Initial treating and dehairing operations for tanning involve soaking the skins to treat them for infestation and to prepare the skins for the mechanical removal of hair. Soaking was typically done with either organic acid solution or arsenic solutions. These solutions frequently contained phthalates, which were added as a penetrant. Phthalates were also used in the finishing process in lacquers to aid in penetration to the chromed skins. Final dehairing typically involves scraping the skins in the presence of a strong basic solution or oxidant solution. Bating is primarily a pH adjusting step to neutralize and soften the skins prior to chroming, and was accomplished in an adjusting bath. All of the solution baths would have accumulated solids and/or lost their strength after a period of time, and would have been discharged to on-site lagoons prior to replenishing baths' [113, p. 5]. According to W&C, beamhouse operations, including treatment, dehairing, and bating of skins prior to chroming and finishing, occurred on the portion of the facility located on the western shore of the Crane River [113, p. 5]. Tanning and finishing activities were performed on the opposite (eastern shore) of the river [113, p. 5]. Discharge from dehairing and bating was directed to the on-site lagoons, located east of the beamhouse, before decanting into the Crane River [113, p. 5].

Based on a Department of the Interior topographic map, as well as site figures referencing a survey conducted by Hancock Survey Associates, the western Creese & Cook Tannery facility generally slopes toward the Crane River [19, p. 1; 97, p. 43 (Exhibit A); 129, p. 5 (C-1); 148, p. 2]. Three source areas have been evaluated on the western side of the Crane River and include the following: a pile of leather scraps and soil located directly adjacent to Crane River (see Source No. 1 Evaluation); a pile of soil material of unknown origin with documented site-related contaminants (see Source No. 2 Evaluation); and the Former Lagoons utilized by the tannery operations and located directly adjacent to the Crane River (see Source No. 3 Evaluation). No portions of Source Nos. 1 through 3 were observed to have a maintained engineered cover or complete runoff control management systems [11, p. 26]. No report of a natural or man-made liner was documented or observed during source sampling activities on these sources [11, p. 26].

Based on a Department of the Interior topographic and on-site observations, the eastern Creese & Cook

Co. facility generally slopes toward the Crane River [11, p. 5; 12, p. 2; 19, p. 1]. One source area has been evaluated on the eastern side of the Crane River and is documented as a contaminated soil source associated with the Water Street and MBTA parcels (see Source No. 4 Evaluation). No portion of Source No. 4 was observed to have a maintained engineered cover or complete runoff control management systems [11, p. 26]. No report of a natural or man-made liner was documented or observed during source sampling activities on these sources [11, p. 26].

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

Source No. 1, which is located in the northern area of the western facility property, was observed to be sloping steeply toward the Crane River, with source matrix material containing leather scraps eroding from the pile and depositing into the river sediments [11, p. 17; 22]. Therefore, the hazardous substance migration path for Source No. 1 is defined by the direct contact of source materials with the Crane River. Site plans indicate that the area associated with Source No. 1 drops approximately 8 feet to the Crane River [129, p. 5 (C-1)]. The areal extent of Source No. 1 was mapped by documenting exposed leather scraps along the western bank of the Crane River; therefore, the most upstream probable point of entry (PPE) for the source is located at the most upstream point where the pile abuts the Crane River (PPE No. 1) [11, pp. 17-18; 21].

Source No. 2, which is located in the northwestern area of the western facility property, adjacent to the former beamhouse building footprint, was observed to be a pile roughly 8 feet in height [11, p. 12; 129, p. 5 (C-1)]. The area surrounding and contained by Source No. 2 slopes east toward the Crane River [129, p. 5 (C-1)]. The overland segment of the hazardous substance migration path follows the gravel path, located north of the beamhouse footprint, east toward the Crane River [11, p. 14; 113, p. 19; 129, p. 5 (C-1)]. The PPE for the source is along the base of the slope to the Crane River (PPE No. 2) [11, p. 17-18; 113, p. 19; 129, p. 5 (C-1)].

Source No. 3, which is located in the southeastern area of the western facility property, adjacent to the Crane River, was observed to be bounded by raised earthen bermed material and is slightly depressed from the surrounding area [11, p. 11; 113, p. 19; 129, p. 5 (C-1)]. Based on multiple reference sources, discharge from the lagoons was directed into the Crane River through a discharge pipe [35, p. 2; 43, p. 1; 113, p. 5]. In addition, liquid material contained within the surface impoundment source was documented to overtop the earthen berms and discharge into the Crane River [172, pp. 1-2]. The PPE for the source is the location where the discharge pipe empties into the Crane River (PPE No. 3) [11, p. 2; 113, p. 19; 129, p. 5 (C-1)].

Source No. 4, which is located on the southern and western area of the eastern facility property, was observed to be sloping west, toward the Crane River, with source matrix material containing leather scraps eroding from the bank and depositing into the river sediments [11, p. 16; 12, p. 2; 22]. In addition, stormwater drains located on the condominium portion of Source No. 4 drain directly into the Crane River [12, pp. 1-2]. This source borders directly onto the Crane River, and therefore contains numerous probable points of entry. The PPE for the source is the most upstream portion of the source that borders the river (PPE No. 4a). In addition, Source No. 4 represents the most downstream source for the site, and therefore, the target distance limit (TDL) is measured from the most downstream PPE associated with this source (PPE No. 4b) [1, p. 51605 (Section 4.1.1.2)].

Two of the source areas evaluated as part of this HRS Documentation Record border directly onto the Crane River (see Figure 2, and Source Nos. 1 and 4 Evaluation Sections). Source matrix materials containing leather scraps were observed eroding from these two source areas (Source Nos. 1 and 4) and depositing into the Crane River sediments [22]. In addition, based on multiple reference sources, discharge from the former wastewater lagoons (Source No. 3) was directed into the Crane River [35, p. 2;

43, p. 1; 113, p. 5; 172, pp. 1-2]. Based on maps depicting the topography of the western facility property, the land surface elevation slopes from Source No. 2 toward the Crane River [113, p. 19; 129, p. 5 (C-1)]. The TDL for the Creese & Cook Tannery (Former) site extends from the most downstream PPE (PPE No. 4b) for 15-miles, terminating in the Atlantic Ocean (see Figures 4a, 4b, and Section 4.1.1.2 of this HRS Evaluation). In addition, flow within the Crane River is reversed by tides, and the TDL extends upstream of PPE No. 1 (see Figures 4a, 4b, and Section 4.1.1.2 of this HRS Evaluation) [11, pp. 16, 18-20; 149, p. 5; 150, pp. 132, 135].

4.1.1.2 Target Distance Limit

The most upstream PPE for the Creese & Cook Tannery (Former) site is PPE No. 1 associated with Source No. 1 (see Figure 4b) [41]. The most downstream PPE for the Creese & Cook Tannery (Former) site is PPE No. 4b which is associated with Source No. 4 and is 0.36 miles downstream of PPE No. 1 [41]. Sediment sample SD-26 is the most downstream sediment sample collected as part of the EPA SR, while sediment sample SD-24 is the most downstream sample documenting an observed release to the Crane River through chemical analysis (see Section 4.1.2.1.1 of this HRS Evaluation) [13, pp. 12, 51, 80]. Therefore, as observed contamination is not documented more than 15 miles downstream of PPE No. 4b, the TDL extends 15 miles downstream of the PPE (see Figure 4b) [1, p. 51605 (Section 4.1.1.2)]. The TDL extends from the Crane River, through the Danvers River, to Beverly Harbor, which then extends into the Atlantic Ocean (see Figure 4a) [41].

In addition, flow within the Crane River is reversed by tides, and the TDL extends upstream of PPE No. 1 (see Figure 4b and Section 4.1.1.2 of this HRS Evaluation) [11, pp. 16, 18-20; 149, p. 5; 150, pp. 132, 135]. Based on sampling results outlined in Section 4.1.2.1.1 of this evaluation, sediments (SD-04) impacted by site-attributable hazardous substances have been documented immediately north of the MA Route 128 Bridge. Tidal influence has been documented through salinity observations to a location just south of the Purchase Street Bridge at sediment sample locations SD-03, SD-50, and SD-51 [11, pp. 18-20, 25, 26]. A Massachusetts Division of Marine Fisheries study on Rainbow Smelt populations in the Crane River indicated the sluiceway just north of Purchase Street is located less than 100 meters upstream of the tidal interface of the Danvers River estuary [149, p. 5]. The TDL for the Creese & Cook Tannery (Former) site is evaluated only to the point where substances from the site have been documented upstream, which is to sediment sample location SD-04 [1, p. 51605 (Section 4.1.1.2)]. The TDL may extend upstream past this point, but this has not been confirmed to date.

4.1.2.1 Likelihood of Release

4.1.2.1.1 Observed Release

Direct Observation

Basis for Direct Observation:

During reconnaissances of the property, portions of Source No. 1 (Leather Scrap Pile) and Source No. 4 (Water Street/MBTA Source) were observed to be inundated by river flow during tidal fluctuations [11, pp. 16-20; 22]. Sources materials containing pieces of leather scraps were observed eroding from Source Nos. 1 and 4 and depositing directly into the river. Pieces of leather scraps within both the bank materials adjacent to the Crane River and within the river sediments adjacent to the riverbank were also observed [11, pp. 17-19; 12, p. 2; 22]. Analysis of source materials containing leather scraps from Source Nos. 1 and 4 indicated hazardous substances (dioxin/furan congeners and total metals) associated with the tannery at concentrations significantly exceeding background concentrations (see Source No. 1 and Source No. 4 Evaluation Sections of this Documentation Record). Analysis of the Crane River sediment samples adjacent to the river banks of Source Nos. 1 and 4, within the areas of direct observation, also confirmed the presence of hazardous substances (dioxin/furan congeners and total metals) at concentrations significantly exceeding background concentrations (see Chemical Analysis below) [11, pp., 24-25; 13, pp. 57-58; 22].

Hazardous Substances in Release:

Table 35 - Hazardous Substances in Observed Release by Direct Observation

Hazardous Substance	Evidence	References
1,2,3,6,7,8-HxCDD	Analysis of material containing leather scraps observed to be eroding out of sources and depositing into the Crane River.	11, pp. 24-25; 13, pp. 57-58; 22, Source Numbers 1 and 4 of this Evaluation
1,2,3,7,8,9-HxCDD	Analysis of material containing leather scraps observed to be eroding out of sources and depositing into the Crane River.	11, pp. 24-25; 13, pp. 57-58; 22, Source Numbers 1 and 4 of this Evaluation
2,3,7,8-TCDF	Analysis of material containing leather scraps observed to be eroding out of sources and depositing into the Crane River.	11, pp. 24-25; 13, pp. 57-58; 22, Source Numbers 1 and 4 of this Evaluation
2,3,4,6,7,8-HxCDF	Analysis of material containing leather scraps observed to be eroding out of sources and depositing into the Crane River.	11, pp. 24-25; 13, pp. 57-58; 22, Source Numbers 1 and 4 of this Evaluation
1,2,3,4,6,7,8-HpCDF	Analysis of material containing leather scraps observed to be eroding out of sources and depositing into the Crane River.	11, pp. 24-25; 13, pp. 57-58; 22, Source Numbers 1 and 4 of this Evaluation
Chromium	Analysis of material containing leather scraps observed to be eroding out of sources and depositing into the Crane River.	11, pp. 24-25; 13, pp. 57-58; 22, Source Numbers 1 and 4 of this Evaluation
Mercury	Analysis of material containing leather scraps observed to be eroding out of sources and depositing into the Crane River.	11, pp. 24-25; 13, pp. 57-58; 22, Source Numbers 1 and 4 of this Evaluation

Chemical Analysis

Background Concentrations:

On 18 May 2011 and 6 December 2011, as part of the EPA SR, background sediment sampling activities were conducted [11, pp. 8-9, 24-26; 13, pp. 18-21, 41-44]. The background sediment samples were collected in accordance with the EPA-approved Site-Specific QAPP, dated 18 April 2011, and the Site-Specific QAPP Addendum, dated 22 November 2011 [8, pp. 34, 37-45, 50; 9, pp. 2-3, 9 (Figure 4), 11, pp. 8, 24; 13, pp. 18, 41-42]. Three background sediment samples (SD-03, SD-50, and SD-51) were collected from the Crane River, south of Purchase Street and between 0.461 and 0.471 miles upstream of PPE No. 1 for the Creese & Cook Tannery (Former) site (see Figure 4b) [11, pp. 8-9, 18-20, 25-26; 13, pp. 18-19, 57-58; 23, p. 2]. The background and release sediment samples were collected from the estuarine Crane River segment MA93-41 (see Figure 4b) [145, p. 134; 147, p. 33]. Based on observations during the EPA SR, the locations of background sediment samples are influenced by tidal fluctuations, as evident from changes in salinity measurements and stream flow at the background sediment sample locations [11, p. 18]. A Massachusetts Division of Marine Fisheries study on rainbow smelt populations in the Crane River indicated the sluiceway just north of Purchase Street is located less than 100 meters upstream of the tidal interface of the Danvers River estuary [149, p. 5]. In addition, observations conducted during the EPA SR did not indicate additional major surface water inputs (rivers, streams, pipes) in the area of the background sediment sample locations downstream, through the TDL reach of the Creese & Cook Tannery (Former) site, to the Water Street Bridge [11, pp. 17-18]. The background sediment samples were collected from similar depths as the release samples, contained similar matrix material as the release samples, and were collected and analyzed using the same methods during the two sediment sampling events as the release samples [11, pp. 8, 25-26; 13 pp. 18-19, 57-58; 25, pp. 1-2, 4, 6, 8-9, 13, 15-18, 20-22, 25-28, 30-32]. The three background sediment samples were used to establish reference chemical composition of the matrix materials within the Crane River System. This includes the establishment of the range of concentration variations for naturally occurring metals in the media of concern (sediment) located upstream of the Creese & Cook Tannery (Former) source areas, and the establishment of specific concentration values that demonstrate that a significant concentration of a hazardous substance is present above naturally occurring concentrations.

Table 36 - Background Sediment Sample Location Description

Sample ID	Sample Medium	Sample Location	Depth (inches)	Date	References
SD-03	Sediment	Crane River – south of Purchase Street and approximately 0.471 miles upstream of PPE No. 1	0 to 12	5/18/11	11, pp. 8-9, 18-20, 25-26; 13, p. 18-19; 23, p. 2; Figure 4b
SD-50	Sediment	Crane River – south of Purchase Street and approximately 0.466 miles upstream of PPE No. 1	0 to 8	12/6/11	11, p. 25; 13, p. 43; 23, p. 2; Figure 4b
SD-51	Sediment	Crane River – south of Purchase Street and approximately 0.461 miles upstream of PPE No. 1	0 to 8	12/6/11	11, p. 26; 13, p. 43; 23, p. 2; Figure 4b

Table 37 – Background Sediment Sample Description		
Sample ID	**Sample Description**	**Reference**
SD-03	Black, organic rich silt, trace clay, trace fine-to-coarse sand.	25, p. 1
SD-50	Dark brown, silt and clay, trace fine-to-medium sand, little organics.	25, p. 25
SD-51	Dark brown, silt and clay, trace fine-to-medium sand, little organics.	25, p. 26

Background sediment sample SD-03 was submitted to CLP laboratories for dioxin/furan analyses following DLM02.2, and for total metals analysis following ISM01.2; while background sediment samples SD-50 and SD-51 were submitted to a CLP laboratory for total metals analysis only, following ISM01.3 [11, pp. 8-9, 27; 13, pp. 19, 58, 71; 28, p. 3; 29, pp. 3, 8; 66, pp. 1, 4; 68, p. 1, 12; 70, p. 1; 87, pp. 10, 94; 89, pp. 9, 78]. COCs for all background sediment samples collected as part of the 2011 EPA SR and presented in this HRS Documentation Record are provided in References 28 and 29. The applicable COC sections for the background sediment samples and all corresponding sample identifiers are provided in available COC, field notes reference documentation, and sample crosswalk [11, pp. 8-9, 18-20, 25-26; 13, p. 18-19, 43; 25, pp. 1, 25-26; 28, p. 3; 29, pp. 3, 8]. The dioxin/furan analytical results were manually validated at a stage 4 level in accordance with the criteria specified in the USEPA SOW DLM02.2 and EPA Region I's ESAT Dioxin/Furan Data Validation SOP ESAT-01-0007 [66, p. 1]. The total metals analytical data were evaluated on a Tier II level in accordance with the Region I Tiered Organic and Inorganic Data Validation Guidelines dated November 2008 [68, p. 1; 70, p. 1]. The validation of dioxin/furan and total metals analytical results was conducted independently by designated chemists who were not involved in the sample collection and HRS evaluation [11, pp. 8-9, 18-20, 25-26; 13, p. 18-19, 43; 66, pp. 1-3; 68, pp. 1-7]. Based on an examination of the background sediment sample collected and submitted for dioxin/furan analysis and the three background sediment samples collected and submitted for total metals analysis, the highest background hazardous substance concentrations are presented in Table 38. See below for further evaluation of background concentrations utilized in this HRS evaluation.

Table 38 - Hazardous Substances Associated with Background Sediment Samples							
Sample ID	**Sample Type**	**Date**	**Hazardous Substance**	**Bias***	**Hazardous Substance Concentration**	**Sample-Adjusted CRQL**	**Reference**
SD-03	Sediment	5/18/11	1,2,3,6,7,8-HxCDD	None	8.39 ng/Kg	7.86 ng/Kg	11, p. 8; 13, pp.19, 71; 66, p. 4; 87, pp. 1-2, 10, 94
SD-03	Sediment	5/18/11	1,2,3,7,8,9-HxCDD	None	7.46 ng/Kg	7.86 ng/Kg	
SD-03	Sediment	5/18/11	2,3,7,8-TCDF	None	7.1 ng/Kg	1.57 ng/Kg	
SD-03	Sediment	5/18/11	2,3,4,6,7,8-HxCDF	None	2.97 J (2.97) ng/Kg	7.86 ng/Kg	
SD-03	Sediment	5/18/11	1,2,3,4,6,7,8-HpCDF	None	62.8 ng/Kg	7.86 ng/Kg	

Table 38 - Hazardous Substances Associated with Background Sediment Samples (Concluded)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SD-03	Sediment	5/18/11	Chromium	None	82.4 mg/Kg	1.89 mg/Kg	11, p. 8; 13, pp. 19, 71; 68, p. 12; 89, pp. 1-2, 9, 78
SD-03	Sediment	5/18/11	Mercury	None	0.69 mg/Kg	0.19 mg/Kg	

ng/Kg = Nanograms per kilogram.
mg/Kg = Milligrams per kilogram.
HxCDD= Hexachlorodibenzodioxin.
HpCDD= Heptachlorodibenzodioxin.
HxCDF= Hexachlorodibenzofuran.
HpCDF= Heptachlorodibenzofuran.
TCDF = Tetrachlorodibenzofuran.
CRQL = Contract Required Quantitation Limit.

J = The associated numerical value is an estimated quantity [141, p. B-20; 66, p. 4].
* = An explanation for the direction of bias is provided in Reference 87, Table 3; Reference 89, Table 3.
( ) = For hazardous substance concentrations, denotes concentration of the compound or element following adjustment, based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination* [140, pp. 4-8].

Based on an examination of the background sediment sample submitted for dioxin/furan analysis and the three background sediment samples submitted for total metals analysis, the highest numerical background value concentrations are presented in Table 38 and used to determine representative background concentrations for comparison of contaminated release samples.

Dioxin/furan congeners 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,4,6,7,8-HpCDF were detected in background sediment samples. The background concentration of 1,2,3,6,7,8-HxCDD, 2,3,7,8-TCDF, and 1,2,3,4,6,7,8-HpCDF each exceeded the sample-adjusted CRQL; and therefore, an observed release is established when the sample measurement is three times or more above the background concentration [1, p. 51589 (Table 2-3)].

Dioxin/furan congeners 1,2,3,7,8,9-HxCDD and 2,3,4,6,7,8-HxCDF were detected at concentrations below the sample-adjusted CRQL [1, p. 51589 (Table 2-3)]. An observed release is established for these two congeners when the release sample concentration is three times or more above the background concentration, since using the sample-adjusted CRQL for comparison would provide a lower threshold value [1, p. 51589 (Table 2-3)].

Chromium and mercury were each detected in background sediment samples above the sample-adjusted CRQL; and therefore, an observed release is established when the release sample concentration is three times or more above the background concentration [1, p. 51589 (Table 2-3)].

