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TABLE 2-23.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
SURFACE* SLUDGE AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil/Sludge
Exposure Medium: Sludge
Exposure Point: Surface* Sludge Area 1

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
2-Methylnaphthalene	ug/kg	16000	NA	21000	J	ug/kg	21000	Max	W-Test(4)
4-Methylphenol	ug/kg	800000	NA	1300000		ug/kg	1300000	Max	W-Test(4)
Pentachlorophenol	ug/kg	34000	NA	32000		ug/kg	32000	Max	W-Test(4)
Toxicity Equivalency	ng/kg	855	NA	1600	J	ng/kg	1600	Max	W-Test(4)
Antimony	mg/kg	1.6	NA	4.0		mg/kg	4.0	Max	W-Test(4)
Arsenic	mg/kg	5.6	NA	7.6	J	mg/kg	7.6	Max	W-Test(4)
Chromium	mg/kg	20400	NA	25200		mg/kg	25200	Max	W-Test(4)
Manganese	mg/kg	7970	NA	13300		mg/kg	13300	Max	W-Test(4)

NOTES:
For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average of the duplicate results was used in the calculation.
W-Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W-Test indicates data are lognormally distributed.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for RME EPC, lesser of Mean-N or Max used for CTE EPC.
(3) Shapiro-Wilk W-Test indicates data are normally distributed.
(4) < 11 sample results. Therefore, maximum concentration used for RME EPC, lesser of Mean-N or Max used for CTE EPC.
*The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.
These exposure point concentrations are used to evaluate trespasser exposures to sludge in Area 1.

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TABLE 2-23.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
SURFACE* SOIL/SLUDGE ONLY AREAS 2 TO 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future*
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: Surface * Soil/Sludge Only Areas 2 to 7

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Aroclor-1242	ug/kg	38	NA	280		ug/kg	280	Max	W-Test(4)
Toxicity Equivalency	ng/kg	195	NA	1300	J	ng/kg	1300	Max	W-Test(4)
Antimony	mg/kg	9.7	NA	44	J	mg/kg	44	Max	W-Test(4)
Arsenic	mg/kg	7.5	NA	16		mg/kg	16	Max	W-Test(4)
Barium	mg/kg	89.9	NA	657	J	mg/kg	657	Max	W-Test(4)
Cadmium	mg/kg	2	NA	17		mg/kg	17	Max	W-Test(4)
Lead	mg/kg	51.8	NA	427		mg/kg	427	Max	W-Test(4)
Manganese	mg/kg	124	NA	207	J	mg/kg	207	Max	W-Test(4)
Mercury	mg/kg	0.67	NA	4.5		mg/kg	4.5	Max	W-Test(4)

NOTES:
For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average of the duplicate results was used in the calculation.
W-Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W-Test indicates data are lognormally distributed.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for RME EPC, lesser of Mean-N or Max used for CTE EPC.
(3) Shapiro-Wilk W-Test indicates data are normally distributed.
(4) < 11 sample results. Therefore, maximum concentration used for RME EPC, lesser of Mean-N or Max used for CTE EPC.

*These exposure point concentrations are used to evaluate two scenarios: current/future trespasser and future residential exposures to surface soil/sludge in Areas 2 through 7. Since very fe samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes an sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

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TABLE 2-23.3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
"ALL"* SOIL/SLUDGE AREAS 1 THROUGH 7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: All* Soil and Sludge Areas 1 to 7

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
1,4-Dichlorobenzene	ug/kg	1100	2400	25000		ug/kg	1000	95% UCL-T	W-Test(1)
2-Methylnaphthalene	ug/kg	7900	12000	21000	J	ug/kg	21000	Max	W-Test(2)
4-Methylphenol	ug/kg	220000	390000	1300000	*	ug/kg	1300000	Max	W-Test(2)
Benzo(a)pyrene	ug/kg	8500	13000	660	J	ug/kg	660	Max	W-Test(2)
Naphthalene	ug/kg	10000	15000	61000		ug/kg	61000	Max	W-Test(2)
Pentachlorophenol	ug/kg	20000	30000	120000	J	ug/kg	120000	95% UCL-T	W-Test(1)
Aroclor-1242	ug/kg	25	39	280		ug/kg	28	95% UCL-T	W-Test(1)
Toxicity Equivalency	ng/kg	512	717	2600	J	ng/kg	2600	Max	W-Test(2)
Antimony	mg/kg	58.4	96.6	547	J	mg/kg	506	95% UCL-T	W-Test(1)
Arsenic	mg/kg	6	6.9	16		mg/kg	8.6	95% UCL-T	W-Test(1)
Barium	mg/kg	126	210	1480	J	mg/kg	154	95% UCL-T	W-Test(1)
Cadmium	mg/kg	0.95	1.8	17		mg/kg	0.78	95% UCL-T	W-Test(1)
Chromium	mg/kg	9310	14000	67800	J	mg/kg	67800	Max	W-Test(2)
Lead	mg/kg	40.1	63.1	427		mg/kg	67.6	95% UCL-T	W-Test(1)
Manganese	mg/kg	1170	2020	13300		mg/kg	1810	95% UCL-T	W-Test(1)
Mercury	mg/kg	0.33	0.58	4.5		mg/kg	0.76	95% UCL-T	W-Test(1)
Thallium	mg/kg	0.73	0.86	2.2	J	mg/kg	0.81	95% UCL-T	W-Test(1)
Vanadium	mg/kg	15.4	20.1	69		mg/kg	32.1	95% UCL-T	W-Test(1)

NOTES:
For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average of the duplicate results was used in the calculation.
W-Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W-Test indicates data are lognormally distributed.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for RME EPC, lesser of Mean-N or Max used for CTE EPC.
(3) Shapiro-Wilk W-Test indicates data are normally distributed.

*Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the “all soil” dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

These exposure point concentrations are used to evaluate residential exposures to "all" soil/sludge in Areas 1 through 7.

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TABLE 2-24.1
VALUES USED FOR DAILY INTAKE CALCULATIONS - ADOLESCENT TRESPASSER CONTACT WITH WET SLUDGE AREA 1
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil/Sludge
Exposure Medium: Sludge
Exposure Point: Surface* Sludge in Area 1
Receptor Population: Trespasser
Receptor Age: Adolescent (9-18 Years old)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Sludge	mg/kg	See Table 2-23.1	See Table 2-23.1	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Sludge	mg/day	100	EPA, 1997	CS x Oral Exposure Factor
	FI	Fraction Ingested	dimensionless	1	(1)	Oral exposure Factor =
	OABS	Oral Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.1	See Table 2-25.1	(IR-S x FI x OABS x EF x ED x CF1)/(BW x AT)
	EF	Exposure Frequency	days/year	26	(1)	assumes 1 day/week during warmer months
	ED	Exposure Duration	years	10	EPA, 1997	
	CF1	Conversion Factor	kg/mg	1E-06	--	
	BW	Body Weight	kg	50	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	EPA, 1989	
Dermal Absorption	CS	Chemical Concentration in Sludge	mg/kg	See Table 2-23.1	See Table 2-23.1	CDI (mg/kg-day) =
	CF1	Conversion Factor	kg/mg	1E-06	--	CS x Dermal Exposure Factor
	SA	Skin Surface Area Available for Contact	cm2/day	4,650	EPA, 1997	
	SSAF	Sludge to Skin Adherence Factor	mg/cm2	231	EPA, 2001	
	DABS	Dermal Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.1	See Table 2-25.1	Dermal exposure Factor =
	EF	Exposure Frequency	days/year	26	(1)	(SA x SSAF x EF x ED x DABS x CF)/(BW x AT)
	ED	Exposure Duration	years	10	EPA, 1997	
	BW	Body Weight	kg	50	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	EPA, 1989	

NOTES:
(1) Professional Judgement.
EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
EPA, 1997: Exposure Factors Handbook. Volume I, Aug. 1997, EPA/600/P-25/002FA.
EPA, 2001: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. December 2001.
Surface Area is based on hands, lower arms, lower legs, and feet.
Skin-to-soil Adherence Factor is based on 95th percentile for Children in Mud. Exhibit 3.3 (EPA, 2001).
*The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.
These exposure assumptions are used to evaluate trespasser exposures to sludge in Area 1.

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TABLE 2-24.2
VALUES USED FOR DAILY INTAKE CALCULATIONS - ADOLESCENT TRESPASSER CONTACT WITH DRY SURFACE SOIL/SLUDGE AREAS 2-7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: Surface* Soil/Sludge in Areas 2 through 7
Receptor Population: Trespasser
Receptor Age: Adolescent (9-18 Years old)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil/Sludge	mg/kg	See Table 2-23.2	See Table 2-23.2	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-S	Ingestion Rate of Soil/Sludge	mg/day	100	EPA, 1997	CS x Oral Exposure Factor
	FI	Fraction Ingested	dimensionless	1	(1)	Oral exposure Factor =
	OABS	Oral Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.2a	See Table 2-25.2a	(IR-S x FI x OABS x EF x ED x CF1)/(BW x AT)
	EF	Exposure Frequency	days/year	26	(1)	assumes 1 day/week during warmer months
	ED	Exposure Duration	years	10	EPA, 1997	
	CF1	Conversion Factor	kg/mg	1E-06	--	
	BW	Body Weight	kg	50	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	EPA, 1989	
Dermal Absorption	CS	Chemical Concentration in Soil/Sludge	mg/kg	See Table 2-23.2	See Table 2-23.2	CDI (mg/kg-day) =
	CF1	Conversion Factor	kg/mg	1E-06	--	CS x Dermal Exposure Factor
	SA	Skin Surface Area Available for Contact	cm2/day	4,650	EPA, 1997	
	SSAF	Sludge to Skin Adherence Factor	mg/cm2	0.4	EPA, 2001	
	DABS	Dermal Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.2a	See Table 2-25.2a	Dermal Exposure Factor =
	EF	Exposure Frequency	days/year	26	(1)	(SA x SSAF x EF x ED x DABS x CF)/(BW x AT)
	ED	Exposure Duration	years	10	EPA, 1997	
	BW	Body Weight	kg	50	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	EPA, 1989	
Inhalation of Dust	CS	Chemical Concentration in Soil/Sludge	mg/kg	See Table 2-23.2	See Table 2-23.2	CDI (mg/kg-day) =
	PEF	Particulate Emission Factor	m3/kg	1.32E+09	EPA, 1996	CS x Inhalation Exposure Factor
	Inh R	Inhalation Rate	m3/hr	1.2	EPA, 1997	(BW x AT)
	ET	Exposure Time	hr/day	4	(1)	Inhalation Exposure Factor =
	EF	Exposure Frequency	days/year	26	EPA, 2001	((I/PEF) x InhR x ET x EF x ED)/(BW x AT)
	ED	Exposure Duration	years	10	EPA, 1997	
	BW	Body Weight	kg	50	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	EPA, 1989	

NOTES:

(1) Professional Judgement.