Contaminated Samples:

On 16 through 18 May 2011 and 6 December 2011, as part of the EPA SR of the Creese & Cook Co. (Former) 1 property, sediment sampling activities were conducted at locations both upstream and downstream of the Creese & Cook Tannery (Former) site [11, pp. 2-9, 20-24; 13, pp. 10-21, 41-44]. The sediment samples were collected in accordance with the EPA-approved Site-Specific QAPP, dated 18 April 2011, and the Site-Specific QAPP Addendum, dated 22 November 2011 [8, pp. 34, 37-45, 50; 9, pp. 2-3, 9 (Figure 4), 11, pp. 2-9, 20-24; 13, pp. 11, 14, 18, 41].

A total of 20 sediment samples (SD-04, SD-06, SD-08, SD-10, SD-11, SD-13, SD-15, SD-17, SD-18, SD-19, SD-20, SD-22, SD-23, SD-24, SD-56, SD-57, SD-59, SD-60, SD-61, and SD-70) were collected from the Crane River both upstream and downstream of the site, from immediately upstream (north) of the MA Route 128 Bridge and extending downstream to the Water Street Bridge (see Figure 4b) [11, pp. 3-7, 24-25; 13, pp. 50, 57-58; 23, p. 2]. The release sediment samples were collected through the TDL reach associated with the Creese & Cook Tannery (Former) on-site sources and from estuarine Crane River segment MA93-41 (see Figure 4b) [11, pp. 3-7, 24-25; 13, pp. 50, 57-58; 145, p. 134; 147, p. 33]. In addition, the release sediment samples were collected from similar depths as the background sediment samples, contained similar matrix material as the background sediment samples, and were collected and analyzed using the same methods during the two sediment sampling events as the background sediment samples [11, pp. 8, 25-26; 13, pp. 50, 57-58; 25, pp. 1-2, 4, 6, 8-9, 13, 15-18, 20-22, 25-28, 30-32].

Table 39 - Sediment Sample Location Description

Sample ID	Sample Medium	Sample Location	Distance from PPE No. 1	Depth (inches)	Date	References
SD-04	Sediment	Crane River – upstream of MA Route 128 and Source No. 1	0.057 miles Upstream	0 to 6	5/17/11	11, p. 7; 23; 25, p. 2; Figure 4b
SD-06	Sediment	Crane River – adjacent to Creese & Cook Co. (Former) 1 facility and Source No. 1	0.011 miles Downstream	0 to 12	5/17/11	11, p. 7; 23; 25, p. 4; Figure 4b
SD-08	Sediment	Crane River - adjacent to Creese & Cook Co. (Former) 1 facility	0.163 miles Downstream	0 to 12	5/17/11	11, pp. 6-7; 23; 25, p. 6; Figure 4b
SD-10	Sediment	Crane River - adjacent to Creese & Cook Co. (Former) 1 facility	0.212 miles Downstream	0 to 12	5/17/11	11, pp. 6-7; 23; 25, p. 8; Figure 4b
SD-11	Sediment	Crane River – adjacent to eastern riverbank and upstream of Source No. 4	0.129 miles Downstream	0 to 12	5/17/11	11, pp. 6-7; 23; 25, p. 9; Figure 4b
SD-13	Sediment	Crane River - adjacent to eastern riverbank and upstream of Source No. 4	0.168 miles Downstream	6 to 12	5/16/11	11, pp. 3-5; 23; 25, p. 11; Figure 4b
SD-15	Sediment	Crane River - adjacent to eastern riverbank and upstream of Source No. 4	0.230 miles Downstream	10 to 14	5/16/11	11, pp. 3-5; 23; 25, p. 13; Figure 4b
SD-17	Sediment	Crane River - adjacent to eastern riverbank and upstream of Source No. 4	0.324 miles Downstream	12 to 18	5/16/11	11, pp. 3, 5; 23; 25, p. 15; Figure 4b
SD-18	Sediment	Crane River - adjacent to eastern riverbank and Source No. 4	0.262 miles Downstream	0 to 12	5/16/11	11, p. 5; 25, 23; p. 16; Figure 4b
SD-19	Sediment	Crane River – adjacent to eastern riverbank and Source No. 4	0.308 miles Downstream	0 to 12	5/16/11	11, p. 5; 25, p. 17; Figure 4b

Table 39 - Sediment Sample Location Description (Concluded)						
Sample ID	**Sample Medium**	**Sample Location**	**Distance from PPE No. 1**	**Depth (inches)**	**Date**	**References**
SD-20	Sediment	Crane River – adjacent to eastern riverbank and Source No. 4	0.366 miles Downstream	0 to 12	5/16/11	11, pp. 5, 7; 23; 25, p. 18; Figure 4b
SD-22	Sediment	Crane River – downstream of the site and adjacent to MBTA Right-of-way bridge	0.473 miles Downstream	0 to 12	5/16/11	11, pp. 4-5; 23; 25, p. 20; Figure 4b
SD-23	Sediment	Crane River – downstream of the site and adjacent to MBTA Right-of-way bridge	0.531 miles Downstream	0 to 12	5/16/11	11, pp. 4-5; 23; 25, p. 21; Figure 4b
SD-24	Sediment	Crane River – downstream of the site and adjacent to Water Street Bridge	0.649 miles Downstream	0 to 12	5/16/11	11, pp. 3-5; 23; 25, p. 22; Figure 4b
SD-56/ SD-70	Sediment	Crane River – adjacent to the western riverbank and Source No. 1	0.020 miles Downstream	0 to 12	12/6/11	11, p. 25; 23; 25, p. 27; Figure 4b
SD-57	Sediment	Crane River – adjacent to the western riverbank and Source No. 1	0.023 miles Downstream	2 to 12	12/6/11	11, p. 25; 23; 25, p. 28; Figure 4b
SD-59	Sediment	Crane River - adjacent to the western riverbank and Source No. 3	0.246 miles Downstream	0 to 8	12/6/11	11, p. 25; 23; 25, p. 30; Figure 4b
SD-60	Sediment	Crane River – adjacent to the eastern riverbank and Source No. 4	0.343 miles Downstream	0 to 12	12/6/11	11, p. 24; 23; 25, p. 31; Figure 4b
SD-61	Sediment	Crane River – adjacent to the eastern riverbank and Source No. 4	0.352 miles Downstream	0 to 8	12/6/11	11, p. 24; 23; 25, p. 32; Figure 4b

Table 40 – Sediment Sample Description		
Sample ID	**Sample Description**	**Reference**
SD-04	Wet, dark brown, silt and organics (rootlets), trace fine-to-coarse sand, trace clay.	25, p. 2
SD-06	Wet, black, silt and clay, little organics (rootlets).	25, p. 4
SD-08	Wet, dark gray, silt and clay, trace fine sand, trace organics (rootlets).	25, p. 6
SD-10	Wet, dark gray, clay and silt, trace fine-to-coarse sand, trace organics (rootlets).	25, p. 8
SD-11	Wet, dark gray-to-black, silt, little clay, trace fine-to-coarse sand, trace fine gravel.	25, p. 9
SD-13	Was not described in the field.	25, p. 11
SD-15	Wet, dark brown, silt and organics, little clay, trace fine-to-coarse sand, trace fine-to-medium gravel.	25, p. 13
SD-17	Wet, dark brown-to-dark gray, silt and organics, little clay, trace fine-to-coarse sand, trace fine-to-medium gravel.	25, p. 15
SD-18	Wet, dark gray-to-brown, clay and silt, little organics (peat, shells), trace fine-to-coarse sand.	25, p. 16

Table 40 – Sediment Sample Description (Concluded)

Sample ID	Sample Description	Reference
SD-19	Wet, dark gray-to-black, clay and silt, trace fine-to-coarse sand, trace fine gravel, trace organics.	25, p. 17
SD-20	Wet, dark grayish-black, silt and clay, trace fine-to-coarse sand, trace fine gravel, trace organics.	25, p. 18
SD-22	Wet, dark gray-to-olive gray, silt, some clay, trace fine-to-coarse sand, trace organics (rootlets).	25, p. 20
SD-23	Wet, dark gray-to-dark olive gray, silt, little clay, trace fine-to-coarse sand, trace organics (rootlets, shells)	25, p. 21
SD-24	Wet, gray-to-olive gray, silt, little clay, and trace organics (rootlets, shells).	25, p. 22
SD-56/ SD-70	Wet, dark brown, organic-rich clay and silt, trace fine-to-coarse sand, trace debris (glass, wood, leather scraps, tile).	25, p. 27
SD-57	Wet, dark brown, organic-rich silt, little fine-to-medium sand, trace clay, trace coarse sand.	25, p. 28
SD-59	Wet, dark brown, clay and silt, little organics (rootlets, plant debris), trace fine-to-coarse sand.	25, p. 30
SD-60	Wet, dark brown, organic-rich silt, trace fine-to-medium sand.	25, p. 31
SD-61	Wet, dark brown, silt and clay, little fine-to-coarse sand, little debris (glass, tile, plastic), little fine-to-medium gravel, little organics (roots, plant material).	25, p. 32

Fourteen of the 20 sediment samples (SD-04, SD-06, SD-08, SD-10, SD-11, SD-13, SD-15, SD-17, SD-18, SD-19, SD-20, SD-22, SD-23, and SD-24) were submitted to CLP laboratories for dioxin/furan analyses following DLM02.2, and for total metals analysis following ISM01.2; while the remaining six sediment samples (SD-56, SD-57, SD-59, SD-60, SD-61, and SD-70) were submitted to CLP laboratories for dioxin/furan analyses following DLM02.2, and for total metals analysis following ISM01.3. COCs for all sediment samples collected as part of the 2011 EPA SR and presented in this HRS Documentation Record are provided in References 28 and 29. The applicable COC sections for the surface water pathway samples and all corresponding sample identifiers are provided in available COC, field notes reference documentation, and sample crosswalk [11, pp. 3-7, 24-25; 13, pp. 12-17, 41-43, 71-85; 28, pp. 1-4, 12; 29, pp. 1-4, 8]. The dioxin/furan analytical results were manually validated at a stage 4 level in accordance with the criteria specified in the USEPA SOW DLM02.2 and EPA Region I's ESAT Dioxin/Furan Data Validation SOP ESAT-01-0007 [50, p. 1; 65, p. 1; 66, p. 1; 67, p. 1]. The total metals analytical data were evaluated on a Tier II level in accordance with the Region I Tiered Organic and Inorganic Data Validation Guidelines dated November 2008 [68, p. 1; 69, p. 1; 70, p. 1]. The validation of dioxin/furan and total metals analytical results was conducted independently by designated chemists who were not involved in the sample collection and HRS evaluation [11, pp. 3-7, 24-25; 13, pp. 12-17, 41-43, 71-85; 25, pp. 2,4,6,8,9,11,13,15-22, 27,28,30-32; 50, pp. 1-3; 65, pp. 1-3; 67, pp. 1-3; 68, pp. 1-7; 69, pp. 1-7; 70, pp. 1-6].

Among the 20 selected sediment samples: 1,2,3,6,7,8-HxCDD was detected at a maximum concentration of 255 ng/Kg in sediment sample SD-60; 1,2,3,7,8,9-HxCDD was detected at a maximum concentration of 103 ng/Kg in sediment sample SD-60; 2,3,7,8-TCDF was detected at a maximum concentration of 45.3 ng/Kg in sediment sample SD-60; 2,3,4,6,7,8-HxCDF was detected at a maximum concentration of 494 ng/Kg in sediment sample SD-60; 1,2,3,4,6,7,8-HpCDF was detected at a maximum concentration of 4,850 ng/Kg in sediment sample SD-60; chromium was detected at a maximum concentration of 9,240 J EB mg/Kg in sediment sample SD-56; and mercury was detected at a maximum concentration of 9.3

mg/Kg in sediment sample SD-15 [13, pp. 12-16, 41-43, 76-85; 66, p. 5; 67, p. 4; 68, p. 13; 70, p. 10; 87, pp. 13, 97; 88, pp. 7, 94; 89, pp. 15, 89; 91, pp. 11, 63].

Table 41 - Hazardous Substances Associated with Sediment Samples

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SD-04	Sediment	5/17/11	Chromium	None	763 mg/Kg	2.4 mg/Kg	11, p. 7; 13, pp. 17, 71; 68, p. 12; 89, pp. 1-2, 10, 79
SD-06	Sediment	5/18/11	Chromium	None	1,670 mg/Kg	4.5 mg/Kg	11, p. 7; 13, pp. 17, 72; 68, p. 12; 89, pp. 1-2, 11, 81
			Mercury	None	3.0 mg/Kg	0.19 mg/Kg	
SD-08	Sediment	5/17/11	Chromium	None	2,140 mg/Kg	7.0 mg/Kg	11, pp. 6-7; 13, pp. 16, 72; 68, p. 13; 89, pp. 1-2, 12, 83
			Mercury	None	3.4 mg/Kg	0.23 mg/Kg	
SD-10	Sediment	5/17/11	Chromium	None	592 mg/Kg	2.0 mg/Kg	11, p. 6; 13, pp. 16, 73; 68, p. 13; 89, pp. 1-2, 13, 85
SD-11	Sediment	5/17/11	Chromium	None	562 mg/Kg	1.4 mg/Kg	11, p. 7; 13, pp. 16-17, 73; 68, p. 13; 89, pp. 1-2, 13, 86
SD-13	Sediment	5/16/11	1,2,3,6,7,8-HxCDD	None	76.5 ng/Kg	42.5 ng/Kg	11, p. 4; 13, pp. 13, 74; 65, p. 4; 86, pp. 1-2, 9, 100
			1,2,3,7,8,9-HxCDD	None	61.2 ng/Kg	42.5 ng/Kg	
			Chromium	Unknown	1,110 J (860) mg/Kg	2.9 mg/Kg	11, p. 4; 13, pp. 13, 74; 69, p. 12; 90, pp. 1-2, 9, 72
			Mercury	None	2.5 mg/Kg	0.19 mg/Kg	
SD-15	Sediment	5/16/11	1,2,3,6,7,8-HxCDD	None	31.4 ng/Kg	16.2 ng/Kg	11, p. 4; 13, pp. 12-13, 75; 65, p. 4; 86, pp. 1-2, 10, 101
			Chromium	None	766 mg/Kg	3.1 mg/Kg	11, p. 4; 13, pp. 12-13, 75; 68, p. 13; 89, pp. 1-2, 15, 89
			Mercury	None	9.3 mg/Kg	0.94 mg/Kg	

Table 41 - Hazardous Substances Associated with Sediment Samples (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SD-17	Sediment	5/16/11	1,2,3,6,7,8-HxCDD	None	56.9 ng/Kg	19.0 ng/Kg	11, p. 3; 13, pp. 16, 76; 65, p. 5; 86, pp. 1-2, 12, 103
			1,2,3,7,8,9-HxCDD	None	35.8 ng/Kg	19.0 ng/Kg	
			Chromium	Unknown	561 J (435) mg/Kg	1.3 mg/Kg	11, p. 3; 13, pp. 16, 76; 69, p. 12; 90, pp. 1-2, 10, 74
			Mercury	None	2.3 mg/Kg	0.15 mg/Kg	
SD-18	Sediment	5/16/11	Chromium	Unknown	340 J (264) mg/Kg	1.2 mg/Kg	11, p. 5; 13, pp. 13, 77; 69, p. 12; 90, pp. 1-2, 10, 75
SD-19	Sediment	5/16/11	1,2,3,6,7,8-HxCDD	None	176 ng/Kg	17.2 ng/Kg	11, p. 5; 13, pp. 14, 77; 65, p. 5; 86, pp. 1-2, 14, 105
			1,2,3,7,8,9-HxCDD	None	63.4 ng/Kg	17.2 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	21.2 ng/Kg	17.2 ng/Kg	
			Chromium	Unknown	1,890 J (1465) mg/Kg	4.6 mg/Kg	11, p. 5; 13, pp. 14, 77; 69, p. 12; 90, pp. 1-2, 11, 76
			Mercury	None	3.0 mg/Kg	0.22 mg/Kg	
SD-20	Sediment	5/16/11	1,2,3,6,7,8-HxCDD	None	71.9 ng/Kg	15.7 ng/Kg	11, p. 5; 13, pp. 14, 78; 65, p. 6; 86, pp. 1-2, 15, 107
			1,2,3,7,8,9-HxCDD	None	32.9 ng/Kg	15.7 ng/Kg	
			Chromium	Unknown	1,560 J (1,210) mg/Kg	3.5 mg/Kg	11, p. 5; 13, pp. 14, 78; 69, p. 12; 90, pp. 1-2, 11, 77
			Mercury	None	3.4 mg/Kg	0.32 mg/Kg	
SD-22	Sediment	5/16/11	Chromium	Unknown	929 J (720) mg/Kg	2.7 mg/Kg	11, p. 4; 13, pp. 13, 79; 69, p. 13; 90, pp. 1-2, 12, 79
			Mercury	None	2.1 mg/Kg	0.20 mg/Kg	
SD-23	Sediment	5/16/11	Chromium	Unknown	948 J (735) mg/Kg	2.0 mg/Kg	11, p. 4; 13, pp. 13, 79; 69, p. 13; 90, pp. 1-2, 13, 80

Table 41 - Hazardous Substances Associated with Sediment Samples (Continued)

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SD-24	Sediment	5/16/11	1,2,3,6,7,8-HxCDD	None	244 ng/Kg	20.4 ng/Kg	11, pp. 3-4; 13, pp. 12, 80; 65, p. 7; 86, pp. 1-2, 19, 111
			1,2,3,7,8,9-HxCDD	None	62.7 ng/Kg	20.4 ng/Kg	
			2,3,7,8-TCDF	None	21.5 ng/Kg	4.08 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	23.6 ng/Kg	20.4 ng/Kg	
			Chromium	Unknown	1,740 J (1,350) mg/Kg	4.1 mg/Kg	11, pp. 3-4; 13, pp, 12, 80; 69, p. 13; 90, pp. 1-2, 13, 81
			Mercury	None	3.1 mg/Kg	0.22 mg/Kg	
SD-56	Sediment	12/6/11	1,2,3,6,7,8-HxCDD	None	66.3 ng/Kg	6.38 ng/Kg	11, p. 25; 13, pp. 43, 83; 50, p. 8; 71, pp. 1-2, 25, 129
			1,2,3,4,6,7,8-HpCDF	None	195 ng/Kg	6.38 ng/Kg	
			Chromium	Unknown	9,240 J EB (7,160) mg/Kg	14.5 mg/Kg	11, p. 25; 13, pp. 43, 83; 70, p. 10; 91, pp. 1-2, 11, 63
SD-57	Sediment	12/6/11	Chromium	Unknown	466 J EB (361) mg/Kg	1.7 mg/Kg	11, p. 25; 13, pp. 43, 83; 70, p. 10; 91, pp. 1-2, 11, 64
SD-59	Sediment	12/6/11	1,2,3,6,7,8-HxCDD	None	28.2 ng/Kg	5.42 ng/Kg	11, p. 25; 13, pp. 42, 84; 50, p. 9; 71, pp. 1-2, 28, 132
			1,2,3,4,6,7,8-HpCDF	None	191 ng/Kg	5.42 ng/Kg	
			Chromium	Unknown	1,320 J EB (1,020) mg/Kg	2.3 mg/Kg	11, p. 25; 13, pp. 42, 84; 70, p. 10; 91, pp. 1-2, 12, 66
SD-60	Sediment	12/6/11	1,2,3,6,7,8-HxCDD	None	255 ng/Kg	93.3 ng/Kg	11, p. 24; 13, pp. 42, 85; 67, p. 4; 88, pp. 1-2, 7, 94
			1,2,3,7,8,9-HxCDD	None	103 ng/Kg	93.3 ng/Kg	
			2,3,7,8-TCDF	None	45.3 ng/Kg	18.7 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	494 ng/Kg	93.3 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	4,850 ng/Kg	93.3 ng/Kg	
			Chromium	Unknown	2,810 J EB (2,180) mg/Kg	4.6 mg/Kg	11, p. 24; 13, pp. 42, 85; 70, p. 10; 91, pp. 1-2, 13, 67

Table 41 - Hazardous Substances Associated with Sediment Samples (Concluded)									
Sample ID	**Sample Type**	**Date**	**Hazardous Substance**	**Bias***	**Hazardous Substance Concentration**		**Sample-Adjusted CRQL**		**Reference**
SD-61	Sediment	12/6/11	Chromium	Unknown	449 J EB (348)	mg/Kg	1.6	mg/Kg	11, p. 24; 13, pp. 41, 85; 70, p. 11; 91, pp. 1-2, 13, 68
SD-70	Sediment	12/6/11	1,2,3,6,7,8-HxCDD	None	98.2	ng/Kg	6.37	ng/Kg	11, p. 25; 13, pp. 43, 85; 67, p. 4; 88, pp. 1-2, 9, 96
			2,3,4,6,7,8-HxCDF	None	9.51	ng/Kg	6.37	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	298	ng/Kg	6.37	ng/Kg	
			Chromium	Unknown	9,110 J EB (7,060)	mg/Kg	15	mg/Kg	11, p. 25; 13, pp. 43, 85; 70, p. 11; 91, pp. 1-2, 14, 69

CRQL = Contract Required Quantitation Limit.
ng/Kg = Nanograms per kilogram. mg/Kg = Milligrams per kilogram.
HxCDD= Hexachlorodibenzodioxin. HpCDF= Heptachlorodibenzofuran.
TCDF = Tetrachlorodibenzofuran. HxCDF= Hexachlorodibenzofuran.