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1997: Exposure Factors Handbook. Volume I, Aug. 1997, EPA/600/P-25/002FA.

EPA, 2001: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. December 2001.

Surface Area is based on hands, lower arms, lower legs, and feet.

Skin-to-soil Adherence Factor is based on 95th percentile for children playing in dry soil. Exhibit 3.3 (EPA, 2001).

*Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

These exposure assumptions are used to evaluate trespasser exposures to surface soil/sludge in Areas 2 through 7.

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TABLE 2-24.3
VALUES USED FOR DAILY INTAKE CALCULATIONS - FUTURE RESIDENT CONTACT WITH SOIL/SLUDGE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Future
Medium: Soil/Sludge
Exposure Medium: Soil/Sludge
Exposure Point: Soil/Sludge *
Receptor Population: Resident
Receptor Age: Adult/Child (1-31 Years old)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil/Sludge	mg/kg	See Table 2-23.2 & 2-23.3	See Table 2-23.2 & 2-23.3	Chronic Daily Intake (CDI) (mg/kg-day) =
	$IR\text{-}S_a$	Adult Ingestion Rate of Soil/Sludge	mg/day	100	EPA, 1997	CS x Oral Exposure Factor
	$IR\text{-}S_c$	Child Ingestion Rate of Soil/Sludge	mg/day	200	EPA, 1997	
	FI	Fraction Ingested	dimensionless	1	(1)	
	OABS	Oral Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.2b & 2-25.3	See Table 2-25.2b & 2-25.3	Oral exposure Factor =(Age-Adjusted Ingestion Rate x FI x EF x OABS x CF)/AT
	EF	Exposure Frequency	days/year	150	EPA, 1994	
	ED_a	Adult Exposure Duration	years	24	EPA, 1997	Age-Adjusted Ingestion Rate =((IR-Sa x ED_c)/BW_c) + ((IR-Sa x ED_a)/BW_a)
	ED_c	Child Exposure Duration	years	6	EPA, 1997	
	CF1	Conversion Factor	kg/mg	1E-06	--	
	BW_a	Adult Body Weight	kg	70	EPA, 1997	
	BW_c	Child Body Weight	kg	15	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	EPA, 1989	
Dermal Absorption	CS	Chemical Concentration in Soil/Sludge	mg/kg	See Table 2-23.2 & 2-23.3	See Table 2-23.2 & 2-23.3	CDI (mg/kg-day) =
	CF1	Conversion Factor	kg/mg	1E-06	--	CS x Dermal Exposure Factor
	SA_a	Adult Skin Surface Area Available for Contact	cm2/day	5,700	EPA, 2001	
	SA_c	Child Skin Surface Area Available for Contact	cm2/day	2,800	EPA, 2001	
	$SSAF_a$	Adult Soil to Skin Adherence Factor	mg/cm2	0.07	EPA, 2001	Dermal exposure Factor =(Age-Adjusted Dermal Contact Rate x EF x DABS x CF)/AT
	$SSAF_c$	Child Soil to Skin Adherence Factor	mg/cm2	0.2	EPA, 2001	
	DABS	Dermal Absorption Factor (chemical-specific)	dimensionless	See Table 2-25.2b & 2-25.3	See Table 2-25.2b & 2-25.3	Age-Adjusted Dermal Contact Rate =((SA_c x $SSAF_c$ x ED_c)/BW_c) + ((SAa x SSAFa x ED_a)/BW_a)
	EF	Exposure Frequency	days/year	150	EPA, 1994	
	ED_a	Adult Exposure Duration	years	24	EPA, 1997	
	ED_c	Child Exposure Duration	years	6	EPA, 1997	
	BW_a	Adult Body Weight	kg	70	EPA, 1997	
	BW_c	Child Body Weight	kg	15	EPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	EPA, 1989	

NOTES:

(1) Professional Judgement.

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1994: USEPA Region I Waste Management Division, USEPA Risk Update No. 2, Aug. 1994.

EPA, 1997: Exposure Factors Handbook. Volume I, Aug. 1997, EPA/600/P-25/002FA.

EPA, 2001: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. December 2001.

Adult Skin-to-soil Adherence Factor is based on 50th percentile for gardening, a high-end activity. Exhibit 3.3 (EPA, 2001).

Child Skin-to-soil Adherence Factor is based on 50th percentile for children playing in wet soil, a high-end activity. Exhibit 3.3 (EPA, 2001).

Adult Surface Area is based on head, hands, lower arms, and lower legs.

Child Surface Area is based on head, hands, lower arms, lower legs, and feet.

*These exposure assumptions are used to evaluate residential exposures to two different exposure points: "all" soil/sludge in Areas 1 through 7 and residential exposures to surface soil/sludge in Areas 2 through 7. Since very few samples were collected from only surface materia to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs. Similarly, since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the “all soil” dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

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TABLE 2-25.1
NONCANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE SOIL/SLUDGE AREA 1 - 9-18 YEARS OLD**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Total Hazard Index
4-Methylphenol	1300	Max		*		0.1	1.42E-07	1.53E-04	5.00E-03	1.00E+00	5.00E-03	3.70E-02	3.98E+01	3.98E+01
2-Methylnaphthalene	21	Max		*		0.13	1.42E-07	1.99E-04	2.00E-02	1.00E+00	2.00E-02	1.50E-04	2.09E-01	2.09E-01
Pentachlorophenol	32	Max		*		0.25	1.42E-07	3.83E-04	3.00E-02	1.00E+00	3.00E-02	1.52E-04	4.08E-01	4.08E-01
Dioxin TEQ	0.0016	Max		0.5	6	0.03	7.12E-08	4.59E-05		1.00E+00				
Antimony	4	Max		*			1.42E-07		4.00E-04	1.50E-01	6.00E-05	9.50E-03		9.50E-03
Arsenic	7.6	Max		1	7	0.03	1.42E-07	4.59E-05	3.00E-04	1.00E+00	3.00E-04	3.61E-03	1.16E+00	1.17E+00
Chromium	25200	Max		*			1.42E-07		1.50E+00	1.30E-02	1.95E-02	1.84E-01		1.84E-01
Manganese	13300	Max		*			1.42E-07		7.00E-02	4.00E-02	2.80E-03	6.77E-01		6.77E-01
														4.25E+01

NOTES:
Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS $_{oral}$*Conversion Factor/BW*Averaging Time
= (100 mg/d * 1 * 26 d/y * 10 y * ABS $_{oral}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)
Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS $_{dermal}$*Conversion Factor/BW*Averaging Time
= (4650 cm^2 * 231 mg/cm^2-ev * 1 ev/d * 26 d/y * 10 y * ABS $_{dermal}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)
RfDabs = RfDadm * GI ABS used in toxicity study
HI = EPC*Exposure Factor/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.

5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.

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TABLE 2-25.2a
NONCANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE** SOIL/SLUDGE AREAS 2-7 - 9-18 YEARS OLD
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	Inhalation Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	RfDinhal mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Inhalation Hazard Index	Total Hazard Index
Aroclor 1242	0.28	Max		*		0.14	1.42E-07	3.71E-07	5.18E-18	2.00E-05	1.00E+00	2.00E-05		1.99E-03	5.19E-03		7.19E-03
Dioxin TEQ	0.0013	Max		0.5	6	0.03	7.12E-08	7.95E-08	5.18E-18		1.00E+00						
Antimony	44.4	Max		*			1.42E-07		5.18E-18	4.00E-04	1.50E-01	6.00E-05		1.05E-01			1.05E-01
Arsenic	15.7	Max		1	7	0.03	1.42E-07	7.95E-08	5.18E-18	3.00E-04	1.00E+00	3.00E-04		7.46E-03	4.16E-03		1.16E-02
Barium	657	Max		*			1.42E-07		5.18E-18	7.00E-02	7.00E-02	4.90E-03	1.40E-04	1.91E-02		2.43E-11	1.91E-02
Cadmium	16.8	Max		*		0.001	1.42E-07	2.65E-09	5.18E-18	5.00E-04	2.50E-02	1.25E-05		1.91E-01	3.56E-03		1.95E-01
Lead	427	Max		*			1.42E-07		5.18E-18								
Manganese	207	Max		*			1.42E-07		5.18E-18	7.00E-02	4.00E-02	2.80E-03	1.40E-05	1.05E-02		7.66E-11	1.05E-02
Mercury	4.5	Max		*			1.42E-07		5.18E-18	3.00E-04	1.00E+00	3.00E-04	8.60E-05	2.14E-03		2.71E-13	2.14E-03
																	3.51E-01

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS $_{oral}$*Conversion Factor/BW*Averaging Time

= (100 mg/d * 1 * 26 d/y * 10 y * ABS $_{oral}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS $_{dermal}$*Conversion Factor/BW*Averaging Time

= (4650 cm^2 * 0.4 mg/cm^2-ev * 1 ev/d * 26 d/y * 10 y * ABS $_{dermal}$ * 10-6 kg/mg)/(50 kg * 10 y * 365 d/y)

Inhalation Exposure Factor = ((1/PEF)*Inhalation Rate * Exposure Time * Exposure Frequency * Exposure Duration) / (Body Weight * Averaging Time)

= ((1/1320000000) * 1.2 m3/hr * 4 hr/d * 26 d/y * 10 y)/(50 kg * 10 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study

HI = EPC*Exposure Factor/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

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TABLE 2-25.2b
NONCANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE SURFACE SOIL/SLUDGE AREAS 2-7**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Total Hazard Index
Aroclor 1242	0.28	Max		*		0.14	5.48E-06	2.15E-06	2.00E-05	1.00E+00	2.00E-05	7.67E-02	3.01E-02	1.07E-01
Dioxin TEQ	0.0013	Max		0.5	6	0.03	2.74E-06	4.60E-07		1.00E+00				
Antimony	44.4	Max		*			5.48E-06		4.00E-04	1.50E-01	6.00E-05	4.05E+00		4.05E+00
Arsenic	15.7	Max		1	7	0.03	5.48E-06	4.60E-07	3.00E-04	1.00E+00	3.00E-04	2.87E-01	2.41E-02	3.11E-01
Barium	657	Max		*			5.48E-06		7.00E-02	7.00E-02	4.90E-03	7.35E-01		7.35E-01
Cadmium	16.8	Max		*		0.001	5.48E-06	1.53E-08	5.00E-04	2.50E-02	1.25E-05	7.36E+00	2.06E-02	7.39E+00
Lead	427	Max		*			5.48E-06							
Manganese	207	Max		*			5.48E-06		7.00E-02	4.00E-02	2.80E-03	4.05E-01		4.05E-01
Mercury	4.5	Max		*			5.48E-06		3.00E-04	1.00E+00	3.00E-04	8.22E-02		8.22E-02
														1.31E+01