J = The associated numerical value is an estimated quantity [142; 69, pp. 12-13; 70, pp. 10-11].
EB = The associated compound or element was detected in rinsate blank samples collected for quality control [70, pp. 10-11]. The potential contribution for carryover from non-dedicated sampling equipment has been evaluated. In most cases, the concentration of the analyte or compound observed in a sample is significantly greater than the concentration observed in the associated equipment blank. Therefore, the sample data can be used with a high degree of certainty to confirm the presence of the substance in the samples [44].
* = An explanation for the direction of bias is provided in Reference 71, Table 3; Reference 86, Table 3; Reference 88, Table 3; Reference 89, Table 3; Reference 90, Table 3; Reference 91, Table 3.
( ) = For hazardous substance concentrations, denotes concentration of the compound or element after adjustment. Analytical adjustments are based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination* [140, pp. 4-8].

Attribution:

During reconnaissances of the property, portions of Source No. 1 (Leather Scrap Pile) and Source No. 4 (Water Street/MBTA Source) were observed to be inundated by river flow during tidal fluctuations [11, pp. 16-20; 22]. Sources materials containing pieces of leather scraps were observed eroding from Source Nos. 1 and 4 and depositing directly into the river. Pieces of leather scraps within both the bank materials adjacent to the Crane River and within the river sediments adjacent to the riverbank were also observed [11, pp. 17-19; 12, p. 2; 22]. Chemical analysis of source materials containing leather scraps from Source Nos. 1 and 4 indicated hazardous substances (dioxin/furan congeners and total metals) associated with the tannery at concentrations significantly exceeding background concentrations (see Source No. 1 and Source No. 4 Evaluation Sections of this Documentation Record). Chemical analysis of the Crane River sediment samples adjacent to the riverbanks of Source Nos. 1 and 4, within the areas of direct observation, also confirmed the presence of hazardous substances (dioxin/furan congeners and total metals) at concentrations significantly exceeding background concentrations (see Chemical Analysis section above) [11, pp. 24-25; 13, pp. 57-58; 22].

Historical environmental investigations of the Crane River and properties in the area indentified several potential contributors to contamination of the Crane River sediments, including the Creese & Cook Tannery (Former) property.

In June 2005, Geological Field Services, Inc. (GFS), completed an assessment of existing site-specific and area-wide data to identify additional sources of likely contamination to sediments in the Crane River [129, p. 1]. GFS concluded that there are elevated arsenic and chromium concentrations in the sediments adjacent to the site and within the estuarine system, and that there were numerous tanneries and farms that historically discharged process water and stormwater to the Crane River [129, p. 1]. As part of the sediment assessment, GFS summarized existing sediment sampling conducted as part of investigations of the western facility property, which indicated elevated levels of arsenic and chromium in sediments adjacent to Source No. 1 and Source No. 3 (see Figure 4a) [129, pp. 1-3, 5-6]. In addition, GFS presented a study of the Porter River, Danvers River, Crane River, and Water Rivers, completed by REW, which indicated that the highest concentrations of arsenic and chromium were detected from the samples collected from the Crane River [129, pp. 9-16]. GFS further stated that samples representing the lower end of the Porter River, Danvers River, and Water Rivers appear to be within the expected background range [129, pp. 9-16]. GFS also collected shallow and deep sediment samples from areas adjacent to the western facility property which were submitted to Toxikon Corporation for arsenic analysis [129, pp. 2-3, 5, 8, 74-105]. Analytical results of the sampling indicated elevated concentrations of arsenic in the shallow sediments compared to deeper sediments [129, pp. 2-3, 5, 8].

In addition, as part of the GFS investigation, a Sanborn Map Report was prepared by Environmental Data Resources Inc [129, pp. 103-128]. The Sanborn Map Report indicated the presence of five former tanneries along Crane Brook and Beaver Brook, directly upstream of the Creese & Cook Tannery (Former) site [129, pp. 104-106]. These five former tanneries existed up until approximately 1916 and were located upstream of Purchase Street and the Creese and Cook Tannery (Former) site [19; 129, pp. 104-106]. Background sediment samples SD-03, SD-50, and SD-51 were collected south of Purchase Street, downstream of all identified possible upstream tannery sources to the Crane River (see Table 41) [11, pp. 8, 25-26; 13, pp. 50, 57-58; 25, pp. 1, 25-26]. In addition, the Sanborn Map Report identified one additional former tannery (Cross & Murphy Morocco) downstream of the Creese & Cook Tannery (Former) facility properties (which will be discussed further within this section of the Record, see below) [19; 129, pp.105-106, 111].

A review of available information was conducted to identify other potential sources of dioxin, chromium, and mercury contamination in the area of the Creese & Cook Tannery (Former) site. As part of the review effort, a search of the Searchable Waste Site List/Site Files for the Massachusetts Department of Environmental Protection (MassDEP) was conducted [157]. This database allows sites and reportable releases to be searched and identified by the following attributes: Town, Address, Release Tracking Number (RTN), Site Name, Status, and Licensed Site Professional (LSP) [157]. This service allows users to retrieve a report once the data relative to it have been approved by MassDEP for public viewing [157]. As part of the potential source search, the database was queried for the following site criteria: Town equal to Town of “Danvers”, which identified 238 spill records [157].

In July 1995, Gulf of Maine Research Center, Inc. (GMRC), completed a Phase I Assessment Comprehensive Subsurface Investigation of the property located at 24 Water Street (RTN 3-10524) and the properties 22, 24, and 28 Water Street and 13 & 15 Mill Street (RTN 3-10955) [158, p. 5]. Background information concerning the subject properties indicated that one of the buildings on the property (Building 3) was used as a leather tannery [158, pp. 12, 54]. A Sanborn Report contracted by GFS indicated the presence of the Cross & Murphy Morocco facility in this general area [129, pp. 105, 108]. Soil samples collected as part of the Subsurface Investigation indicated arsenic concentrations up to

14.8 mg/Kg and total chromium up to 1,200 mg/Kg in samples collected in and around Building 3 [158, pp. 26-27, 55]. In August 2010, Tighe & Bond (T&B) prepared a Release Abatement Measure (RAM) Plan outlining the proposed handling and management of potentially impacted soil and ground water/surface water during the repair of a damaged seawall along the Crane River at the property located at 24 Water Street, which was subject to an Activity and Use Limitation (AUL) (Sept 2002 for RTN 3-10955) [160, pp. 3, 7]. Subsurface soil sampling indicated arsenic at a concentration of 34 mg/Kg [160, p. 8].

In September 1999, Haley & Aldrich, Inc.(H&A) assembled a Phase II Comprehensive Site Assessment to summarize investigative, risk assessment, and risk reduction activities undertaken by the Massachusetts Electric Company, Northborough, MA, the Responsible Party/Owner for response actions at the Danvers Manufactured Gas Plant (MGP) facility [159, p. 4]. The facility, located on the eastern side of the Crane River, was formerly used as a manufactured coal gas plant from approximately 1860 to 1906, and appears to have served as a gas storage and distribution facility from approximately 1906 through 1956, and then as residential properties until the time of the Phase II Comprehensive Site Assessment [159, p. 4, 173]. The Phase II Comprehensive Site Assessment identifies a former gas holder present at the MGP which contained materials contaminated with tannery byproducts exhibiting significant levels of chromium and high pH. H&A concluded these materials were typical of tannery effluent [159, p. 4]. Typical site contaminants for the MGP included polyaromatic hydrocarbons and free-phase coal tar products [159, p. 5]. H&A suggested that the superstructure of the gas holder was razed, possibly buried in place, and additional materials were imported to the site to backfill the holder [159, p. 49]. Within the gas holder an organic silt fill, approximately 4 feet thick, which contained varying amounts of sand, brick, clinker, metal, and ash particles and specks, was observed [159, p. 49]. H&A commented that this material resembled typical organic silt, as would be found offshore in the intertidal zone of the Crane River, and the organic silt fill may be dredge spoils used to initially backfill the holder during decommissioning [159, p. 49]. According to observations, this dredge fill exhibited a strong odor of decomposition and decay, and several soil samples examined contained apparent animal hairs and fibers [159, p. 49]. Analytical results of the organic fill layer within the gas holder indicated metals, including chromium at 10,000 parts per million (ppm), while the highest results of site wide soil samples indicated chromium at 65 ppm [159, pp. 50, 52]. In addition, the organic layer within the gas holder contained a maximum pH of 12.82, which led H&A to further support their supposition of the material being derived from tannery operations [159, p. 50].

H&A conducted an extent of contamination study of the Crane River, in order to reconstruct the depositional history of the estuary adjacent to the MGP site and to assist in delineating the areal limits of free-phase coal tar [159, p 33]. A local long-term resident told H&A that effluent discharged from the operating, adjacent Creese & Cook tannery lead to noxious, unpleasant odors (and reduction in water quality for swimming) in the Crane River [159, p. 34]. Several pushcores completed in the Crane River identified leather scraps, animal hairs, material interpreted to be leather buffings (part of the tanning process), or organic silt sediments exhibiting odors of "wet leather" within the industrialized subhorizon [159, pp. 34, 126]. Analytical results of sediment sample SD-11, collected from the Crane River directly adjacent to the former MGP facility, indicated chromium at a concentration of 562 mg/Kg [11, pp. 6-7; 13, pp. 16-17, 73; 25, p. 9; 68, p. 13; 89, pp. 13, 86]. In 2007, ARCADIS, submitted a Partial Response Action Statement in which they stated that a condition of no substantial hazard exists at the property and that all identified sources have been characterized and contained [171, pp. 1, 3].

On 2 December 2011, Tetra Tech, Inc. (Tetra Tech) completed a Comprehensive Site Assessment (Phase II) report, on behalf of the Massachusetts Department of Transportation (MassDOT) [161, p. 6]. During reconfiguration construction of the on-and off-ramps for MA Route 128, soil material was identified that was inconsistent with those in the surrounding area (granules of a white, powder-like substance) [162, pp. 6-7]. X-Ray Fluorescence (XRF) screening results of the white material indicated arsenic at a

concentration of 6,757 mg/Kg [162, p. 7]. Laboratory analysis of the white material indicated arsenic concentrations at 3,900 mg/Kg and chromium at 40 mg/Kg [162, p. 7]. Tetra Tech concluded that the arsenic-containing white material is generally present beneath topsoil at depths ranging from 6 inches to 3 feet below the ground surface, and that its source is unknown [162, p. 18]. White material was observed between the railroad tracks and the High Street/Route-128 on/off ramps more frequently on steeper slopes than on shallower slopes of highway embankments [162, p. 18]. In addition, the white material was not observed beneath the paved highway ramps or other permanent roadway structures, which suggests that it may have been placed at some point after the highway was constructed in the early 1940s [162, p. 18]. Grid sampling of the highway project area indicated elevated arsenic concentrations within the MassDOT Right of Way from approximately High Street to just southwest of the Crane River, with the most heavily impacted areas identified as the steep embankments of the highway from the Route-128/High Street interchange ramps down toward the railroad tracks (cells H3, H4, I3, H6, I6, I7 and J7) [162, pp. 18-19, 33]. As a part of the release response, approximately 11,479 tons of soil has been excavated from the highway interchange, and disposed of off-site [161, p. 16]. Tetra Tech noted that elevated arsenic concentrations in soil at the highway interchange property, which abuts the Crane River, have been identified [162, p. 20]. It was also noted that arsenic-contaminated soil related to the highway construction was generally present at depths from 6 inches to 3 feet under vegetative cover and a layer of topsoil [162, p. 20]. Tetra Tech concluded that while sediment impacts as a result of the arsenic-contaminated materials are possible, any impacts are expected to be negligible compared to impacts from the documented releases at the former Creese & Cook tannery [162, p. 20]. Analytical results of sediment sample SD-07, collected from the Crane River directly adjacent to the highway on-ramp property, did not indicate site related hazardous substances significantly above background [11, p. 7; 13, pp. 17, 72; 25, p. 5; 66, p. 6; 68, p. 12; 87, pp. 14, 98; 89, p. 11, 82].

Pentachlorophenol (PCP) is a synthetic general biocide which does not occur naturally in the environment and has been used extensively as a fungicide, bactericide, herbicide, molluscicide, algaecide, and insecticide by industries such as textiles [104, p. 10; 105, p. 21]. The production of PCP for wood preserving began in the 1930s [104, p. 12; 115, p. 1]. PCP was one of the most widely used biocides in the U.S. prior to regulatory actions to cancel and restrict certain non-wood preservative uses of pentachlorophenol in 1987 [104, p. 12; 105, p. 21]. Biocides, such as PCP, were used to prevent damage of the skin by bacterial growth during the soaking period of the tanning process [102, p. 2; 104, p. 10; 111, p. 6; 115, p. 1]. Based on regulatory action, PCP was not used for leather preservation after the late 1980s [107, p. 1; 115, p. 1; 116, p. 9]. PCP also contains chlorinated dibenzodioxins and chlorinated dibenzofurans as contaminants, formed during the manufacture of the chemical [104, p. 10; 110, pp. 22, 389]. All six tanneries documented by the GFS investigation within the Sanborn Map Report (five upstream and one downstream) were no longer operational after at least 1916; and many were not represented on the 1909 Sanborn Maps [129, p. 106]. As noted above, this pre-dates the use of PCP in tannery operations and associated chlorinated dibenzodioxins and chlorinated dibenzofurans releases. Furthermore, only the Creese & Cook Co. continued operating in the vicinity of the Crane River and used biocides after 1930.

Through salinity observations, tidal influence has been documented to extend up to a location slightly south of the Purchase Street Bridge, at sediment sample locations SD-03, SD-50, and SD-51 [11, pp. 18-20]. A Massachusetts Division of Marine Fisheries study on rainbow smelt populations in the Crane River indicated the sluiceway just north of Purchase Street is located less than 100 meters upstream of the tidal interface of the Danvers River estuary [149, p. 5]. Based on analytical results of sediment samples presented in this HRS Documentation Record, a zone of actual contamination has been documented both upstream and downstream of site sources. Source materials containing pieces of leather scraps were observed to be in contact with and released directly into the Crane River [11, pp. 17-19; 12, p. 2; 22]. In addition, the presence of hazardous substances at elevated concentrations in the sources and the observed releases of these substances to the surface water pathway support at least partial attribution of the

hazardous substances to release from the site (see Source Nos. 1 through 4 Sections of this Evaluation and the Surface Water Pathway Likelihood of Release section above).

Therefore, as presented above, the Creese & Cook Tannery (Former) site is at least partially attributable to the release to the surface water pathway, based on the following: the direct observation of leather scrap material from sources depositing into the river sediments; the lack of sites with similar hazardous substances documented to have released to the river; and the documentation of former tanneries which did not operate while PCP was being used and which have been accounted for in sampling of background sediments.

Hazardous Substances Released

1,2,3,6,7,8-HxCDD (by Direct Observation and Chemical Analysis)
1,2,3,7,8,9-HxCDD (by Direct Observation and Chemical Analysis)
2,3,7,8-TCDF (by Direct Observation and Chemical Analysis)
2,3,4,6,7,8-HxCDF (by Direct Observation and Chemical Analysis)
1,2,3,4,6,7,8-HpCDF (by Direct Observation and Chemical Analysis)
Chromium (by Direct Observation and Chemical Analysis)
Mercury (by Direct Observation and Chemical Analysis)

Surface Water Observed Release Factor Value: 550

4.1.2.3 Drinking Water Threat Targets

Drinking Water Threat targets have not been identified for the Surface Water Overland Flow pathway; therefore, the Drinking Water Threat was not scored as part of this evaluation.

4.1.3.2 Human Food Chain Threat Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

The Toxicity Factor Value, the Persistence Factor Value, and the Bioaccumulation Factor Value are assigned to the hazardous substances associated with the sources and releases at the Creese & Cook Tannery (Former) site based on the values presented in SCDM [4, pp. A-84, A-186, A-202, A-204, A-212, A-236, A-332]. Since the upstream and downstream hazardous substance migration pathways are comprised of salt water bodies, toxicity and bioaccumulation factor values for salt water are used. In addition, since the upstream and downstream hazardous substance migration pathways are comprised of rivers, persistence values for rivers are also used.

Table 42 - Toxicity, Persistence, Bioaccumulation Values

Hazardous Substance	Source Nos.	Toxicity Factor Value	Persistence Factor Value	Bioaccumulation Value	Toxicity/Persistence/ Bioaccumulation Factor Value [1, Table 4-16]	References
1,2,3,6,7,8-HxCDD	1-4	10,000	1.0	5,000	5×10^7	4, A-202
1,2,3,7,8,9-HxCDD	1-4	10,000	1.0	50,000	5×10^8	4, A-204
2,3,7,8-TCDF	1, 4	10,000	1.0	50,000	5×10^8	4, A-332
2,3,4,6,7,8-HxCDF	1, 2, 4	10,000	0.4	0.5	2,000	4, A-212
1,2,3,4,6,7,8-HpCDF	1-4	10,000	1.0	50,000	5×10^8	4, A-186
Chromium	1-4	10,000	1.0	500	5×10^6	4, A-84
Mercury	1-4	10,000	1.0	50,000	5×10^8	4, A-236

HxCDD= Hexachlorodibenzodioxin. HpCDF= Heptachlorodibenzofuran.
TCDF = Tetrachlorodibenzofuran. HxCDF= Hexachlorodibenzofuran.

From HRS Table 4-12, a Toxicity Factor Value of 10,000 and a Persistence Factor Value of 1.0 for 1,2,3,7,8,9-HxCDD, 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDF, and mercury are assigned a Toxicity/Persistence Factor Value of 10,000 [1, p. 51613, Table 4-12]. From HRS Table 4-16, a Toxicity/Persistence Factor Value of 10,000 and a Bioaccumulation Factor Value of 50,000 for 1,2,3,7,8,9-HxCDD, 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDF, and mercury are assigned a Toxicity/Persistence/Bioaccumulation Factor Value of 5×10^8 [1, p. 51619].

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.3.2.2 Hazardous Waste Quantity

Table 43 - Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1	Pile	547.31
2	Pile	462.23
3	Surface Impoundment	1,124.23
4	Contaminated Soil	3.36

Sum of Values: 2,137.13

Based on HRS Section 2.4.2.2, if the Hazardous Constituent Quantity is not adequately determined for one or more sources and if any target for the surface water pathway is subject to Level I or Level II concentrations, a factor value is assigned from Table 2-6 or a value of 100, whichever is greater, as the Hazardous Waste Quantity Factor Value for that pathway [1, pp. 51591-51592 (Section 2.4.2.2, Table 2-6)].

Hazardous Waste Quantity Factor Value [1, Table 2-6]: 100

4.1.3.2.3 Waste Characteristics Factor Category Value

The Toxicity/Persistence Factor Value (10,000) for 1,2,3,7,8,9-HxCDD, 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDF, and mercury is multiplied by the Hazardous Waste Quantity Factor Value for the watershed (100) in order to determine the Waste Characteristics Product, subject to a maximum value of 1×10^8 [1, pp. 51591, 51620 (Section 4.1.3.2.3)]. $10{,}000 \times 100 = 1 \times 10^6$.

Toxicity/Persistence Factor Value ×
Hazardous Waste Quantity Factor Value: 1×10^6

The product of the Toxicity/Persistence Factor Value and the Hazardous Waste Quantity Factor Value for the watershed is multiplied by the Bioaccumulation Potential Factor Value for 1,2,3,7,8,9-HxCDD, 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDF, and mercury (50,000), subject to a maximum value of 1×10^{12} [1, p. 51620 (Section 4.1.3.2.3)]. $(1 \times 10^6) \times 50{,}000 = 5 \times 10^{10}$.