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS_{oral}*Conversion Factor/BW*Averaging Time

= (200 mg/d * 1.0 * 150 d/y * 6 y * ABS_{oral} * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS_{dermal}*Conversion Factor/BW*Averaging Time

= (2800 cm^2 * 0.2 mg/cm^2-ev * 1 ev/d * 150 d/y * 6 y * ABS_{dermal} * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study

HI = EPC*Exposure Factor/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.

2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.

3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.

4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.

5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.

6 Personal communication with A. Burke.

7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.

* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

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TABLE 2-25.3
NONCANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE ALL** SOIL/SLUDGE AREAS 1-7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	RfDadm[3] mg/kg-d	GI ABS used in toxicity study[4]	RfDabs[5] mg/kg-d	Ingestion Hazard Index	Dermal Hazard Index	Total Hazard Index
1,4-Dichlorobenzene	1	95%UCL		*		0.1	5.48E-06	1.53E-06	3.00E-02	1.00E+00	3.00E-02	1.83E-04	5.11E-05	2.34E-04
Chlorobenzene	1.7	95%UCL		*		0.1	5.48E-06	1.53E-06	2.00E-02	1.00E+00	2.00E-02	4.66E-04	1.30E-04	5.96E-04
4-Methylphenol	1300	Max		*		0.1	5.48E-06	1.53E-06	5.00E-03	1.00E+00	5.00E-03	1.42E+00	3.99E-01	1.82E+00
Benzo(a)Pyrene	0.66	Max		*		0.13	5.48E-06	1.99E-06		1.00E+00				
2-Methylnaphthalene	21	Max		*		0.13	5.48E-06	1.99E-06	2.00E-02	1.00E+00	2.00E-02	5.75E-03	2.09E-03	7.85E-03
Naphthalene	61	Max		*		0.13	5.48E-06	1.99E-06	2.00E-02	1.00E+00	2.00E-02	1.67E-02	6.08E-03	2.28E-02
Pentachlorophenol	120	95%UCL		*		0.25	5.48E-06	3.84E-06	3.00E-02	1.00E+00	3.00E-02	2.19E-02	1.53E-02	3.73E-02
Total Aroclors	0.028	95%UCL		*		0.14	5.48E-06	2.15E-06	2.00E-05	1.00E+00	2.00E-05	7.67E-03	3.01E-03	1.07E-02
Dioxin TEQ	0.0026	Max		0.5	6	0.03	2.74E-06	4.60E-07		1.00E+00				
Antimony	506	95%UCL		*			5.48E-06		4.00E-04	1.50E-01	6.00E-05	4.62E+01		4.62E+01
Arsenic	8.6	95%UCL		1	7	0.03	5.48E-06	4.60E-07	3.00E-04	1.00E+00	3.00E-04	1.57E-01	1.32E-02	1.70E-01
Barium	154	95%UCL		*			5.48E-06		7.00E-02	7.00E-02	4.90E-03	1.72E-01		1.72E-01
Cadmium	0.78	95%UCL		*		0.001	5.48E-06	1.53E-08	5.00E-04	2.50E-02	1.25E-05	3.42E-01	9.57E-04	3.43E-01
Chromium	67800	Max		*			5.48E-06		1.50E+00	1.30E-02	1.95E-02	1.91E+01		1.91E+01
Lead	67.6	95%UCL		*			5.48E-06							
Manganese	1810	95%UCL		*			5.48E-06		7.00E-02	4.00E-02	2.80E-03	3.54E+00		3.54E+00
Mercury	0.76	95%UCL		*			5.48E-06		3.00E-04	1.00E+00	3.00E-04	1.39E-02		1.39E-02
Thallium	0.81	95%UCL		*			5.48E-06		6.60E-05	1.00E+00	6.60E-05	6.72E-02		6.72E-02
Vanadium	32.1	95%UCL		*			5.48E-06		7.00E-03	2.60E-02	1.82E-04	9.66E-01		9.66E-01
														7.24E+01

NOTES:

Oral Exposure Factor = Ingestion Rate *Fraction Ingested* Exposure Frequency*Exposure Duration*ABS_{oral}*Conversion Factor/BW*Averaging Time

= (200 mg/d * 1.0 * 150 d/y * 6 y * ABS_{oral} * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

Dermal Exposure Factor = Surface Area*Soil-to-skin Adherence Factor * Exposure Frequency*Exposure Duration*ABS_{dermal}*Conversion Factor/BW*Averaging Time

= (2800 cm^2 * 0.2 mg/cm^2-ev * 1 ev/d * 150 d/y * 6 y * ABS_{dermal} * 10-6 kg/mg)/(15 kg * 6 y * 365 d/y)

RfDabs = RfDadm * GI ABS used in toxicity study

HI = (EPC * Exposure Factor)/RfD

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered RfDs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.