(Toxicity/Persistence × Hazardous Waste Quantity)
× Bioaccumulation Potential Factor Value: 5×10^{10}

From HRS Table 2-7, a Waste Characteristics Product of 5×10^{10} is assigned a Waste Characteristics Factor Category Value of 320 [1, pp. 51592 (Section 2.4.3.1, Table 2-7)].

Waste Characteristics Factor Category Value [1, Table 2-7]: 320

4.1.3.3 Human Food Chain Threat Targets

Based on observations in August 2011 during the Creese & Cook Co. (Former) 1 SR, a man was interviewed and confirmed the presence of a recreational fishery occurring in the Crane River near the MBTA Bridge [151]. According to an interviewed fisherman, stripers (also referred to as striped bass) are taken from the Crane River and consumed if they meet the state regulations on size limit (greater than 24 inches) [151]. In addition, an interview with other local residents indicated that fishing occurs at the upstream side of the Water Street Bridge where anglers departed with the fish that were caught [152]. Additionally, studies of rainbow smelt spawning and reintroduction in the Crane River have been conducted and indicate that the upstream portion of the Crane River is a smelt run [149, 150, pp. 32-33]. The annual harvest information for the above species was not found in available file information, but is greater than zero (> 0) pounds based on the documentation of the interviewed fisherman consuming fish from the fishery.

Actual Human Food Chain Contamination

The observed release to sediment from the Creese & Cook Tannery (Former) site is established by direct observation and by sediment sample analytical results (See Section 4.1.2.1.1 of this evaluation). Based on the analytical results of sediment samples SD-04, SD-06, SD-08, SD-10, SD-11, SD-13, SD-15, SD-17, SD-18, SD-19, SD-20, SD-22, SD-23, SD-24, SD-56, SD-57, SD-59, SD-60, SD-61, and SD-70, the following hazardous substances attributed to Source Nos. 1 through 4 have been detected at concentrations significantly above background in sediments: 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, chromium, and mercury (see Section 4.1.2.1.1 Observed Release). The sediment samples presented, which define the zone of actual contamination, were collected from the Crane River. The Crane River is actively fished according to direct observation along with interviews with local residents and a fisherman (see Figure 4b) [151; 152].

Table 44 - Actual Human Food Chain Contamination

Sample ID	Sample Medium	Distance from PPE (miles)	Hazardous Substance	Bioaccumulation Factor Value	References
SD-04	Sediment	0.057	Chromium	500	4, p. A-84; 23, p. 2
SD-06	Sediment	0.011	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			1,2,3,7,8,9-HxCDD	50,000	4, p. A-204; 23, p. 2
			2,3,7,8-TCDF	50,000	4, p. A-236; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2
			Mercury	50,000	4, p. A-236; 23, p. 2
SD-08	Sediment	0.163	Chromium	500	4, p. A-84; 23, p. 2
			Mercury	50,000	4, p. A-236; 23, p. 2
SD-10	Sediment	0.212	Chromium	500	4, p. A-84; 23, p. 2
SD-11	Sediment	0.129	Chromium	500	4, p. A-84; 23, p. 2
SD-13	Sediment	0.168	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			1,2,3,7,8,9-HxCDD	50,000	4, p. A-204; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2
			Mercury	50,000	4, p. A-236; 23, p. 2

Table 44 - Actual Human Food Chain Contamination (Continued)					
Sample ID	**Sample Medium**	**Distance from PPE (miles)**	**Hazardous Substance**	**Bioaccumulation Factor Value**	**References**
SD-15	Sediment	0.230	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2
			Mercury	50,000	4, p. A-236; 23, p. 2
SD-17	Sediment	0.324	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			1,2,3,7,8,9-HxCDD	50,000	4, p. A-204; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2
			Mercury	50,000	4, p. A-236; 23, p. 2
SD-18	Sediment	0.262	Chromium	500	4, p. A-84; 23, p. 2
SD-19	Sediment	0.308	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			1,2,3,7,8,9-HxCDD	50,000	4, p. A-204; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2
			Mercury	50,000	4, p. A-236; 23, p. 2
SD-20	Sediment	0.366	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			1,2,3,7,8,9-HxCDD	50,000	4, p. A-204; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2
			Mercury	50,000	4, p. A-236; 23, p. 2
SD-22	Sediment	0.473	Chromium	500	4, p. A-84; 23, p. 2
			Mercury	50,000	4, p. A-236; 23, p. 2
SD-23	Sediment	0.531	Chromium	500	4, p. A-84; 23, p. 2
SD-24	Sediment	0.649	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			1,2,3,7,8,9-HxCDD	50,000	4, p. A-204; 23, p. 2
			2,3,7,8-TCDF	50,000	4, p. A-232; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2
			Mercury	50,000	4, p. A-236; 23, p. 2
SD-25	Sediment	0.579	Chromium	500	4, p. A-84; 23, p. 2
SD-56	Sediment	0.020	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			1,2,3,4,6,7,8-HpCDF	50,000	4, p. A-186; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2
SD-57	Sediment	0.023	Chromium	500	4, p. A-84; 23, p. 2

Table 44 - Actual Human Food Chain Contamination (Concluded)					
Sample ID	**Sample Medium**	**Distance from PPE (miles)**	**Hazardous Substance**	**Bioaccumulation Factor Value**	**References**
SD-59	Sediment	0.246	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			1,2,3,4,6,7,8-HpCDF	50,000	4, p. A-186; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2
SD-60	Sediment	0.343	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			1,2,3,7,8,9-HxCDD	50,000	4, p. A-204; 23, p. 2
			2,3,7,8-TCDF	50,000	4, p. A-232; 23, p. 2
			1,2,3,4,6,7,8-HpCDF	50,000	4, p. A-186; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2
SD-61	Sediment	0.352	Chromium	500	4, p. A-84; 23, p. 2
SD-70	Sediment	0.020	1,2,3,6,7,8-HxCDD	5,000	4, p. A-202; 23, p. 2
			1,2,3,4,6,7,8-HpCDF	50,000	4, p. A-186; 23, p. 2
			Chromium	500	4, p. A-84; 23, p. 2

HxCDD= Hexachlorodibenzodioxin. HpCDF= Heptachlorodibenzofuran.
TCDF = Tetrachlorodibenzofuran. HxCDF= Hexachlorodibenzofuran.

Closed Fisheries:

No closed downstream fisheries have been identified.

Table 45 - Closed Fisheries				
Identity of Fishery	**Sample ID**	**Distance from PPE**	**Hazardous Substance**	**References**

Benthic Tissue:

Table 46 - Benthic Tissue					
Identity of Fishery	**Sample ID**	**Distance from PPE**	**Hazardous Substance**	**Organism**	**References**

Level I Concentrations

The observed release to sediment from the Creese & Cook Tannery (Former) site is established by direct observation and sediment sample analytical results (See Section 4.1.2.1.1 of this evaluation). However, fish tissue samples are not available for comparison to applicable health-based benchmarks; therefore, the fishery in Crane River is evaluated as subject to Level II actual contamination [1, p. 51620 (Section 4.1.3.3)]. No Level I fisheries have been identified.

Table 47 - Level I Concentrations						
Sample ID	**Sample Medium**	**Hazardous Substance**	**Hazardous Substance Concentration**	**Benchmark Concentration**	**Benchmark**	**References**
NS						

NS = Not Scored.

Most Distant Level I Sample
Sample ID:
Distance from Probable Point of Entry:
Reference:

Level I Fisheries:

Table 48 - Level I Fisheries		
Identity of Fishery	**Extent of Level I Fishery (Relative to PPE)**	**Reference**
NS		

NS = Not Scored.

Most Distant Level II Sample

The observed release of 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, chromium, and mercury to sediment from the Creese & Cook Tannery (Former) site is established by direct observation and chemical analysis of sediment samples (See Section 4.1.2.1.1 of this Evaluation). On 16 through 18 May 2011 and 6 December 2011, as part of the EPA SR of the Creese & Cook Co. (Former) 1 property, sediment sampling activities were conducted at locations both upstream and downstream of the Creese & Cook Tannery (Former) site [11, pp. 2-9, 24-26; 13, pp. 10-21, 41-44]. Twenty of the sediment samples collected (SD-04, SD-06, SD-08, SD-10, SD-11, SD-13, SD-15, SD-17, SD-18, SD-19, SD-20, SD-22, SD-23, SD-24, SD-56, SD-57, SD-59, SD-60, SD-61, and SD-70) document observed contamination to Crane River sediments (See Section 4.1.2.1.1 of this Evaluation). Sediment sample SD-04 was collected 0.057 miles upstream of the most upstream PPE on the north side of the MA Route 128 Bridge (see Figure 4b) [11, p. 7; 13, pp. 17, 71; 23, p. 2; 25, p. 2]. Sediment sample SD-06 was collected 0.011 miles downstream of the PPE adjacent to Source No. 1 (see Figure 4b) [11, p. 7; 13, pp. 17, 72; 23, p. 2; 25, p. 4]. Sediment sample SD-56 was collected 0.020 miles downstream of the PPE adjacent to Source No. 1 in an area of leather scrap deposition into the Crane River (see Figure 4b) [11, p. 25; 13, pp. 43, 83; 23, p. 2; 25, p. 27]. Sediment sample SD-60 was collected 0.246 miles downstream of the PPE adjacent to Source No. 4 in an area of leather scrap deposition into the Crane River (see Figure 4b) [11, p. 24; 13, pp. 42, 85; 23, p. 2; 25, p. 31]. Sediment sample SD-24 was collected 0.649 miles downstream of the PPE and east of the Water Street Bridge (see Figure 4b) [11, p. 3-5; 13, pp. 12, 80; 23, p. 2; 25, p. 22].

Sample ID: SD-04
Distance from the PPE: 0.057 miles upstream
Reference: 23, p. 2

Sample ID: SD-06
Distance from the PPE: 0.011 miles downstream
Reference: 23, p. 2

Sample ID: SD-56
Distance from the PPE: 0.020 miles downstream
Reference: 23, p. 2

Sample ID: SD-60
Distance from the PPE: 0.246 miles downstream
Reference: 23, p. 2

Sample ID: SD-24
Distance from the PPE: 0.649 miles downstream
Reference: 23, p. 2

Level II Fisheries

Table 49 - Level II Fisheries

Identity of Fishery	Extent of Level II Fishery (Relative to PPE or Level II Fishery)	References
Crane River	Level II concentrations of dioxin/furan congeners, chromium, and mercury are present in sediment samples collected from upstream of the most upstream PPE (SD-04) through the area of the documented fishery, to the most downstream release sample (SD-24), located 0.649 miles from PPE No. 1.	See Section 4.1.2.1.1; 11, pp. 3-7; 13, pp. 12, 17, 71, 80; 23, p. 2; 25, pp. 2-22

4.1.3.3.1 Food Chain Individual

The Crane River fishery is subject to actual contamination based on the observed release of hazardous substances by direct observation and chemical analysis (1,2,3,6,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 2,3,7,8-TCDF; 2,3,4,6,7,8-HxCDF; 1,2,3,4,6,7,8-HpCDF chromium, and mercury) of sediment samples (SD-04, SD-06, SD-56, SD-60, and SD-24) (See Section 4.1.2.1.1). An observed release of attributable hazardous substances (1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDF, chromium, and mercury), having a Bioaccumulation Factor Value of 500 or greater (maximum value 50,000), to the in-water segment for the watershed containing fisheries has been established [4, pp. A-84, A-186, A-202, A-204, A-236]. However, fish tissue samples are not available for comparison to applicable health-based benchmarks; therefore, the fishery in Crane River is evaluated as subject to Level II actual contamination [1, p. 51620 (Section 4.1.3.3)].As a result, a Food Chain Individual Factor Value of 45 is assigned [1, p. 51620 (Section 4.1.3.3.1)].

Sample ID: SD-04
Level I/Level II/or Potential: Level II
Hazardous Substance: Chromium
Bioaccumulation Potential: 500

Sample ID: SD-06
Level I/Level II/or Potential: Level II
Hazardous Substance: 1,2,3,6,7,8-HxCDD/1,2,3,7,8,9-HxCDD/2,3,7,8-TCDF/chromium/ mercury

Bioaccumulation Potential: 5,000/50,000/50,000/500/50,000

Sample ID: SD-56
Level I/Level II/or Potential: Level II
Hazardous Substance: 1,2,3,6,7,8-HxCDD/1,2,3,4,6,7,8-HpCDF/chromium
Bioaccumulation Potential: 5,000/50,000/500

Sample ID: SD-60
Level I/Level II/or Potential: Level II
Hazardous Substance: 1,2,3,6,7,8-HxCDD/1,2,3,7,8,9-HxCDD/2,3,7,8-TCDF/1,2,3,4,6,7,8-HpCDF/chromium
Bioaccumulation Potential: 5,000/50,000/50,000/50,000/500

Sample ID: SD-24
Level I/Level II/or Potential: Level II
Hazardous Substance: 1,2,3,6,7,8-HxCDD/1,2,3,7,8,9-HxCDD/2,3,7,8-TCDF/chromium/ mercury
Bioaccumulation Potential: 5,000/50,000/50,000/500/50,000

Table 50 - Food Chain Individual

Identity of Fishery	Type of Surface Water Body	Dilution Weight (Ref. 1,Table 4-13)	References
Crane River upstream of Water Street Bridge	Small to moderate stream	0.1	41; 150, p. 134

If Potential Contamination, Dilution Weight x 20:

Food Chain Individual Factor Value: 45
[1, p. 51620 (Section 4.1.3.3.1)]

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

The observed release to sediment from the Creese & Cook Tannery (Former) site is established by direct observation and chemical analysis of sediment samples (See Section 4.1.2.1.1 of this evaluation). However, fish tissue samples are not available for comparison to applicable health-based benchmarks; therefore, the fishery in Crane River is evaluated as subject to Level II actual contamination [1, p. 51620 (Section 4.1.3.3)]. No Level I fisheries have been identified.

Level I Population Concentrations

Table 51 - Level I Human Food Chain Population Value

Identity of Fishery	Annual Production (pounds)	References	Human Food Chain Population Value [1, Table 4-18]
NS			

Sum of Level I Human Food Chain Population Values: NS

Sum of Level I Human Food Chain Population Values × 10:

Level I Concentrations Factor Value: Not Scored

4.1.3.3.2.2 Level II Concentrations

Level II Population Targets

The observed release to sediment from the Creese & Cook Tannery (Former) site is established by direct observation and chemical analysis of sediment samples (See Section 4.1.2.1.1 of this evaluation). However, fish tissue samples are not available for comparison to applicable health-based benchmarks; therefore, the fishery in Crane River is evaluated as subject to Level II actual contamination [1, p. 51620 (Section 4.1.3.3)].

Table 52 - Level II Human Food Chain Population Value

Identity of Fishery	Annual Production (pounds)	References	Human Food Chain Population Value [1, Table 4-18]
Crane River	> 0	1, p. 51620 (Section 4.1.3.3); 151; 152	0.03

Sum of Level II Human Food Chain Population Values: 0.03

Level II Concentrations Factor Value: 0.03

4.1.3.3.2.3 Potential Human Food Chain Contamination

Potential Population Targets

Table 53 - Potential Population Targets							
Identity of Fishery	**Annual Production (pounds)**	**Type of Surface Water Body**	**Average Annual Flow (cfs)**	**References**	**Population Value (P_i) [1, Table 4-18]**	**Dilution Weight (D_i) [1, Table 4-13]**	**P_i x D_i**
NS							

Sum of P_i x D_i:
(Sum of P_i x D_i)/10:

Potential Human Food Chain Contamination Factor Value: Not Scored

4.1.4.2 Environmental Threat Waste Characteristics

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

The Ecosystem Toxicity Factor Value, the Persistence Factor Value, and the Environmental Bioaccumulation Factor Value are assigned to the hazardous substances associated with the sources and releases at the Creese & Cook Tannery (Former) site based on the values presented in SCDM [4, pp. A-84, A-186, A-202, A-204, A-212, A-236, A-332]. Since the upstream and downstream hazardous substance migration pathways are comprised of salt water bodies, toxicity and bioaccumulation factor values for salt water are used. In addition, since the upstream and downstream hazardous substance migration pathways are comprised of rivers, persistence values for rivers are also used.

Table 54 - Ecosystem Toxicity, Persistence, and Bioaccumulation

Hazardous Substance	Source Nos.	Ecosystem Toxicity Factor Value	Persistence Factor Value	Environmental Bioaccumulation Value	Ecosystem Toxicity/ Persistence/ Environmental Bioaccumulation Factor Value [1, Table 4-21]	References
1,2,3,6,7,8-HxCDD	1-4	0	1.0	5,000	0	4, A-202
1,2,3,7,8,9-HxCDD	1-4	0	1.0	50,000	0	4, A-204
2,3,7,8-TCDF	1, 4	0	1.0	50,000	0	4, A-332
2,3,4,6,7,8-HxCDF	1, 2, 4	0	0.4	0.5	0	4, A-212
1,2,3,4,6,7,8-HpCDF	1-4	0	1.0	50,000	0	4, A-186
Chromium	1-4	100	1.0	500	50,000	4, A-84
Mercury	1-4	10,000	1.0	50,000	5×10^8	4, A-236

HxCDD= Hexachlorodibenzodioxin. HpCDF= Heptachlorodibenzofuran.
TCDF = Tetrachlorodibenzofuran. HxCDF= Hexachlorodibenzofuran.

The Environmental Threat Waste Characteristic is evaluated for mercury. From HRS Table 4-21, a Ecosystem Toxicity/Persistence Factor Value of 10,000 and an Environmental Bioaccumulation Factor Value of 50,000 for mercury are assigned an Ecosystem Toxicity/Persistence/ Bioaccumulation Factor Value of 5×10^8 [1, p. 51623].

Ecosystem Toxicity/Persistence/Environmental Bioaccumulation Factor Value: 5×10^8

4.1.4.2.2 Hazardous Waste Quantity

Table 55 - Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1	Pile	547.31
2	Pile	462.23
3	Surface Impoundment	1,124.23
4	Contaminated Soil	3.36

Sum of Values: 2,137.13

Based on HRS Section 2.4.2.2, if the Hazardous Constituent Quantity is not adequately determined for one or more sources and if any target for the surface water pathway is subject to Level I or Level II concentrations, a factor value is assigned from Table 2-6 or a value of 100, whichever is greater, as the Hazardous Waste Quantity Factor Value for that pathway [1, pp. 51591-51592 (Section 2.4.2.2, Table 2-6)].

Hazardous Waste Quantity Factor Value [1, Table 2-6]: 100

4.1.4.2.3 Waste Characteristics Factor Category Value

The Ecosystem Toxicity Factor Value (10,000) and the Persistence Factor Value (1.0) for mercury are multiplied in order to determine the Ecosystem Toxicity/Persistence Factor Value (10,000) [1, p. 51624, Section 4.1.4.2.1.4, Table 4-20]. The Ecosystem Toxicity/Persistence Factor Value for the watershed (10,000) is multiplied by the Hazardous Waste Quantity Factor Value for the watershed (100) in order to determine the Waste Characteristics Product, subject to a maximum value of 1×10^8 [1, pp. 51592, Section 2.4.3.1, 51624, Section 4.1.4.2.3]. $10{,}000 \times 100 = 1 \times 10^6$.

Ecosystem Toxicity/Persistence Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 100

Ecosystem Toxicity/Persistence Factor Value × Hazardous Waste Quantity Factor Value: 1×10^6

The Waste Characteristics Product for the watershed (subject to a maximum value of 1×10^8) is multiplied by the Bioaccumulation Potential Factor Value (50,000) for mercury, to generate a second product, subject to a maximum value of 1×10^{12} [1, p. 51624, Section 4.1.4.2.3]. $(1 \times 10^6) \times 50{,}000 = 50{,}000{,}000{,}000$ (5×10^{10}).

(Ecosystem Toxicity/Persistence × Hazardous Waste Quantity) ×
Bioaccumulation Potential Factor Value: 5×10^{10}

From HRS Table 2-7, the second Waste Characteristics Product (5×10^{10}) is assigned a Waste Characteristics Factor Category Value of 320 [1, pp. 51592 (Section 2.4.3.1), 51624 (Section 4.1.4.2.3)].

Waste Characteristics Factor Category Value (1, p. 51592, Table 2-7): 320

4.1.4.3 Environmental Threat Targets

The Creese & Cook Co. Tannery (Former) site is located within the Crane River System, which is located in the Beverly Harbor Drainage Area and is part of the North Shore Coastal Watersheds [144, pp. 1, 12, 69, 86]. Source areas associated with former tannery operations at the site are located within the Crane River System, designated as segment MA93-41, which extends from the outlet pump house sluiceway, on Purchase Street, to the confluence with the Danvers River [144, p. 86]. The Crane River segment MA93-41 is classified as an estuary and designated by the state Integrated List of Waters as a Category 5, which denotes the segment as impaired and requiring one or more Total Maximum Daily Load studies [145, p. 22, 134; 147, p. 33]. The Integrated List of Waters was compiled in response to Section 303(d) of the Clean Water Act (CWA) and the implementing regulations at 40 CFR 130.7, which requires states to identify those water bodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and to prioritize and schedule them for the development of a Total Maximum Daily Load [145, p. 5]. Based on direct observation and chemical analysis, an observed release has been documented to CWA-protected water body sensitive environment (Crane River segment MA93-41) [1, p. 51624 (Table 4-23)].

According to a wetland delineation completed by an EPA Senior Wetland Scientist, there is wetland frontage located along the Crane River and extends from the area of the upstream background sediment samples to the Water Street Bridge [24, pp. 3-4, 9 (Figure 4)]. Based on analytical results of sediment samples, the wetland frontage along the Crane River from sediment sample SD-04 through sediment sample SD-24 is subject to actual contamination and documents impacts to a sensitive environment (see Figure 4 and Section 4.2.1.2.1 of this evaluation) [24, pp. 2-3, 8-9 (Figures 3 and 4)].

Level I Concentrations

The observed release to sediment from the Creese & Cook Tannery (Former) site is established by direct observation and chemical analysis of sediment samples (See Section 4.1.2.1.1 of this evaluation). Sensitive Environments that are determined to be actual contamination targets based on sediment sample analytical results, but for which no ecological-based benchmarks are applicable, are evaluated as subject to actual contamination at Level II [1, p. 51625 (Section 4.1.4.3.1)]. Therefore, no Level I sensitive environments have been identified.

Table 56 - Level I Concentrations

Sample ID	Sample Medium	Hazardous Substance	Hazardous Substance Concentration	Benchmark Concentration	Benchmark	References

Most Distant Level I Sample

Sample ID:
Distance from the probable point of entry:
Reference:

Most Distant Level II Sample

The observed release of 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, chromium, and mercury to sediment from the Creese & Cook Co. Tannery

(Former) site is established by direct observation and chemical analysis of sediment samples (See Section 4.1.2.1.1 of this Evaluation). On 16 through 18 May 2011 and 6 December 2011, as part of the EPA SR of the Creese & Cook Co. (Former) 1 property, sediment sampling activities were conducted at locations both upstream and downstream of the Creese & Cook Co. Tannery (Former) site [11, pp. 2-9, 24-27; 13, pp. 10-21, 41-44]. Twenty of the sediment samples collected (SD-04, SD-06, SD-08, SD-10, SD-11, SD-13, SD-15, SD-17, SD-18, SD-19, SD-20, SD-22, SD-23, SD-24, SD-56, SD-57, SD-59, SD-60, SD-61, and SD-70) document observed contamination to Crane River sediments (See Section 4.1.2.1.1 of this Evaluation). Sediment sample SD-04 was collected 0.057 miles upstream of the most upstream PPE on the north side of the MA Route 128 Bridge (see Figure 4b) [11, p. 7; 13, pp. 17, 71; 23, p. 2; 25, p. 2, 4, 6, 8-9, 11, 13, 15-18, 20-22, 27-28, 30-32]. Sediment sample SD-06 was collected 0.011 miles downstream of the PPE adjacent to Source No. 1 (see Figure 4b) [11, p. 7; 13, pp. 17, 72; 23, p. 2; 25, p. 4]. Sediment sample SD-56 was collected 0.020 miles downstream of the PPE adjacent to Source No. 1 in an area of leather scrap deposition into the Crane River (see Figure 4b) [11, p. 25; 13, pp. 43, 83; 23, p. 2; 25, p. 27]. Sediment sample SD-60 was collected 0.246 miles downstream of the PPE adjacent to Source No. 4 in an area of leather scrap deposition into the Crane River (see Figure 4b) [11, p. 24; 13, pp. 42, 85; 23, p. 2; 25, p. 31]. Sediment sample SD-24 was collected 0.649 miles downstream of the PPE adjacent and east of the Water Street Bridge (see Figure 4b) [11, pp. 3-5; 13, pp. 12, 80; 23, p. 2; 25, p. 22].

Sample ID: SD-04
Distance from the PPE: 0.057 miles upstream
Reference: 23, p. 2

Sample ID: SD-06
Distance from the PPE: 0.011 miles downstream
Reference: 23, p. 2

Sample ID: SD-56
Distance from the PPE: 0.020 miles downstream
Reference: 23, p. 2

Sample ID: SD-60
Distance from the PPE: 0.246 miles downstream
Reference: 23, p. 2

Sample ID: SD-24
Distance from the PPE: 0.649 miles downstream
Reference: 23, p. 2

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

The observed release to sediment from the Creese & Cook Tannery (Former) site is established by direct observation and chemical analysis of sediment samples (See Section 4.1.2.1.1 of this evaluation). Sensitive Environments that are determined to be actual contamination targets based on sediment sample analytical results, but for which no ecological-based benchmarks are applicable, are evaluated as subject to actual contamination at Level II [1, p. 51625 (Section 4.1.4.3.1)]. Therefore, no Level I sensitive environments have been identified.

Level I Sensitive Environment Targets

Table 57 - Level I Sensitive Environment Targets			
Sensitive Environment	**Distance from PPE to Nearest Sensitive Environment**	**References**	**Sensitive Environment Value [1, Table 4-23]**
NS			

Sum of Level I Sensitive Environments Value: NS

Level I Wetland Frontages

Table 58 - Level I Wetland Frontages		
Wetland	**Wetland Frontage (miles)**	**References**
NS		

Sum of Level I Wetland Frontages: NS
Wetlands Value (Ref. 1, Table 4-24): NS

Sum of Level I Sensitive Environments Value + Wetlands Value: NS
(Sum of Level Sensitive Environments Value + Wetlands Value) x 10: NS

Level I Concentrations Factor Value: NS

4.1.4.3.1.2. Level II Concentrations

Sensitive environments that were determined to be actual contamination targets based on direct observation and chemical analysis of sediment samples are evaluated using Level II concentrations [1, p. 51625 (Section 4.1.4.3.1)]. An observed release to sediment from the Creese & Cook Tannery (Former) site has been established for a portion of Crane River, from 0.057 miles upstream (SD-04) to 0.649 miles downstream (SD-24) of the PPE for Source No. 1 (See Section 4.1.2.1.1 of this evaluation) [11, pp. 3-5, 7; 13, pp. 12, 17, 71, 80; 23, p. 2].

Level II Sensitive Environment Targets

The Crane River segment MA93-41 is classified as an estuary and designated by the state Integrated List of Waters as a Category 5 [145, p. 24, 134; 147, p. 47]. The Integrated List of Waters was compiled in response to Section 303(d) of the CWA and the implementing regulations at 40 CFR 130.7, which requires states to identify those water bodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and to prioritize and schedule them for the development of a total maximum daily load (TMDL) [145, p. 5]. Crane River segment MA93-41 is listed as a class SA water body which denotes an excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation [146, p. 12; 147, p. 47]. Based on direct observation and chemical analysis of sediment samples, an observed release has been documented to a CWA-protected water body sensitive environment (Crane River segment MA93-41) [1, p. 51624 (Table 4-23)].

Table 59 - Level II Sensitive Environment Targets			
Sensitive Environment	**Distance from PPE to Nearest Sensitive Environment**	**References**	**Sensitive Environment Value (Ref. 1, Table 4-23)**
CWA-Protected Water Body (Crane River)	0	1, p. 51624, Table 4-23	5

Sum of Level II Sensitive Environments Value: 5

Level II Wetland Frontages

According to a wetland delineation completed by an EPA Senior Wetland Scientist, there is wetland frontage located along the Crane River, extending from the upstream background sediment samples to the Water Street Bridge [24, pp. 2-3, 9 (Figure 4)]. The United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) indicates numerous wetland types along the area of documented contamination within the Crane River [24, p. 3]. The HRS uses the definition of a wetland presented in 40 CFR 230.3, which differs from the USFWS definition in that, under normal circumstances, the wetland should support a prevalence of rooted emergent hydrophytes [24, p. 3]. Therefore, the NWI maps present some wetland types that may be used in HRS scoring depending on the presence of these rooted hydrophytes [24, p. 3]. The wetland delineation, completed by an EPA Senior Wetland Scientist on 2 November 2011, indicated the presence of Estuarine Intertidal Emergent wetlands along the facility properties on both the eastern and western banks of the Crane River and from the Water Street Bridge up to and including sediment sample SD-04 (see Figure 4b) [24, pp. 4, 9 (Figure 4)]. Based on analytical results of sediment samples, the wetland frontage along the Crane River from sediment sample SD-04 through sediment sample SD-24 is subject to actual contamination and documents impacts to a sensitive environment (see Figure 4 and Section 4.2.1.2.1 of this evaluation) [24, pp. 2-3, 9 (Figure 4)]. Chromium was detected in sediment samples SD-04 and SD-24 at concentrations significantly above background, and mercury was detected in sediment samples SD-06 and SD-24 at concentrations significantly above background (see Section 4.2.1.2.1 of this evaluation). The distance from the southern side of the MA Route 128 Bridge to the upstream (eastern) side of the Water Street Bridge, which is contained between sediment samples SD-04 and SD-24, is evaluated as containing impacted wetland frontage. From the wetland delineation this includes Wetland ID Nos. 1 through 21 [24, pp. 2-3, 9, 19]. Therefore, based on the HRS eligible wetland delineation, performed by an EPA Senior Wetland Scientist, a wetland frontage distance of 1.287 miles is documented as a Level II actual observed release environmental target [24, pp. 2-3, 9 19].

Table 60 – Wetland Frontage		
Wetland	**Wetland Frontage (miles)**	**References**
Crane River Impacted Wetlands	1.287	Section 4.2.1.2.1, 24, pp. 2-3, 9, 19

Sum of Level II Wetland Frontages: 1.287
Wetlands Value [1, Table 4-24]: 50

Sum of Level II Sensitive Environments Value + Wetlands Value: 55

Level II Concentrations Factor Value: 55

4.1.4.3.1.3 Potential Contamination

Potential Contamination Factor Value: Not Scored

5.0 SOIL EXPOSURE PATHWAY

5.0.1 GENERAL CONSIDERATIONS

Letter by which this area is to be identified: A

Name of area: Contaminated Soil Associated with the Water Street/MBTA Source

Location and description of area (with reference to a map of the site):

The surface soil area documented to contain site-related hazardous substances associated with operations on the Creese & Cook Tannery facility is referred to as Area A and is located on the eastern side of the Crane River. This area is defined by the areal extent of Source No. 4: contained on portions of three separate properties, consisting of the 33 Water Street parcel the adjacent MBTA Right-of-way parcel, and the 20 Cheever street parcel; and is outlined by 12 shallow surface soil samples (SS-12A, SS-02A, SS-18A, SS-05A, SS-20A/SS-20C, SS-21A, SS-11A, SS-22A, SS-23A/SS-35A, SO-63, SO-62, and SS-26A) (see Figure 5) [17]. In addition, sampling of surface materials within Area A (SS-03A, SS-04A/SS-04C, SS-06A, SS-07A, SS-08A, SS-09A/SS-33A, SS-10A, SS-12A, SS-18A, SS-24A/SS-24C, and SS-25A) has indicated the presence of site-related hazardous substances significantly above background (see Source No. 4 Evaluation). The 33 Water Street portion of Area A is located on a parcel containing residential population targets, while the adjacent MBTA Right-of-Way and the Cheever Street parcel are not residential and have no associated residential targets [12, p. 17; 163].

- Background Concentrations:

On 5 December 2011, as part of the EPA SR of the Creese & Cook Co. (Former) 1 facility, background surface soil sampling activities were conducted [11, pp.20-24; 13, pp. 36-41]. The background surface soil samples were collected in accordance with the EPA-approved Site-Specific QAPP, dated 18 April 2011, and the Site-Specific QAPP Addendum, dated 22 November 2011 [8, pp. 29,50; 9, pp. 2-3, 8 (Figure 3); 13, pp. 37] Two background surface soil samples (SO-52 and SO-53) were collected from an area directly adjacent to the exterior side of the granite stone wall marking the Endicott-Russell Family Cemetery (located at 25 Clinton Avenue) [11, p. 21; 13, pp. 37-38, 53, 56-57, 66, 135; 19]. The samples were collected to document background soil concentrations in natural materials in the vicinity of the site [11, p. 21; 13, pp. 37-38, 40]. The samples were collected from an area presumed to be outside the area influenced by waste disposal practices from the tannery. The Endicott-Russell Family Cemetery pre-dates the tannery operations [11, p. 21; 13, pp. 37-38]. START personnel noted grave markers dating back to the mid-1700s (including Mrs. Margaret Endicott – 1759 and Capt. Samuel Endicott - 1766) [11, p. 21; 13, pp. 37-38].

Table 61 - Background Surface Soil Sample Location Description

Sample ID	Sample Medium	Depth (inches)	Date	References
SO-52	Soil	8 to 18	12/5/2011	11, p. 21; 13, pp. 37, 66; 26, p. 24
SO-53	Soil	8 to 24	12/5/2011	11, p. 21; 13, pp. 38, 66; 26, p. 25

Two background surface soil samples (SO-52 and SO-53) were collected from less than 2 feet below ground surface (bgs) from similar depth intervals and contained soil matrix material similar to the surface soil samples associated with release samples presented as part of the Soil Exposure Evaluation – Area A [11, pp. 21, 23; 12, pp. 4-17; 13, pp. 37-38; 14, pp. 12-30; 26, pp. 24-25; 27, pp. 4, 7-8, 10-12, 16-17, 20-21, 24, 28, 31, 34, 37, 53, 57-69]. Background surface soil samples were collected within the same

general time period (7 months) as those release samples presented as part of the Soil Exposure evaluation [11, p. 21; 12, pp. 4-17; 13, pp. 52, 56; 14, pp. 12-30]. Reconnaissance observations during the time period between sampling events did not indicate any change to the source area identified here as Area A [11, p. 26; 13, pp. 34].

Table 62 – Background Surface Soil Sample Description

Sample ID	Sample Description	Reference
SO-52	Brown-to-orange brown, silt and fine-to-coarse sand, trace fine gravel, trace organics.	26, p. 24
SO-53	Brown, silt and fine-to-medium sand, trace fine-to-medium gravel, trace clay, trace organic.	26, p. 25

Background surface soil sample SO-53 was submitted to CLP laboratories for dioxin/furan analysis following DLM02.2, and for total metals analysis following ISM01.3; while background surface soil sample SO-52 was submitted to a CLP laboratory for total metals analysis only, following ISM01.3 [11, pp. 21, 27; 13, pp. 36-38, 57-58, 66; 28, p. 11; 29, p. 7; 50, pp. 1, 4; 57, pp. 1, 13; 71, pp. 12, 107; 78, pp. 11, 87-88]. COCs for all source samples collected as part of the 2011 EPA SR and presented in this HRS Documentation Record are provided in References 28 and 29. The applicable COC sections for the background surface soil samples and all corresponding sample identifiers are provided in available COC, field notes reference documentation, and sample crosswalk [11, p. 21; 13, pp. 36-38, 66; 26, pp. 24-25; 28, p. 11; 29, p. 7]. The dioxin/furan analytical results were manually validated at a stage 4 level in accordance with the criteria specified in the USEPA SOW DLM02.2 and EPA Region I's ESAT Dioxin/Furan Data Validation SOP ESAT-01-0007 [50, p. 1]. The total metals analytical data were evaluated on a Tier II level in accordance with the Region I Tiered Organic and Inorganic Data Validation Guidelines dated November 2008 [57, p. 1]. The validation of dioxin/furan and total metals analytical results was conducted independently by designated chemists who were not involved in the sample collection and HRS evaluation [11, pp. 21, 23; 13, pp. 36-38, 40, 66, 69; 50, pp. 1-3; 57, pp. 1-8].

Based on an examination of the two background surface soil samples collected and submitted for total metals analysis, the highest background hazardous substance comparison concentrations are presented in Table 63. See below for further evaluation of background concentrations utilized in this HRS evaluation to determine observed contamination for the Soil Exposure pathway.

Table 63 - Hazardous Substances Associated with Background Surface Soil Samples

Sample ID	Sample Type	Date	Hazardous Substance	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-53	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	0.371 U ng/Kg	4.81 ng/Kg	11, p. 21; 13, p. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-53	Soil	12/5/11	1,2,3,7,8,9-HxCDD	None	0.425 U ng/Kg	4.81 ng/Kg	11, p. 21; 13, p. 38, 66; 50, p. 4; 71, pp.1-2, 12, 107

Table 63 - Hazardous Substances Associated with Background Surface Soil Samples (Concluded)							
Sample ID	**Sample Type**	**Date**	**Hazardous Substance**	**Bias***	**Hazardous Substance Concentration**	**Sample-Adjusted CRQL**	**Reference**
SO-53	Soil	12/5/11	1,2,3,4,6,7,8-HpCDD	None	21.2 ng/Kg	4.81 ng/Kg	11, p. 21; 13, p. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-53	Soil	12/5/11	2,3,7,8-TCDF	None	0.259 EMPC ng/Kg	0.961 ng/Kg	11, p. 21; 13, p. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-53	Soil	12/5/11	2,3,4,6,7,8-HxCDF	None	0.338 U ng/Kg	4.81 ng/Kg	11, p. 21; 13, p. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-53	Soil	12/5/11	1,2,3,4,6,7,8-HpCDF	None	1.77 J (1.77) ng/Kg	4.81 ng/Kg	11, p. 21; 13, p. 38, 66; 50, p. 4; 71, pp. 1-2, 12, 107
SO-52	Soil	12/5/11	Arsenic	None	11.4 mg/Kg	1.2 mg/Kg	11, p. 21; 13, p. 36-37, 66; 57, p. 13; 78, pp. 1-2, 11, 87
SO-53	Soil	12/5/11	Barium	None	21.2 J (21.2) mg/Kg	23.6 mg/Kg	11, p. 21; 13, p. 38, 66; 57, pp. 11, 13; 78, pp. 1-2, 11, 88
SO-52	Soil	12/5/11	Chromium	None	17.3 mg/Kg	1.2 mg/Kg	11, p. 21; 13, p. 36-37, 66; 57, p. 13; 78, pp. 1-2, 11, 87
SO-53	Soil	12/5/11	Mercury	None	0.040 J (0.04) mg/Kg	0.12 mg/Kg	11, p. 21; 13, p. 38, 66; 57, pp. 11, 13; 78, pp. 1-2, 11, 88

CRQL = Contract Required Quantitation Limit. ng/Kg = Nanograms per kilogram.
mg/Kg = Milligrams per kilogram. HpCDF = Heptachlorodibenzofuran.
HxCDD = Hexachlorodibenzodioxin. HpCDD = Heptachlorodibenzodioxin.
TCDF = Tetrachlorodibenzofuran. HxCDF = Hexachlorodibenzofuran.

U = The compound or element was analyzed for, but not detected. The associated numerical value is the sample-adjusted CRQL [141, p. B-21; 50, p. 7].
J = The associated numerical value is an estimated quantity [141, p. B-20; 50, p. 4; 142, p. B-21; 57, p. 11].
EMPC = Estimated Maximum Possible Concentration based on a failure of the ion abundance ratio. The EMPC is a worst case estimate of the sample concentration that the signal would represent if it did meet all the identification criteria [141, p. D-4].
* = An explanation for the direction of bias is provided in Reference 71, Table 3; Reference 86, Table 3; Reference 88, Table 3; Reference 89, Table 3; Reference 90, Table 3; Reference 91, Table 3.

( ) = For hazardous substance concentrations, denotes concentration of the compound or element after adjustment. Analytical adjustments are based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination* [140, pp. 4-8].

Based on an examination of the one background surface soil sample submitted for dioxin/furan analysis and the two background surface soil samples submitted for total metals analysis, the highest numerical comparison background value concentrations are presented in Table 63. These are used to establish specific analyte background comparison concentrations to determine observed contamination of Area A for the Soil Exposure evaluation.

Dioxin/furan congeners 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, and 2,3,4,6,7,8-HxCDF in background surface soil samples were non-detect; therefore, observed contamination is established when the contaminated surface soil sample concentration equals or exceeds the sample-adjusted CRQL [1, p. 51589 (Table 2-3)].