5 Absorbed RfDs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the "all soil" dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

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TABLE 2-26.1
CANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE SOIL/SLUDGE AREA 1 - 9-18 YEARS OLD**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
4-Methylphenol	1300	Max		*		0.1	2.04E-08	2.19E-05		1.00E+00				
2-Methylnaphthalene	21	Max		*		0.13	2.04E-08	2.84E-05		1.00E+00				
Pentachlorophenol	32	Max		*		0.25	2.04E-08	5.47E-05	1.20E-01	1.00E+00	1.20E-01	7.82E-08	2.10E-04	2.10E-04
Dioxin TEQ	0.0016	Max		0.5	6	0.03	1.02E-08	6.56E-06	1.50E+05	1.00E+00	1.50E+05	2.44E-06	1.57E-03	1.58E-03
Antimony	4	Max		*			2.04E-08			1.50E-01				
Arsenic	7.6	Max		1	7	0.03	2.04E-08	6.56E-06	1.50E+00	1.00E+00	1.50E+00	2.32E-07	7.48E-05	7.50E-05
Chromium	25200	Max		*			2.04E-08			1.30E-02				
Manganese	13300	Max		*			2.04E-08			4.00E-02				
														1.86E-03

NOTES:

Oral Exposure Factor = Ingestion Rate * Fraction Ingested * Exposure Frequency * Exposure Duration * ABS_{oral} * Conversion Factor / Body Weight * Averaging Time

= (100 mg-y/kg-d * 1 * 26 d/y * 10 y * ABS_{oral} * 10-6 kg/mg)/(50 kg * 70 y * 365 d/y)

Dermal Exposure Factor = Exposed Surface Area * Soil Adherence Factor * Exposure Frequency * Exposure Duration * ABS_{dermal} * Conversion Factor / Body Weight * Averaging Time

= (4650 cm2 * 231 mg/cm^2-ev * 1 ev/d * 26 d/y *10 y * ABS_{dermal} * 10-6 kg/mg)/(50 kg * 70y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.

5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** The sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs.

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TABLE 2-26.2a
CANCER RISK SUMMARY
TRESPASSER EXPOSURE SURFACE** SOIL/SLUDGE AREAS 2-7 - 9-18 YEARS OLD
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	Inhalation Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	CSFinhal mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Cancer Risk	Total Cancer Risk
Aroclor 1242	0.28	Max		*		0.14	2.04E-08	5.30E-08	7.40E-19	2.00E+00	1.00E+00	2.00E+00	2.00E+00	1.14E-08	2.97E-08	4.14E-19	4.11E-08
Dioxin TEQ	0.0013	Max		0.5	6	0.03	1.02E-08	1.14E-08	7.40E-19	1.50E+05	1.00E+00	1.50E+05	1.50E+05	1.98E-06	2.21E-06	1.44E-16	4.20E-06
Antimony	44.4	Max		*			2.04E-08		7.40E-19		1.50E-01						
Arsenic	15.7	Max		1	7	0.03	2.04E-08	1.14E-08	7.40E-19	1.50E+00	1.00E+00	1.50E+00	1.50E+01	4.79E-07	2.67E-07	1.74E-16	7.47E-07
Barium	657	Max		*			2.04E-08		7.40E-19		7.00E-02						
Cadmium	16.8	Max		*		0.001	2.04E-08	3.79E-10	7.40E-19		2.50E-02		6.30E+00			7.83E-17	7.83E-17
Lead	427	Max		*			2.04E-08		7.40E-19								
Manganese	207	Max		*			2.04E-08		7.40E-19		4.00E-02						
Mercury	4.5	Max		*			2.04E-08		7.40E-19		1.00E+00						
																	4.99E-06

NOTES:

Oral Exposure Factor = Ingestion Rate * Fraction Ingested * Exposure Frequency * Exposure Duration * ABS_{oral} * Conversion Factor / Body Weight * Averaging Time
= (100 mg-y/kg-d * 1 * 26 d/y * 10 y * ABS_{oral} * 10-6 kg/mg)/(50 kg * 70 y * 365 d/y)

Dermal Exposure Factor = Exposed Surface Area * Soil Adherence Factor * Exposure Frequency * Exposure Duration * ABS_{dermal} * Conversion Factor / Body Weight * Averaging Time
= (4650 cm2 * 0.4 mg/cm^2-ev * 1 ev/d * 26 d/y *10 y * ABS_{dermal} * 10-6 kg/mg)/(50 kg * 70y * 365 d/y)

Inhalation Exposure Factor = ((1/PEF)*Inhalation Rate * Exposure Time * Exposure Frequency * Exposure Duration) / (Body Weight * Averaging Time)
= ((1/1320000000) * 1.2 m3/hr * 4 hr/d * 26 d/y * 10 y)/(50 kg * 70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

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TABLE 2-26.2b
CANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE SURFACE SOIL/SLUDGE AREAS 2-7**
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
Aroclor 1242	0.28	Max		*		0.14	6.69E-07	2.96E-07	2.00E+00	1.00E+00	2.00E+00	3.75E-07	1.66E-07	5.40E-07
Dioxin TEQ	0.0013	Max		0.5	6	0.03	3.35E-07	6.34E-08	1.50E+05	1.00E+00	1.50E+05	6.53E-05	1.24E-05	7.76E-05
Antimony	44.4	Max		*			6.69E-07			1.50E-01				
Arsenic	15.7	Max		1	7	0.03	6.69E-07	6.34E-08	1.50E+00	1.00E+00	1.50E+00	1.58E-05	1.49E-06	1.73E-05
Barium	657	Max		*			6.69E-07			7.00E-02				
Cadmium	16.8	Max		*		0.001	6.69E-07	2.11E-09		2.50E-02				
Lead	427	Max		*			6.69E-07							
Manganese	207	Max		*			6.69E-07			4.00E-02				
Mercury	4.5	Max		*			6.69E-07			1.00E+00				
														9.54E-05