Dioxin congener 1,2,3,4,6,7,8-HpCDD was detected in the background surface soil sample at a concentration exceeding the sample-adjusted CRQL; therefore, observed contamination is established when the contaminated surface soil sample's concentration is three times or more above the background concentration [1, p. 17 (Table 2-3)]. In addition, arsenic and chromium were each detected in background surface soil samples at a concentration exceeding the sample-adjusted CRQL; therefore, observed contamination is established when the contaminated surface soil sample concentration is three times or more above the background concentration [1, p. 51589 (Table 2-3)].

Furan congener 1,2,3,4,6,7,8-HpCDF was detected in the background surface soil sample at a concentration below the sample-adjusted CRQL [1, p. 51589 (Table 2-3)]. Observed contamination is established when this furan congener concentration is three times or more above the background concentration [1, p. 51589 (Table 2-3)]. In addition, barium and mercury were each detected in background surface soil samples at concentrations below the sample-adjusted CRQL [1, p. 51589 (Table 2-3)]. Observed contamination is established for these total metals when the surface soil sample concentration is three times or more above the background concentration [1, p. 51589 (Table 2-3)].

Furan congener 2,3,7,8-TCDF in the background surface soil sample was detected at concentrations below the sample-adjusted CRQL. This furan congener is considered above background when the source sample concentration is greater than the sample-adjusted CRQL [1, p. 51589 (Table 2-3)]. This approach provides the highest possible background comparison value.

- Contaminated Samples

Area Letter: A

On 18 through 22 April 2011, as part of the EPA SI, and on 5 December 2011, as part of the EPA SR, surface soil samples were collected from Area A [11, pp. 20-24; 12, pp. 4-17; 13, pp. 36-41; 14, pp. 12-30]. All surface soil source samples were collected in accordance with the EPA-approved Site-Specific QAPP for the Creese & Cook Co. (Former) 2 SI, dated 21 January 2011, and/or the EPA-approved Site-Specific QAPP, dated 18 April 2011, and the Site-Specific QAPP Addendum, dated 22 November 2011 for the Creese & Cook Co. (Former) 1 SR [8, pp. 29, 50; 9, pp. 2-3, 8 (Figure 3), 11; 10, pp. 24, 27-32; 13, p. 37; 14, pp. 12-30]. As part of the Area A characterization, 26 surface soil samples (SS-02A, SS-03A, SS-04A, SS-04C, SS-05A, SS-06A, SS-07A, SS-08A, SS-09A, SS-10A, SS-11A, SS-12A, SS-18A, SS-20A, SS-20C, SS-21A, SS-22A, SS-23A, SS-24A, SS-24C, SS-25A, SS-26A, SS-33A, SS-35A, SO-62, and SO-63) were collected from various locations throughout the contaminated soil Area A (see Figure 5) [12, pp. 4-17; 14, pp. 12-30; 27, pp. 4, 7, 10-12, 16, 20, 24, 28, 31, 34, 37, 53, 57-69].

Table 64 – Surface Soil Samples Associated with Area A				
Sample ID	**Sample Medium**	**Depth (inches)**	**Date**	**References**
SS-02A	Surface Soil	0 to 12	4/18/2011	14, p. 14, 48 (Table 1); 27, p. 4
SS-03A	Surface Soil	4 to 12	4/19/2011	14, pp. 15, 48 (Table 1); 27, p. 7
SS-04A	Surface Soil	0 to 12	4/21/2011	14, pp. 24, 49 (Table 1); 27, p. 10
SS-04C	Surface Soil	12 to 18	4/21/2011	14, pp. 24, 49 (Table 1); 27, p. 11
SS-05A	Surface Soil	6 to 20	4/20/2011	14, pp. 20, 49 (Table 1); 27, p. 12
SS-06A	Surface Soil	0 to 24	4/19/2011	14, pp. 16, 50 (Table 1); 27, p. 16
SS-07A	Surface Soil	6 to 20	4/19/2011	14, pp. 17, 50 (Table 1); 27, p. 20
SS-08A	Surface Soil	0 to 12	4/20/2011	14, pp. 19-20, 50 (Table 1); 27, p. 24
SS-09A	Surface Soil	0 to 12	4/21/2011	14, pp. 23, 51 (Table 1); 27, p. 28
SS-10A	Surface Soil	7 to 24	4/21/2011	14, pp. 24, 51 (Table 1); 27, p. 31
SS-11A	Surface Soil	0 to 12	4/21/2011	14, pp. 25, 51 (Table 1); 27, p. 34
SS-12A	Surface Soil	0 to 24	4/22/2011	14, pp. 28, 55 (Table 1); 27, p. 37
SS-18A	Surface Soil	0 to 12	4/19/2011	14, pp. 15, 52 (Table 1); 27, p. 53
SS-20A	Surface Soil	0 to 12	4/20/2011	14, pp. 20, 53 (Table 1); 27, p. 57
SS-20C	Surface Soil	12 to 18	4/20/2011	14, pp. 20, 53 (Table 1); 27, p. 58
SS-21A	Surface Soil	0 to 12	4/20/2011	14, pp. 19, 53 (Table 1); 27, p. 59
SS-22A	Surface Soil	0 to 12	4/21/2011	14, pp. 24, 54 (Table 1); 27, p. 61
SS-23A	Surface Soil	0 to 24	4/21/2011	14, pp. 23, 58 (Table 1); 27, p. 63
SS-24A	Surface Soil	12 to 18	4/21/2011	14, pp. 23, 58 (Table 1); 27, p. 65
SS-24C	Surface Soil	18 to 24	4/21/2011	14, pp. 23, 58 (Table 1); 27, p. 66
SS-25A	Surface Soil	0 to 24	4/20/2011	14, pp. 19, 58 (Table 1); 27, p. 67
SS-26A	Surface Soil	0 to 24	4/19/2011	14, pp. 16, 59 (Table 1); 27, p. 69
SS-33A	Surface Soil	0 to 12	4/21/2011	14, pp. 23, 54 (Table 1); 27, p. 28
SS-35A	Surface Soil	0 to 24	4/21/2011	14, pp. 23, 59 (Table 1); 27, p. 63
SO-62	Surface Soil	0 to 12	12/5/2011	13, pp. 39-40, 69; 26, p. 34
SO-63	Surface Soil	0 to 12	12/5/2011	13, pp. 40, 69; 26, p. 35

Table 65– Surface Soil Sample Description		
Sample ID	**Sample Description**	**Reference**
SS-02A	Brown, fine-to-coarse sand, some fine-to-coarse gravel (rocks), debris (metal slag, leather, and brick), trace silt, and trace roots.	27, p. 4
SS-03A	Black, fine-to-medium gravel and fine-to-coarse sand, trace silt, trace clay, and trace debris (concrete).	27, p. 7-8
SS-04A	Brown, fine-to-medium sand and silt, trace fine-to-coarse gravel, and trace organics.	27, p. 10
SS-04C	Brown, fine sand, some silt, little fine-to-coarse gravel (up to 5-inch cobble), trace debris (brick, plastic, glass, ceramic, and slag), and trace organics.	27, p. 11
SS-05A	Light brown-to-brown, fine-to-coarse gravel (up to 10-inch cobble), little fine-to-coarse sand, trace silt.	27, p. 12
SS-06A	Combination of three distinct intervals: Interval 1 = dark brown-to-black, fine-to-coarse sand and silt, some fine-to-medium gravel, trace clay, trace debris (brick), trace organics (roots); Interval 2 = fine-to-medium gravel; and Interval 3 = medium-to-dark brown, fine-to-coarse sand and silt, some debris (brick, cement), trace fine gravel.	27, p. 16-17
SS-07A	Brown, fine-to-medium sand and silt, little debris (brick, concrete, and glass).	27, p. 20-21
SS-08A	Light brown, fine-to-medium sand, little silt, little fine-to-coarse gravel, trace roots.	27, p. 24
SS-09A/ SS-33A	Light brown-to-brown, fine-to-coarse sand, little fine-to-coarse gravel, trace silt, and trace organics.	27, p. 28
SS-10A	Combination of two distinct intervals: Interval 1 = dark brown-to-greyish black, fine-to-coarse sand, some silt, trace debris (brick); Interval 2 = black silt, some fine-to-coarse sand, little debris (burned materials, apparent roofing and tar material), trace gravel, and contained a petroleum-like/creosote-like odor throughout the interval.	27, p. 31-32
SS-11A	Combination of two distinct intervals: Interval 1 = dark brown silt, trace fine-to-coarse sand, trace debris (glass), trace organics (rootlets); Interval 2 = dark brown, fine-to-coarse sand and silt, some fine-to-medium gravel, little debris (brick, ash material, clinkers), trace clay, and was moist.	27, p. 34
SS-12A	Dark brown silt and debris (glass, brick, wood, metal, and ash), trace fine-to-coarse sand, and trace rootlets.	27, p. 37
SS-18A	Combination of two distinct intervals: Interval 1=dark brown, sand and silt, little organics; Interval 2= light brown sand (fill), and was moist.	27, p. 53
SS-20A	Dark brown, fine-to-coarse sand and gravel (up to 5-inch cobble), and trace organics (roots and mulch).	27, p. 57
SS-20C	Dark brown, fine-to-coarse sand and gravel (up to 3-inch cobble), and trace organics.	27, p. 58
SS-21A	Brown, fine-to-medium sand, some silt, trace gravel (up to 1-inch, brick debris), and trace organics.	27, p. 59
SS-22A	Light brown, clay, some silt, trace fine sand, trace fine-to-coarse gravel, and organics (roots).	27, p. 61
SS-23A/ SS-35A	Dark brown, fine-to-medium sand and silt, some clay, trace fine-to-coarse gravel, trace debris and plastic, and trace organics.	27, p. 63

Table 65– Surface Soil Sample Description (Concluded)		
Sample ID	**Sample Description**	**Reference**
SS-24A	Dark brown, fine sand and silt, some debris (leather and plastic), trace fine-to-coarse gravel, trace clay, and trace organics.	27, p. 65
SS-24C	Dark brown, fine sand and silt, trace gravel, trace clay, trace debris (plastic), and trace organics.	27, p. 66
SS-25A	Dark brown, fine-to-coarse sand, little gravel (up to 1-inch cobble, plastic, leather debris, possible coal slag), trace organics.	27, p. 67
SS-26A	Dark brown-to-black, fine-to-coarse sand, little gravel (up to 1-inch cobble, leather, glass, metal), trace organics.	27, p. 69
SO-62	Dark brown, organic-rich silt, little fine-to-coarse sand, trace fine gravel.	26, p. 34
SO-63	Dark brown, silt and fine-to-coarse sand, little organics, trace fine-to-medium gravel, trace clay.	26, p. 35

Twenty-one surface soil samples (SS-02A, SS-03A, SS-04A, SS-05A, SS-06A, SS-07A, SS-08A, SS-09A, SS-10A, SS-11A, SS-12A, SS-18A, SS-20A, SS-21A, SS-22A, SS-23A, SS-24A, SS-25A, SS-26A, SS-33A, and SS-35A) collected from Area A were submitted to CLP laboratories for dioxin/furan analyses following DLM02.2, and for total metals analysis following ISM01.2 [12, pp. 4-17; 14, pp. 12-30; 28, pp. 13, 15, 17, 19; 29, pp. 9, 15, 16, 24, 26, 27; 53, p. 1; 54, p. 1; 55, p. 1; 56, p. 1; 60, p. 1; 62, p.1, 64, p. 1]. Two surface soil samples (SO-62 and SO-63) were submitted to CLP laboratories for dioxin/furan analyses following DLM02.2, and total metals analysis following ISM01.3 [11, p. 27; 13, p. 57; 28, p. 11; 29, p. 7; 50, p. 2; 57, p. 1]. Three surface soil samples (SS-04C, SS-20C, and SS-24C) were submitted to a CLP laboratory for only total metals analysis following ISM01.2 [12, pp. 10, 12, 13; 14, pp. 20, 23-24; 29, pp. 20, 23; 61, p.1; 63, p. 1]. The dioxin/furan analytical results were manually validated at a stage 4 level in accordance with the criteria specified in the USEPA SOW DLM02.2 and EPA Region I's ESAT Dioxin/Furan Data Validation SOP ESAT-01-0007 [50, p. 1; 53, p. 1; 54, p. 1; 55, p. 1; 56, p. 1]. The total metals analytical data were evaluated on a Tier II level in accordance with the Region I Tiered Organic and Inorganic Data Validation Guidelines dated November 2008 [57, p. 1; 60, p. 1; 61, p. 1; 62, p. 1; 63, p. 1; 64, p. 1].

Table 66 - Hazardous Substances Associated with Area A							
Sample ID	**Sample Type**	**Date**	**Hazardous Substance [1]**	**Bias***	**Hazardous Substance Concentration**	**Sample-Adjusted CRQL**	**Reference**
SS-02A	Soil	4/18/11	1,2,3,6,7,8-HxCDD	None	7.61 ng/Kg	4.91 ng/Kg	12, p. 5; 14, p. 14; 53, p. 4; 74, p. 1-2, 12, 112
			1,2,3,4,6,7,8-HpCDD	None	223 ng/Kg	4.91 ng/Kg	
			2,3,7,8-TCDF	None	3.14 ng/Kg	0.982 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	41.1 ng/Kg	4.91 ng/Kg	
			Barium	None	73.4 mg/Kg	20.7 mg/Kg	12, p. 5; 14, p. 14; 60, p. 11; 81, pp. 1-2, 11, 84
			Chromium	None	94.6 mg/Kg	1.0 mg/Kg	
			Mercury	None	0.23 mg/Kg	0.10 mg/Kg	

Table 66 - Hazardous Substances Associated with Area A (Continued)

Sample ID	Sample Type	Date	Hazardous Substance [1]	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SS-03A	Soil	4/19/11	1,2,3,7,8,9-HxCDD	None	5.37 ng/Kg	4.10 ng/Kg	12, pp. 6-8; 14, pp. 15; 53, p. 4; 74, pp. 1-2, 13, 113
			1,2,3,4,6,7,8-HpCDD	None	687 ng/Kg	4.10 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	77.1 ng/Kg	4.10 ng/Kg	
			Barium	None	86.1 mg/Kg	20.4 mg/Kg	12, pp. 6-8; 14, pp. 15-16; 60, p. 11; 81, pp. 1-2, 12, 85
			Chromium	None	491 mg/Kg	1.0 mg/Kg	
			Mercury	None	0.29 mg/Kg	0.10 mg/Kg	
SS-04A	Soil	4/21/11	1,2,3,6,7,8-HxCDD	None	21.6 ng/Kg	4.82 ng/Kg	12, p. 13; 14, p. 24; 56, p. 4; 77, pp. 1-2, 9, 104
			1,2,3,7,8,9-HxCDD	None	5.09 ng/Kg	4.82 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	694 ng/Kg	4.82 ng/Kg	
			2,3,7,8-TCDF	None	5.75 ng/Kg	0.964 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	101 ng/Kg	4.82 ng/Kg	
			Chromium	High	861 J (667) mg/Kg	1.9 mg/Kg	12, p. 13; 14, p. 24; 62, p. 13; 83, pp. 1-2, 17, 91
			Mercury	None	0.31 mg/Kg	0.11 mg/Kg	
SS-04C	Soil	4/21/11	Chromium	Unknown	871 J (675) mg/Kg	2.6 mg/Kg	12, pp. 13-14; 14, p. 24; 61, p. 8; 82, pp. 1-2, 11, 66
SS-05A	Soil	4/20/11	1,2,3,4,6,7,8-HpCDD	None	141 ng/Kg	4.83 ng/Kg	12, p. 10; 14, p. 20; 54, p. 4; 75, pp. 1-2, 11, 106
			1,2,3,4,6,7,8-HpCDF	None	19.9 ng/Kg	4.83 ng/Kg	
			Chromium	None	196 mg/Kg	0.8 mg/Kg	12, p. 10; 14, p. 20; 60, p. 11; 81, pp. 1-2, 12, 86
			Mercury	None	0.23 mg/Kg	0.10 mg/Kg	
SS-06A	Soil	4/19/11	1,2,3,4,6,7,8-HpCDD	None	1,160 ng/Kg	43.0 ng/Kg	12, pp. 7-8; 14, p. 16; 53, p. 5; 74, pp. 1-2, 14, 114
			1,2,3,4,6,7,8-HpCDF	None	134 ng/Kg	43.0 ng/Kg	
			Barium	None	67.8 mg/Kg	15.0 mg/Kg	12, pp. 7-8; 14, p. 16; 60, p. 11; 81, pp. 1-2, 13, 87
			Chromium	None	337 mg/Kg	0.7 mg/Kg	
			Mercury	None	7.2 mg/Kg	1.08 mg/Kg	
SS-24C	Soil	4/21/11	Chromium	None	152 mg/Kg	1.1 mg/Kg	12, pp. 12, 14; 14, p. 23-24; 63, p. 8; 84, pp. 1-2, 9, 60

Table 66 - Hazardous Substances Associated with Area A (Continued)

Sample ID	Sample Type	Date	Hazardous Substance [1]	Bias	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SS-07A	Soil	4/19/11	1,2,3,4,6,7,8-HpCDD	None	885 ng/Kg	36.3 ng/Kg	12, pp. 7-8; 14, p. 17; 54, p. 4; 75, p. 1-2, 12, 107
			1,2,3,4,6,7,8-HpCDF	None	96.2 ng/Kg	36.3 ng/Kg	
			Arsenic	None	50 mg/Kg	0.8 mg/Kg	12, pp. 7-8; 14, p. 17; 60, p. 11; 81, pp. 1-2, 13, 88
			Chromium	None	623 mg/Kg	2.3 mg/Kg	
			Mercury	None	0.7 mg/Kg	0.11 mg/Kg	
SS-08A	Soil	4/20/11	1,2,3,6,7,8-HxCDD	None	7.78 ng/Kg	4.82 ng/Kg	12, pp. 9-10; 14, pp. 19-20; 54, p. 4; 75, pp. 1-2, 13, 108
			1,2,3,4,6,7,8-HpCDD	None	231 ng/Kg	4.82 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	42.7 ng/Kg	4.82 ng/Kg	
			Chromium	High	93.1 J (72.2) mg/Kg	0.8 mg/Kg	12, pp. 9-10; 14, pp. 19-20; 62, p. 12; 83, pp. 1-2, 11, 92
			Mercury	None	0.15 mg/Kg	0.11 mg/Kg	
SS-09A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDD	None	90.4 ng/Kg	4.83 ng/Kg	12, pp. 12-13; 14, p. 23; 55, p. 4; 76, pp. 1-2, 9, 95
			2,3,7,8-TCDF	None	1.62 ng/Kg	0.967 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	14.2 ng/Kg	4.83 ng/Kg	
			Mercury	Unknown	0.7 J (0.38) mg/Kg	0.10 mg/Kg	12, pp. 12-13; 14, p. 23; 64, p. 11; 85, pp. 1-2, 9, 76
SS-10A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDD	None	313 ng/Kg	49.1 ng/Kg	12, p. 13; 14, p. 24; 56, p. 4; 77, pp. 1-2, 10, 105
			1,2,3,4,6,7,8-HpCDF	None	55.1 ng/Kg	49.1 ng/Kg	
			Barium	None	68.5 mg/Kg	19.2 mg/Kg	12, p. 13; 14, p. 24; 62, p. 13; 83, pp. 1-2, 17, 93
			Chromium	High	79.9 J (61.9) mg/Kg	1.0 mg/Kg	
			Mercury	None	0.39 mg/Kg	0.11 mg/Kg	
SS-11A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDF	None	8.02 ng/Kg	4.83 ng/Kg	12, pp. 13-14; 14, p. 25; 56, p. 4; 77, pp. 1-2, 11, 106
			Chromium	High	175 J (136) mg/Kg	0.8 mg/Kg	12, pp. 13-14; 14, p. 25; 62, p. 14; 83, pp. 1-2, 18, 94
			Mercury	None	0.21 mg/Kg	0.11 mg/Kg	

Table 66 - Hazardous Substances Associated with Area A (Continued)

Sample ID	Sample Type	Date	Hazardous Substance [1]	Bias	Hazardous Substance Concentration		Sample-Adjusted CRQL		Reference
SS-12A	Soil	4/22/11	1,2,3,6,7,8-HxCDD	None	52.5	ng/Kg	4.84	ng/Kg	12, pp. 15-16; 14, p. 28; 55, p. 4; 76, pp. 1-2, 10, 96
			1,2,3,7,8,9-HxCDD	None	25.4	ng/Kg	4.84	ng/Kg	
			1,2,3,4,6,7,8-HpCDD	High	1,000 EB (100)	ng/Kg	4.84	ng/Kg	
			2,3,7,8-TCDF	None	8.82	ng/Kg	0.969	ng/Kg	
			2,3,4,6,7,8-HxCDF	None	31.4	ng/Kg	4.84	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	1,050	ng/Kg	4.84	ng/Kg	
			Barium	None	859	mg/Kg	20.2	mg/Kg	12, pp. 15-16; 14, p. 28; 64, p. 11; 85, pp. 1-2, 9, 77
			Chromium	None	91.1	mg/Kg	1.0	mg/Kg	
			Mercury	Unknown	0.63 J (0.34)	mg/Kg	0.13	mg/Kg	
SS-18A	Soil	4/19/11	1,2,3,4,6,7,8-HpCDD	None	105	ng/Kg	52.0	ng/Kg	12, pp. 6, 8; 14, p. 15; 53, p. 6; 74, pp. 1-2, 19, 119
			Chromium	None	72.5	mg/Kg	0.9	mg/Kg	12, pp. 6, 8; 14, p. 15; 60, p. 12; 81, pp. 1-2, 16, 93
			Mercury	None	0.24	mg/Kg	0.11	mg/Kg	
SS-20A	Soil	4/20/11	1,2,3,6,7,8-HxCDD	None	16.1	ng/Kg	4.80	ng/Kg	12, pp. 10-11; 14, p. 20; 56, p. 5; 77, pp. 1-2, 12, 107
			1,2,3,4,6,7,8-HpCDD	None	523	ng/Kg	4.80	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	71.1	ng/Kg	4.80	ng/Kg	
			Barium	None	164	mg/Kg	17.2	mg/Kg	12, pp. 10-11; 14, p. 20; 62, p. 14; 83, pp. 1-2, 18, 95
			Chromium	High	169 J (131)	mg/Kg	0.9	mg/Kg	
			Mercury	None	0.32	mg/Kg	0.10	mg/Kg	
SS-20C	Soil	4/20/11	Chromium	Unknown	216 J (167)	mg/Kg	0.9	mg/Kg	12, pp. 10-11; 14, p. 20; 61, p. 10; 82, pp. 1-2, 12, 79

Table 66 - Hazardous Substances Associated with Area A (Continued)

Sample ID	Sample Type	Date	Hazardous Substance [1]	Bias	Hazardous Substance Concentration		Sample-Adjusted CRQL		Reference
SS-21A	Soil	4/20/11	1,2,3,4,6,7,8-HpCDD	None	1,010	ng/Kg	54.4	ng/Kg	12, pp. 9-10; 14, p. 19; 54, p. 5; 75, pp. 1-2, 14, 109
			1,2,3,4,6,7,8-HpCDF	None	132	ng/Kg	54.4	ng/Kg	
			Barium	None	73.6	mg/Kg	20.9	mg/Kg	12, pp. 9-10; 14, p. 19; 60, p. 12; 81, pp. 1-2, 17, 95
			Chromium	None	117	mg/Kg	1.0	mg/Kg	
			Mercury	None	0.47	mg/Kg	0.10	mg/Kg	
SS-22A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDD	None	105	ng/Kg	4.72	ng/Kg	12, pp. 12-13; 14, p. 24; 56, p. 5; 77, pp. 1-2, 13, 108
			1,2,3,4,6,7,8-HpCDF	None	6.62	ng/Kg	4.72	ng/Kg	
			Barium	None	74.6	mg/Kg	17.9	mg/Kg	12, pp. 12-13; 14, p. 24; 64, p. 11; 85, pp. 1-2, 10, 79
			Chromium	None	53.5	mg/Kg	0.9	mg/Kg	
SS-23A	Soil	4/21/11	1,2,3,6,7,8-HxCDD	None	13.2	ng/Kg	4.82	ng/Kg	12, pp. 12-13; 14, p. 23; 56, p. 5; 77, pp. 1-2, 14, 109
			1,2,3,4,6,7,8-HpCDD	None	258	ng/Kg	4.82	ng/Kg	
			2,3,7,8-TCDF	None	2.7	ng/Kg	0.965	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	57.8	ng/Kg	4.82	ng/Kg	
			Mercury	None	0.80	mg/Kg	0.11	mg/Kg	12, pp. 12-13; 14, p. 23; 62, p. 14; 83, pp. 1-2, 19, 96
SS-24A	Soil	4/21/11	1,2,3,6,7,8-HxCDD	None	768	ng/Kg	75.6	ng/Kg	12, pp. 12-13; 14, p. 23; 56, p. 6; 77, pp. 1-2, 15, 110
			1,2,3,7,8,9-HxCDD	None	205	ng/Kg	75.6	ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	17,000	ng/Kg	75.6	ng/Kg	
			2,3,4,6,7,8-HxCDF	None	116	ng/Kg	75.6	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	2,440	ng/Kg	75.6	ng/Kg	
			Barium	None	165	mg/Kg	32.5	mg/Kg	12, pp. 12-13; 14, p. 23; 62, p. 14; 83, pp. 1-2, 19, 97
			Chromium	High	4430 J (3,430)	mg/Kg	16.2	mg/Kg	
			Mercury	None	1.4	mg/Kg	0.16	mg/Kg	
SS-24C	Soil	4/21/11	Chromium	None	152	mg/Kg	1.1	mg/Kg	12, pp. 12, 14; 14, p. 23-24; 63, p. 8; 84, pp. 1-2, 9, 60

Table 66 - Hazardous Substances Associated with Area A (Continued)

Sample ID	Sample Type	Date	Hazardous Substance [1]	Bias*	Hazardous Substance Concentration		Sample-Adjusted CRQL		Reference
SS-25A	Soil	4/20/11	1,2,3,6,7,8-HxCDD	None	159	ng/Kg	65.3	ng/Kg	12, pp. 9-10; 14, p. 19; 54, p. 5; 75, pp. 1-2, 15, 110
			1,2,3,7,8,9-HxCDD	None	135	ng/Kg	65.3	ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	4,600	ng/Kg	65.3	ng/Kg	
			2,3,4,6,7,8-HxCDF	None	94.5	ng/Kg	65.3	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	970	ng/Kg	65.3	ng/Kg	
			Arsenic	None	45.2	mg/Kg	1.1	mg/Kg	12, pp. 9-10; 14, p. 19; 60, p. 12; 81, pp. 1-2, 17, 96
			Barium	None	71.2	mg/Kg	21.6	mg/Kg	
			Chromium	None	1,030	mg/Kg	3.2	mg/Kg	
			Mercury	None	0.85	mg/Kg	0.14	mg/Kg	
SS-26A	Soil	4/19/11	1,2,3,6,7,8-HxCDD	None	382	ng/Kg	61.8	ng/Kg	12, pp. 7-8; 14, p. 16; 54, p. 5; 75, pp. 1-2, 16, 111
			1,2,3,7,8,9-HxCDD	None	140	ng/Kg	61.8	ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	12,100	ng/Kg	61.8	ng/Kg	
			2,3,4,6,7,8-HxCDF	None	84.8	ng/Kg	61.8	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	1,840	ng/Kg	61.8	ng/Kg	
			Barium	None	173	mg/Kg	20.2	mg/Kg	12, pp. 7-8; 14, p. 16; 62, p. 12; 83, pp. 1-2, 11, 98
			Chromium	High	2,770 J (2,150)	mg/Kg	10.1	mg/Kg	
			Mercury	None	0.97	mg/Kg	0.13	mg/Kg	
SS-33A	Soil	4/21/11	1,2,3,4,6,7,8-HpCDD	None	145	ng/Kg	4.75	ng/Kg	12, pp. 12-13; 14, p. 23; 55, p. 6; 76, pp. 1-2, 14, 101
			1,2,3,4,6,7,8-HpCDF	None	17.8	ng/Kg	4.75	ng/Kg	
			Chromium	None	59.3	mg/Kg	0.9	mg/Kg	12, pp. 12-13; 14, p. 23; 64, p. 12; 85, pp. 1-2, 12, 84
SS-35A	Soil	4/21/11	1,2,3,6,7,8-HxCDD	None	7.92	ng/Kg	4.89	ng/Kg	12, pp. 12-13; 14, p. 23; 56, p. 6; 77, pp. 1-2, 17, 112
			1,2,3,4,6,7,8-HpCDD	None	157	ng/Kg	4.89	ng/Kg	
			2,3,7,8-TCDF	None	1.92	ng/Kg	0.979	ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	35	ng/Kg	4.89	ng/Kg	
			Mercury	None	0.69	mg/Kg	0.12	mg/Kg	12, pp. 12-13; 14, p. 23; 62, p. 14; 83, pp. 1-2, 20, 100

Table 66 - Hazardous Substances Associated with Area A (Concluded)

Sample ID	Sample Type	Date	Hazardous Substance [1]	Bias*	Hazardous Substance Concentration	Sample-Adjusted CRQL	Reference
SO-62	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	776 ng/Kg	75.3 ng/Kg	11, pp. 23, 25; 13, p. 39-40, 69; 50, p. 7; 71, pp. 1-2, 22, 120
			1,2,3,7,8,9-HxCDD	None	391 ng/Kg	75.3 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	21,900 ng/Kg	75.3 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	126 ng/Kg	75.3 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	2,840 ng/Kg	75.3 ng/Kg	
			Barium	None	114 mg/Kg	36.9 mg/Kg	11, pp. 23, 25; 13, p. 39-40, 69; 57, p. 14; 78, pp. 1-2, 19, 97
			Chromium	None	10,700 mg/Kg	18.5 mg/Kg	
			Mercury	None	1.3 mg/Kg	0.18 mg/Kg	
SO-63	Soil	12/5/11	1,2,3,6,7,8-HxCDD	None	167 ng/Kg	4.87 ng/Kg	11, pp. 23-24; 13, p. 40, 69; 50, p. 7; 71, pp. 1-2, 23, 121-122
			1,2,3,7,8,9-HxCDD	None	34.8 ng/Kg	4.87 ng/Kg	
			1,2,3,4,6,7,8-HpCDD	None	3,260 ng/Kg	24.3 ng/Kg	
			2,3,7,8-TCDF	None	3.59 ng/Kg	0.973 ng/Kg	
			2,3,4,6,7,8-HxCDF	None	53.8 ng/Kg	4.87 ng/Kg	
			1,2,3,4,6,7,8-HpCDF	None	829 ng/Kg	4.87 ng/Kg	
			Chromium	None	768 mg/Kg	1.2 mg/Kg	11, pp. 23-24; 13, p. 40, 69; 57, p. 14; 78, pp. 1-2, 19, 98
			Mercury	None	0.67 mg/Kg	0.12 mg/Kg	

CRQL = Contract Required Quantitation Limit.
ng/Kg = Nanograms per kilogram. mg/Kg = Milligrams per kilogram.
HxCDD= Hexachlorodibenzodioxin.
HpCDD= Heptachlorodibenzodioxin. HxCDF= Hexachlorodibenzofuran.
HpCDF= Heptachlorodibenzofuran. TCDF = Tetrachlorodibenzofuran.

J = The associated numerical value is an estimated quantity [61, pp. 6, 8-11; 62, pp. 10, 12-15; 64, p. 11; 142, p. B-21].
EB = The associated compound or element was detected in rinsate blank samples collected for quality control [55, p. 4]. The potential contribution for carryover from non-dedicated sampling equipment has been evaluated. In most cases, the concentration of the analyte or compound observed in a sample is significantly greater than the concentration observed in the associated equipment blank. Therefore, the sample data can be used with a high degree of certainty to confirm the presence of the substance in the samples to confirm the presence of the substance in the samples [44].
* = An explanation for the direction of bias is provided in Reference 71, Table 3; Reference 74, Table 3; Reference 75, Table 3; Reference 76, Table 3; Reference 77, Table 3; Reference 78; Reference 81, Table 3; Reference 82, Table 3; Reference 83, Table 3; Reference 84, Table 3; and Reference 85, Table 3.
( ) = For hazardous substance concentrations, denotes concentration of the compound or element after adjustment. Analytical adjustments are based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination* [140, pp. 4-8].

Among the 26 selected surface soil samples: 1,2,3,6,7,8-HxCDD was detected at a maximum concentration of 776 ng/Kg in surface soil sample SO-62; 1,2,3,7,8,9-HxCDD was detected at a maximum concentration of 391 ng/Kg in surface soil sample SO-62; 1,2,3,4,6,7,8-HpCDD was detected at a maximum concentration of 21,900 ng/Kg in surface soil sample SO-62; 2,3,7,8-TCDF was detected at a maximum concentration of 8.82 ng/Kg in surface soil sample SS-12A; 2,3,4,6,7,8-HxCDF was detected at a maximum concentration of 126 ng/Kg in surface soil sample SO-62; 1,2,3,4,6,7,8-HpCDF was detected at a maximum concentration of 2,840 ng/Kg in surface soil sample SO-62; arsenic was detected at a maximum concentration of 50 mg/Kg in surface soil sample SS-07A; barium was detected at a maximum concentration of 859 mg/Kg in surface soil sample SS-12A; chromium was detected at a maximum concentration of 10,700 mg/Kg in surface soil sample SO-62; and mercury was detected at a maximum concentration of 7.2 mg/Kg in surface soil sample SS-06A [13, pp. 39-40, 69; 14, pp. 16-17, 28; 50, p. 7; 55, p. 4; 57, p. 14; 60, p. 11; 64, p. 11; 71, pp. 23, 121-122; 76, pp. 10, 96; 78, pp. 19, 98; 81, pp. 12, 87-88; 85, pp. 9, 77]. For the purpose of this evaluation, shallow soil sample concentrations which are significantly above background for the respective hazardous substances have been used to associate hazardous substances with Area A [1, pp. 51588 (Section 2.2.2), 51589 (Table 2-3)].

Attribution

Based on the operational history of the leather tannery and common contaminants detected at leather tanneries, the following hazardous substances are considered hazardous substances associated with the contaminated soil area: dioxin/furans (1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF) and chromium (see Contaminated Samples section above) [32, p. 7; 113, p. 5; 164, p. 1; 165, p. 3]. Chromium is the most common heavy metal waste from the tanning process, which employs chromium salts in the tanning process [34, pp. 7-12; 164 p. 7; 166, pp. 2-4]. Dioxin was not used in the tanning process, but it is a common impurity in chlorinated phenols, commonly used in the tanning process as a fungicide [164, pp. 1, 7]. Other heavy metals, including arsenic, mercury and barium, are also used in the tanning industry and detected in the wastestream on other leather tanning sites [167, p. 42; 168, p. 1; 169, p. 4-5].

For the purpose of this evaluation, 26 shallow soil samples collected from Area A in April 2011 and December 2011 were selected to document observed contamination in Area A. Among the 26 selected soil samples, the presence of the following hazardous substances as been documented (maximum concentration in parentheses): 1,2,3,6,7,8-HxCDD (776 ng/Kg), 1,2,3,7,8,9-HxCDD (391 ng/Kg), 1,2,3,4,6,7,8-HpCDD (21,900 ng/Kg), 2,3,7,8-TCDF (8.82 ng/Kg), 2,3,4,6,7,8-HxCDF (126 ng/Kg), 1,2,3,4,6,7,8-HpCDF (2,840 ng/Kg), arsenic (50 mg/Kg), barium (859 mg/Kg), chromium (10,700 mg/Kg), and mercury (7.2 mg/Kg) (see Contaminated Samples section above). The concentrations of each of these substances were detected at greater than or equal to three times the highest respective background soil sample in the aforementioned shallow soil samples collected from Area A (see Contaminated Samples section above). Chromium was detected in 24 of the 26 aforementioned shallow soil samples collected from Area A, with a maximum concentration of 10,700 mg/Kg in shallow surface soil/source sample SO-62 (see Contaminated Samples section above). The analytical results for these samples are used to attribute hazardous substances to this area (see Contaminated Samples section above) [1, pp. 51588 (Section 2.2.2), 51589 (Table 2-3)].

Table 67 – Hazardous Substances Associated with Surface Soil/Source Samples

Hazardous Substance	Evidence	References
1,2,3,6,7,8-HxCDD	Analytical results	see Contaminated Samples section

Table 67 – Hazardous Substances Associated with Surface Soil/Source Samples (Concluded)		
Hazardous Substance	**Evidence**	**References**
1,2,3,7,8,9-HxCDD	Analytical results	see Contaminated Samples section
1,2,3,4,6,7,8-HpCDD	Analytical results	see Contaminated Samples section
2,3,7,8-TCDF	Analytical results	see Contaminated Samples section
2,3,4,6,7,8-HxCDF	Analytical results	see Contaminated Samples section
1,2,3,4,6,7,8-HpCDF	Analytical results	see Contaminated Samples section
Arsenic	Analytical results	see Contaminated Samples section
Barium	Analytical results	see Contaminated Samples section
Chromium	Analytical results	see Contaminated Samples section
Mercury	Analytical results	see Contaminated Samples section

HxCDD= Hexachlorodibenzodioxin. HpCDD= Heptachlorodibenzodioxin.
TCDF = Tetrachlorodibenzofuran. HxCDF= Hexachlorodibenzofuran.
HpCDF= Heptachlorodibenzofuran.

Area Hazardous Waste Quantity

The Hazardous Waste Quantity of Area A was calculated based on the Area Factor Value of contaminated soil. The Hazardous Constituent Quantity and Hazardous Wastestream Quantity values were not evaluated for Area A because insufficient information was available [1, p. 51647, Table 5-2]. An area of "contaminated soil" cannot be evaluated for Hazardous Waste Quantity for the Soil Exposure Pathway based on its volume [1, p. 51647 (Table 5-2)].

Hazardous Constituent Quantity:

Description

The hazardous constituent quantity for Area A could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source is not known and cannot be estimated with reasonable confidence [1, pp. 51590-51591 (Section 2.4.2.1.1)]. There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Area A with reasonable confidence.

Table 68 - Hazardous Constituent Quantity for Area A		
Hazardous Substance	**Constituent Quantity (pounds)**	**References**
NS (insufficient information)		

NS = Not Scored.

Sum (pounds):

Hazardous Constituent Quantity Assigned Value: Not Scored

Hazardous Constituent Quantity Complete? No

Hazardous Wastestream Quantity:

Description

The hazardous wastestream quantity for Area A could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence [1, p. 51591 (Section 2.4.2.1.2)]. There are insufficient historical and current data (Manifests, PRP records, State records, Permits, Waste concentration data, Annual reports, etc.) available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate the hazardous wastestream quantity for Area A with reasonable confidence.

Table 69 - Hazardous Wastestream Quantity for Area A		
Hazardous Substance	**Constituent Quantity (pounds)**	**References**
NS (insufficient information)		

NS = Not Scored.

Sum (pounds):
Wastestream Quantity/5,000 [1, p. Table 5-2):

Hazardous Wastestream Quantity Assigned Value: Not Scored

Volume:

Description

Since a volume measurement of Area A is not applicable for the Soil Exposure Pathway, a value of 0 is assigned [1, pp. 51591 (Section 2.4.2.1.3), 51647 (Section 5.1.2.2, Table 5-2)].

Table 70 - Volume of Area A			
Source Type	**Description (# drums or dimensions)**	**Units (yd^3/gal)**	**References**
NS (insufficient information)			

NS = Not Scored.

Sum (yd^3/gal):
Equation for Assigning Value (Ref. 1, Table 5-2):

Volume Assigned Value: 0

Area:

Description

The area of Area A was determined by considering the sampling locations which document observed contamination of 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, arsenic, barium, chromium, and mercury, and the area lying between such locations, with the exception of the portions of Area A which are covered with maintained asphalt paving and building footprints [1, p. 51646 (Section 5.0.1); 21].

Area A is contained on portions of three separate properties, the 33 Water Street parcel, the adjacent MBTA Right-of-way parcel, and the 20 Cheever street parcel defined by 12 shallow surface soil samples (SS-12A, SS-02A, SS-18A, SS-05A, SS-20A, SS-21A, SS-11A, SS-22A, SS-23A, SS-25A, SS-24A, and SS-26A) (see Figure 5) [17]. Based on GPS documentation of the Water Street/MBTA Source observed during the EPA SI and SR, the area of observed contamination (Area A) was determined to be approximately 114,099 ft^2 (see Figure 5) [12, pp. 4-17; 21].