NOTES:
Age-Adjusted Ingestion Rate = ((200 mg/d * 6 y)/15 kg) + ((100 mg/d * 24 y)/70 kg) = 114 mg-y/kg-d
Age-Adjusted Dermal Contact Rate = ((2800 cm^2 * 0.2 mg/cm^2-ev * 6 y)/15 kg) + ((5700 cm^2 * 0.07 mg/cm^2-ev * 24 y)/70 kg) = 360 mg-y/kg-event

Oral Exposure Factor = Age-adjusted Ingestion Rate *Fraction Ingested* Exposure Frequency*ABS_{oral}*Conversion Factor/Averaging Time
= (114 mg-y/kg-d * 1.0 * 150 d/y * ABS_{oral} * 10-6 kg/mg)/(70 y * 365 d/y)
Dermal Exposure Factor = Age-adjusted Dermal Contact Rate * Exposure Frequency*ABS_{dermal}*Conversion Factor/Averaging Time
= (360 mg-y/kg-ev * 1 ev/d * 150 d/y * ABS_{dermal} * 10-6 kg/mg)/(70 y * 365 d/y)
CSFabs = CSFadm / GI ABS used in toxicity study
Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.
* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.
** Since very few samples were collected from only surface materials (0 to 2 feet bgs) and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface dataset includes any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs.

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TABLE 2-26.3
CANCER RISK SUMMARY
FUTURE RESIDENTIAL EXPOSURE ALL** SOIL/SLUDGE AREAS 1-7
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

COPCs	EPC mg/kg	Max or UCL	Location of Maximum detected Concentration	Oral ABS[1]	Source	Dermal ABS[1,2]	Oral Exposure Factor d^{-1}	Dermal Exposure Factor d^{-1}	CSFadm[3] mg/kg-d	GI ABS used in toxicity study[4]	CSFabs[5] mg/kg-d	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk
1,4-Dichlorobenzene	1	95%UCL		*		0.1	6.69E-07	2.11E-07	2.40E-02	1.00E+00	2.40E-02	1.61E-08	5.07E-09	2.11E-08
Chlorobenzene	1.7	95%UCL		*		0.1	6.69E-07	2.11E-07		1.00E+00				
4-Methylphenol	1300	Max		*		0.1	6.69E-07	2.11E-07		1.00E+00				
Benzo(a)Pyrene	0.66	Max		*		0.13	6.69E-07	2.75E-07	7.30E+00	1.00E+00	7.30E+00	3.22E-06	1.32E-06	4.55E-06
2-Methylnaphthalene	21	Max		*		0.13	6.69E-07	2.75E-07		1.00E+00				
Naphthalene	61	Max		*		0.13	6.69E-07	2.75E-07		1.00E+00				
Pentachlorophenol	120	95%UCL		*		0.25	6.69E-07	5.28E-07	1.20E-01	1.00E+00	1.20E-01	9.64E-06	7.61E-06	1.72E-05
Aroclor 1242	0.028	95%UCL		*		0.14	6.69E-07	2.96E-07	2.00E+00	1.00E+00	2.00E+00	3.75E-08	1.66E-08	5.40E-08
Dioxin TEQ	0.0026	Max		0.5	6	0.03	3.35E-07	6.34E-08	1.50E+05	1.00E+00	1.50E+05	1.31E-04	2.47E-05	1.55E-04
Antimony	506	95%UCL		*			6.69E-07			1.50E-01				
Arsenic	8.6	95%UCL		1	7	0.03	6.69E-07	6.34E-08	1.50E+00	1.00E+00	1.50E+00	8.63E-06	8.18E-07	9.45E-06
Barium	154	95%UCL		*			6.69E-07			7.00E-02				
Cadmium	0.78	95%UCL		*		0.001	6.69E-07	2.11E-09		2.50E-02				
Chromium	67800	Max		*			6.69E-07			1.30E-02				
Lead	67.6	95%UCL		*			6.69E-07							
Manganese	1810	95%UCL		*			6.69E-07			4.00E-02				
Mercury	0.76	95%UCL		*			6.69E-07			1.00E+00				
Thallium	0.81	95%UCL		*			6.69E-07			1.00E+00				
Vanadium	32.1	95%UCL		*			6.69E-07			2.60E-02				
														1.87E-04

NOTES:

Age-Adjusted Ingestion Rate = ((200 mg/d * 6 y)/15 kg) + ((100 mg/d * 24 y)/70 kg) = 114 mg-y/kg-d

Age-Adjusted Dermal Contact Rate = ((2800 cm^2 * 0.2 mg/cm^2-ev * 6 y)/15 kg) + ((5700 cm^2 * 0.07 mg/cm^2-ev * 24 y)/70 kg) = 360 mg-y/kg-event