The portion of the 33 Water Street parcel contained within Area A which is covered by permanent, or otherwise maintained, essentially impermeable cover (asphalt pavement and buildings) must be excluded in evaluating the Soil Exposure Pathway [1, p. 51646 (Section 5.0.1)]. The area occupied by buildings and maintained asphalt pavement was determined for the Water Street portion of Area A by measuring the area of the on-site condominium buildings and asphalt using digital orthophotographs and ESRI ArcGIS Desktop 10.0 version 10.0 [21]. The area of the on-site condominium building and asphalt (maintained engineered cover) located within the Water Street portion of Area A was determined to be approximately 37,272 ft^2 [21]. The area of observed contamination (Area A) available for resident population target evaluation was determined to be 76,827 ft^2 [21].

114,099 ft^2 (total area) – 37,272 ft^2 (area of condominium buildings and paved parking area) = 76,827 ft^2

Area A therefore comprises 76,827 ft^2 of contaminated soil where hazardous waste generated from on-site activities has been disposed of or has come to be located and meets the criteria for observed contamination [1, p. 51646 (Section 5.0.1); 21].

Table 71 - Area		
Source Type	**Units (ft^2)**	**References**
Contaminated Soil	76,827	Figure 5; 21

Sum (ft^2): 76,827
Equation for Assigning Value [1, Table 5-2]: Area ÷ 34,000

Area Assigned Value: 2.26

Area Hazardous Waste Quantity Value:

The Hazardous Waste Quantity Value for Area A was assigned based on the Area Factor Value (2.26) [1, pp. 51591 (Section 2.4.2.1.5), 51646 (Section 5.0.1), 51647 (Table 5-2)].

5.1 RESIDENT POPULATION THREAT

There are 52 residents located on the 33 Water Street parcel, which has been documented to contain an area of observed contamination (Area A) with the following hazardous substances attributable to the site and present at concentrations significantly above background concentrations: 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, arsenic, barium, chromium, and mercury (see Contaminated Sample section) [21; 163]. There are four residential condominium buildings (Buildings A through D) located on the Water Street property, all located within 200 feet of shallow surface soil samples collected within Area A (see Figure 5) [163]. Chromium was detected above its respective reference dose value in five surface soil samples (SS-03A, SS-04A, SS-04C, SS-06A, and SS-07A), while arsenic was detected above its respective reference dose and cancer risk screening value in one surface soil/source sample (SS-07A) (see Contaminated Sample section) [4, pp. A-30, A-84]. In addition, hazardous substances attributable to the site and present at concentrations significantly above background were detected at 10 surface soil sample locations encompassing 12 shallow surface soil samples (SS-02A, SS-05A, SS-08A, SS-09A, SS-10A, SS-11A, SS-18A, SS-20A, SS-20C, SS-21A, SS-22A, and SS-33A) which did not exceed either the reference dose and cancer risk screening value[4, pp. A-30, A-34, A-84, A-184, A-186, A-202, A-204, A-212, A-236, A-332].

5.1.1 LIKELIHOOD OF EXPOSURE

During activities conducted as part of the EPA SI and SR, residents of the Water Street parcel were documented to reside within the four residential condominium buildings and to utilize the common area within the area of observed contamination (Area A) [12, pp. 1, 17; 163]. Based on GPS documentation of the location of soil samples collected on the Water Street property during the EPA SI, the distance of each surface soil sample documenting observed contamination to the four condominium buildings was determined [163]. The unobstructed linear distance (travel distance) from each sample location to the Water Street condominium buildings (Condominium Buildings A through D) was determined using digital orthophotographs and ESRI ArcGIS Desktop 10.0 version 10.0 [163]. Each of the 14 surface source samples presented as part of the Soil Exposure Pathway evaluation was within 200 unobstructed feet of at least one of the condominium buildings, and 13 of the 14 samples were within 200 unobstructed feet of multiple condominium buildings [163]. Table 72 is a summary of the surface source samples presented in this evaluation whose unobstructed linear distance (travel distance) to the various condominium buildings is less than 200 feet.

Table 72 - Resident Population Threat Likelihood of Exposure Factor

Sample ID	Distance of Population/Resource from Area of Observed Contamination	References
SS-02A	8.41 feet from Building C, 72.91 feet from Building D	163
SS-03A	164.56 feet from Building B, 29.65 feet from Building C, 187.07 feet from Building D	163
SS-04A/SS-04C	28.0 feet from Building B, 12.16 feet from Building C, 173.61 feet from Building D	163
SS-05A	9.26 feet from Building B, 97.15 feet from Building C	163
SS-06A	145.02 feet from Building A, 83.91 feet from Building B, 92.69 feet from Building C	163
SS-07A	146.54feet from Building A, 27.01 feet from Building B, 42.54 feet from Building C	163
SS-08A	139.10 feet from Building A, 11.85 feet from Building B	163

Table 72 - Resident Population Threat Likelihood of Exposure Factor (Concluded)		
Sample ID	**Distance of Population/Resource from Area of Observed Contamination**	**References**
SS-09A/SS-33A	41.39 feet from Building A, 17.58 feet from Building B, 151.25 feet from Building C	163
SS-10A	25.40 feet from Building A, 126.10 feet from Building B	163
SS-11A	4.57 feet from Building A, 185.19 feet from Building B	163
SS-18A	136.91 feet from Building B, 21.59 feet from Building C, 68.90 feet from Building D	163
SS-20A/SS-20C	88.40 feet from Building A, 68.59 feet from Building B	163
SS-21A	62.95 feet from Building A, 133.01feet from Building B	163
SS-22A	31.08 feet from Building A	163

An area of observed contamination (Area A) is located on and within 200 feet of the residences; therefore a Resident Population Threat Likelihood of Exposure Factor Category Value of 550 is assigned [1, p. 51646 (Section 5.1.1)].

Resident Population Threat Likelihood of Exposure Factor Category Value: 550

5.1.2 WASTE CHARACTERISTICS

Source samples collected from source areas throughout the Creese & Cook Tannery (Former) site have documented the presence of the following hazardous substances: 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, arsenic, barium, chromium, and mercury (see Source Nos. 1 through 4 characterization). In addition, surface source samples collected from Soil Contamination Area A document observed contamination of these same substances (see Contaminated Samples section above).

5.1.2.1 Toxicity

Table 73 - Toxicity Factor		
Hazardous Substance	**Toxicity Factor Value**	**References**
1,2,3,6,7,8-HxCDD	10,000	4, p. A-202
1,2,3,7,8,9-HxCDD	10,000	4, p. A-204
1,2,3,4,6,7,8-HpCDD	10,000	4, p. A-184
2,3,7,8-TCDF	10,000	4, p. A-332
2,3,4,6,7,8-HxCDF	10,000	4, p. A-212
1,2,3,4,6,7,8-HpCDF	10,000	4, p. A-186
Arsenic	10,000	4, p. A-30
Barium	10,000	4, p. A-34
Chromium	10,000	4, p. A-84
Mercury	10,000	4, p. A-236

HxCDD= Hexachlorodibenzodioxin. HpCDD= Heptachlorodibenzodioxin.

TCDF = Tetrachlorodibenzofuran. HxCDF = Hexachlorodibenzofuran.
HpCDF = Heptachlorodibenzofuran.

The hazardous substances with the highest toxicity (1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, arsenic, barium, chromium, or mercury) is used to assign the value to the Toxicity Factor for the Residential Population Threat [1, p. 51646, Section 5.1.2.1].

Toxicity Factor Value: 10,000

5.1.2.2 Hazardous Waste Quantity

The Hazardous Waste Quantity Factor Value was assigned as specified in Sections 2.4.2 and 5.1.2.2, based on the Area Factor Value for Area A.

Table 74 - Hazardous Waste Quantity Factor

Area Letter	Source Type	Area Hazardous Waste Quantity
A	Contaminated Soil	2.26

Sum of Values: 1.79

Based on HRS Section 2.4.2.2, if the Hazardous Constituent Quantity is not adequately determined for one or more areas and if any target for the Soil Exposure Pathway is subject to Level I or Level II concentrations, a factor value is assigned from Table 2-6 or a value of 10, whichever is greater, as the Hazardous Waste Quantity Factor Value for that pathway [1, pp. 51591, 51592, Section 2.4.2.2].

Hazardous Waste Quantity Factor Value (1, p. 51591, Table 2-6): 10

5.1.2.3 Calculation of Waste Characteristics Factor Category Value

The Toxicity Factor Value for 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,7,8-TCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, arsenic, barium, chromium, or mercury (10,000) is multiplied by the Hazardous Waste Quantity Factor Value for the site (10) in order to determine the Waste Characteristics Product, subject to a maximum value of 1×10^8 [1, p. 51592, Section 2.4.3.1]. $10{,}000 \times 10 = 1 \times 10^5$

Toxicity Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 10

Toxicity Factor Value × Hazardous Waste Quantity Factor Value: 1×10^5

From HRS Table 2-7, a Waste Characteristics Product of 1×10^5 is assigned a Waste Characteristics Factor Category Value of 18 [1, p. 51592, Section 2.4.3.1].

Waste Characteristic Factor Category Value [1, Table 2-7]: 18

5.1.3 TARGETS

Level I Concentrations

The five shallow surface soil samples presented, which document Level I concentrations of site associated hazardous substances, are located within the documented area of observed contamination (Area A) and within 200 feet of one or more of the on-site condominium buildings (see Contaminated Samples section above) [163]. The shallow surface soil samples presented which document Level I concentrations and are located within 200 feet of the following on-site building area as follows: SS-03A, SS-04A, and SS-04C are located within 200 feet of Condominium Buildings B through D; and SS-06A and SS-07A are located within 200 feet of Condominium Buildings A through C [163]. Chromium was detected above its respective reference dose value in five shallow surface soil samples (SS-03A, SS-04A, SS-04C, SS-06A, and SS-07A), while arsenic was detected above its respective reference dose and cancer risk screening value in one shallow surface soil sample (SS-07A) [4, pp. A-30, A-84].

Sample ID: SS-03A
Area Letter: A
Reference for Benchmark: 4, pp. A-34, A-84, A-236

Table 75 – Hazardous Substance Benchmark Concentrations in SS-03A

Hazardous Substance	Hazardous Substance Concentration [See Table 93]	Benchmark Concentration	Benchmark
Barium	86.1 mg/Kg	5,500 mg/Kg	Reference Dose
Chromium	491 mg/Kg	230 mg/Kg	Reference Dose
Mercury	0.29 mg/Kg	23 mg/Kg	Reference Dose

mg/Kg = Milligrams per kilogram.

Sample ID: SS-04A
Area Letter: A
Reference for Benchmark: 4, pp. A-84, A-236

Table 76 – Hazardous Substance Benchmark Concentrations in SS-04A

Hazardous Substance	Hazardous Substance Concentration [See Table 93]	Benchmark Concentration	Benchmark
Chromium	861 J (667) mg/Kg	230 mg/Kg	Reference Dose
Mercury	0.31 mg/Kg	23 mg/Kg	Reference Dose

mg/Kg = Milligrams per kilogram.

J = The associated numerical value is an estimated quantity [142; 61, p. 9].

( ) = For hazardous substance concentrations, denotes concentration of the compound or element after adjustment. Analytical adjustments are based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination* [140].

Sample ID: SS-04C
Area Letter: A
Reference for Benchmark: 4, p. A-84

Table 77 – Hazardous Substance Benchmark Concentrations in SS-04C

Hazardous Substance	Hazardous Substance Concentration [See Table 93]	Benchmark Concentration	Benchmark
Chromium	871 J (675) mg/Kg	230 mg/Kg	Reference Dose

mg/Kg = Milligrams per kilogram.

J = The associated numerical value is an estimated quantity [142; 61, p. 9].
( ) = For hazardous substance concentrations, denotes concentration of the compound or element after adjustment. Analytical adjustments are based on the EPA Fact Sheet, *Using Qualified Data to Document an Observed Release and Observed Contamination* [140].

Sample ID: SS-06A
Area Letter: A
Reference for Benchmark: 4, pp. A-34, A-84, A-236

Table 78 – Hazardous Substance Benchmark Concentrations in SS-06A

Hazardous Substance	Hazardous Substance Concentration [See Table 93]	Benchmark Concentration	Benchmark
Barium	67.8 mg/Kg	5,500 mg/Kg	Reference Dose
Chromium	337 mg/Kg	230 mg/Kg	Reference Dose
Mercury	7.2 mg/Kg	23 mg/Kg	Reference Dose

mg/Kg = Milligrams per kilogram.

Sample ID: SS-07A
Area Letter: A
Reference for Benchmark: 4, pp. A-30, A-84, A-236

Table 79 – Hazardous Substance Benchmark Concentrations in SS-07A			
Hazardous Substance	**Hazardous Substance Concentration [See Table 93]**	**Benchmark Concentration**	**Benchmark**
Arsenic	50 mg/Kg	23 mg/Kg	Reference Dose
Chromium	623 mg/Kg	230 mg/Kg	Reference Dose
Mercury	0.7 mg/Kg	23 mg/Kg	Reference Dose

mg/Kg = Milligrams per kilogram.

Sample ID: SS-07A
Area Letter: A
Reference for Benchmark: 4, pp. A-30, A-184, A-186

Table 80 – Hazardous Substance Benchmark Concentrations in SS-07A			
Hazardous Substance	**Hazardous Substance Concentration [See Table 93]**	**Benchmark Concentration**	**Benchmark**
1,2,3,4,6,7,8-HpCDD	885 ng/Kg	4,300 ng/Kg	Cancer Risk
1,2,3,4,6,7,8-HpCDF	96.2 ng/Kg	4,300 ng/Kg	Cancer Risk
Arsenic	50 mg/Kg	0.43 mg/Kg	Cancer Risk

HpCDD= Heptachlorodibenzodioxin. HpCDF= Heptachlorodibenzofuran.
mg/Kg = Milligrams per kilogram. ng/Kg = Nanograms per kilogram.

5.1.3.1 Resident Individual

The concentrations of hazardous substances detected in the five shallow surface soil samples which were collected from within 200 feet of the on-site condominium buildings are used to document Level I Residential Population Targets [1, p. 51647 (Section 5.1.3); 4, pp. A-30, A-34; 163]. At least one resident individual is subject to Level I concentrations; therefore, a Resident Individual Factor Value of 50 is assigned [1, p. 51647 (Section 5.1.3.1)].

Area Letter: A
Level of Contamination (Level I/Level II): Level I
Reference: 4, pp. A-30, A-84; 163

Resident Individual Factor Value: 50

5.1.3.2 Resident Population

The population of the on-site residences (condominium buildings) was determined by conducting an interview with the condominium representative [163].

5.1.3.2.1 Level I Concentrations

There are 52 resident individuals located within 200 feet of the area of observed contamination (Area A) that are subject to Level I concentrations of chromium and arsenic (see Contaminated Samples section above) [4, pp. A-30, A-84; 163].

Level I Resident Population Targets

The population of the on-site residence was determined by conducting an interview the condominium representative [163]. The condominium representative stated the following occupancy rates for each of the four condominium buildings: Building A contains 10 residents; Building B contains 12 residents; Building C contains 12 residents; and Building D contains 18 residents [163]. Based on GPS coordinates of shallow surface soil samples presented to document Level I residential population targets, shallow surface soil samples SS-03A, SS-04A and SS-04C are located within 200 feet of condominium Buildings B, C, and D; and surface soil samples SS-06A and SS-07A are located within 200 feet of condominium Buildings A, B, and C [163]. Therefore, all four residential condominium buildings are within 200 feet of a Level I soil exposure sample [163].

Table 81 – Level I Concentration Factor

Area Letter	Sample ID	Number of Residences	County Multiplier	Total No. of Residents	References
A	SS-03A	3	NA	42	12, pp. 6-8; 163
A	SS-04A	3	NA	42	12, p. 13; 163
A	SS-04C	3	NA	42	12 pp. 13-14; 163
A	SS-06A	3	NA	34	12, pp. 7-8; 163
A	SS-07A	3	NA	34	12, pp. 7-8; 163

NA = Not Applicable.

Sum of individuals subject to Level I concentrations: 52
Sum of individuals subject to Level I concentrations x 10: 520

Level I Concentrations Factor Value: 520

5.1.3.2.2 Level II Concentrations

Level II Samples

Fifteen samples document Level II hazardous substance concentrations. Dioxin/furan congeners are compared against Cancer Risk Screening Concentrations, while the three total metals are compared against Reference Dose and/or Cancer Risk Screening Concentrations (see Tables 74 to 79 above) [4, pp. A-30, A-34, A-84, A-184, A-186, A-202, A-204, A-212, A-236, A-332].

Table 82 - Level II Samples and Hazardous Substance

Sample ID	Hazardous Substance
SS-02A	1,2,3,6,7,8-HxCDD, 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, barium, chromium, and mercury
SS-03A	1,2,3,6,7,8-HxCDD, 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, barium, chromium, and mercury
SS-04A	1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDF
SS-05A	1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, chromium, and mercury
SS-06A	1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, barium, chromium, and mercury
SS-08A	1,2,3,6,7,8-HxCDD, 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, chromium, and mercury
SS-09A	1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, and mercury
SS-10A	1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, barium, chromium, and mercury
SS-11A	1,2,3,4,6,7,8-HpCDF, chromium, and mercury
SS-18A	1,2,3,4,6,7,8-HpCDD, chromium, and mercury
SS-20A	1,2,3,6,7,8-HxCDD, 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, barium, chromium, and mercury
SS-20C	Chromium
SS-21A	1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, barium, chromium, and mercury
SS-22A	1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, barium, and chromium
SS-33A	1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, and chromium

HxCDD= Hexachlorodibenzodioxin.
HpCDD= Heptachlorodibenzodioxin.
TCDF = Tetrachlorodibenzofuran.
HxCDF= Hexachlorodibenzofuran.
HpCDF= Heptachlorodibenzofuran.

Level II Resident Population Targets

Based on information provided by the condominium representative, 52 individuals reside within the buildings located less than 200 feet from the area of observed contamination (Area A) (see Contaminated Samples section above) [163]. The 52 residents have been scored as Level I Target Populations (see above) and are not evaluated further.

Table 83 – Level II Concentration Factor					
Area Letter	**Sample ID**	**Number of Residences**	**County Multiplier**	**Total No. of Residents**	**References**
NS					

NS = Not Scored.

Sum of individuals subject to Level II concentrations: 0

Level II Concentrations Factor Value: 0

5.1.3.3 Workers

No known regular worker population has been identified in the available file information reviewed for the area of observed contamination. However, contracted landscapers are suspected to work on the area of observed contamination. Due to a lack of information pertaining to workers regularly working on the area of observed contamination and the occasional/transient nature of landscaping work, no regular worker population could be documented. Since a regular worker population has not been identified, the Resource Factor Value was not evaluated.

Table 84 – Workers		
Area Letter	**Number of Workers**	**References**
NS		

NS = Not Scored.

Total Workers: 0

Workers Factor Value [1, p. 51647 (Table 5-4)]: 0

5.1.3.4 Resources

No known resources were documented to be impacted in the available file information reviewed for the area of observed contamination and therefore the Resource Factor Value is not evaluated.

Description of Resource(s):

Resources Factor Value [1, p. 51647 (Section 5.1.3.5)]: 0

5.1.3.5 Terrestrial Sensitive Environments

No known terrestrial sensitive environments were documented in the available file information reviewed for the area of observed contamination and therefore the Terrestrial Sensitive Environments Factor Value is not evaluated.

Table 85 - Terrestrial Sensitive Environments

Area Letter	Terrestrial Sensitive Environments	Assigned Value [1, Table 5-5]	References
NS			

NS = Not Scored.

Terrestrial Sensitive Environments Factor Value: Not Scored

5.2 NEARBY POPULATION THREAT

The nearby population threat for the area of observed contamination (Area A) is not evaluated as part of this documentation record.

SDMS TARGET SHEET

US EPA New England
Superfund Document Management System
Image Target Sheet

SDMS Document ID #: 522136

Site Name: Creese & Cook Tannery (Former)

Purpose of Target Sheet:

[ ]	Oversized	[ ]	Color
[X]	Non-Paper Media	[ ]	Other (Provide purpose below)

Document Type this Target Sheet Replaces:

[ ]	Map	[ ]	Photograph	[ ]	Graph/Chart
[ ]	Video	[X]	CD/DVD-ROM	[ ]	Other (Specify below)

Description or Comments:

There are 166 Reference Documents that are too large to be provided on the web. This information can be retrieved on the CD-ROM in the OSRR Records and Information Center via the contact information below

Retrieval:

To View This Document, Please Contact the EPA New England Office of Site Remediation and Restoration Records and Information Center- Telephone (617) 918 1440