Oral Exposure Factor = Age-adjusted Ingestion Rate *Fraction Ingested* Exposure Frequency*ABS_{oral}*Conversion Factor/Averaging Time

= (114 mg-y/kg-d * 1.0 * 150 d/y * ABS_{oral} * 10-6 kg/mg)/(70 y * 365 d/y)

Dermal Exposure Factor = Age-adjusted Dermal Contact Rate * Exposure Frequency*ABS_{dermal}*Conversion Factor/Averaging Time

= (360 mg-y/kg-ev * 1 ev/d * 150 d/y * ABS_{dermal} * 10-6 kg/mg)/(70 y * 365 d/y)

CSFabs = CSFadm / GI ABS used in toxicity study

Cancer Risk = EPC*Exposure Factor*CSF

1 Oral ABS and Dermal ABS are absorption factors based on exposures to soils.
2 Table 3.4 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance.
3 Administered CSFs are used in conjunction with administered oral intakes when oral soil absorption factors are not available.
4 Table 4.1 US EPA, 2001 RAGS E, Dermal Risk Assessment Guidance. These values represent absorption factors for the route of administration used in the toxicity study, generally food or water.
5 Absorbed CSFs are used in conjunction with absorbed intakes when soil absorption factors are available for the route of exposure.
6 Personal communication with A. Burke.
7 USEPA Office of Health and Environmental Assessment, Washington, DC, Relevant Absorption Factors for Risk Assessment, Review Draft, September, 1993.

* At this time there is insufficient data to develop a gastrointestinal absorption value for oral exposure to these compounds from soil. Thus it is assumed that the gastrointestinal absorption from the oral-soil route is equal to the gastrointestinal absorption in the toxicity study. As a result the exposure dose-oral for these compounds is combined with the CSFadministered. When oral GI soil absorption data becomes available for these compounds this information can be used to adjust the exposure dose-oral to an absorbed dose and justify the combination of this variable with an absorbed CSF.

** Since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the “all soil” dataset includes any sample with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

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TABLE 2-27
SUMMARY OF RECEPTOR RISKS AND HAZARDS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Area	High Lead (1)	Scenario/Receptor	Media CR>1E-04 or HI>1	Total Cancer Risks	Major contributors to cancer risk above 1E-04 (individual cancer risk>1E-06)	Total Noncancer Hazard Index	Major contributors to noncancer Hazard Index (HI>1.0)
Area 1 Surface* sludge	NO	Current/Future Adolescent Trespasser	YES	1.86E-03	Dioxin TEQ, Pentachlorophenol, Arsenic	42.5	4-Methylphenol, Arsenic
Areas 2 through 7 Surface* soil/sludge	YES	Current/Future Adolescent Trespasser	NO	4.99E-06	NA	0.351	NA
Areas 2 through 7 Surface* soil/sludge	YES	Future Lifetime Resident	YES	9.54E-05	NA	13.1	Antimony, Cadmium
Areas 1 through 7 "All"* soil/sludge	YES	Future Lifetime Resident	YES	1.87E-04	Dioxin TEQ, Pentachlorophenol, Arsenic, Benzo(a)pyrene	72.4	4-Methylphenol, Antimony, Cadmium, Manganese

Notes:

(1) Maximum Lead > 400mg/kg

*The surface sludge samples from Area 1 were composites of materials from 0 to 10-12 feet bgs. Since very few samples were collected from only surface materials (0 to 2 feet bgs) in any area and many of the samples were composites of materials from 0 to as much as 20 feet bgs, the surface datasets include any sample with a top depth of 0 feet bgs, most samples extending below 2 feet bgs. Similarly, since very few samples were collected from only 0 to 10 feet bgs and many of the samples were composites of materials from a wide range of depths, the “all soil” dataset includes any sam with a top depth of less than 10 feet bgs. Many of the samples in this dataset actually extend to depths greater than 10 feet bgs.

NA- Not Applicable

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TABLE 2-28
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Only Areas 2 to 7
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening Toxicity Value (2)	Maximum HQ	COPC Flag	Rationale for Contaminant Deletion or Selection (3)
1,2-Dichlorobenzene	280	J	280	J	ug/kg	MT-SL-603-0007	1/10	NA	NA	YES	NTX
1,4-Dichlorobenzene	200	J	200	J	ug/kg	MT-SL-603-0007	1/10	20000	0.01	NO	BSL
Chlorobenzene	25	J	1300		ug/kg	MT-SL-603-0007	2/10	40000	0.03	NO	BSL
Chloroform	25	J	32	J	ug/kg	MT-SO-A4-OVCOMP	2/10	55000	0.00	NO	BSL
Methyl Acetate	44	J	250	J	ug/kg	MT-SL-603-0007	3/10	NA	NA	YES	NTX
Toluene	19	J	19	J	ug/kg	MT-SO-A2-OVCOMP	1/10	51500	0.00	NO	BSL
bis(2-Ethylhexyl)phthalate	8900		8900		ug/kg	MT-SL-702-0011	1/10	910	9.78	YES	ASL
Di-n-Butylphthalate	23	JEB	61		ug/kg	MT-SL-501-0020-AVG	2/10	90	0.68	NO	BSL
4,4'-DDE	3.2		3.2		ug/kg	MT-SL-702-0011	1/10	2	1.60	YES	ASL
4,4'-DDT	1.8	J	2.2		ug/kg	MT-SL-702-0011	2/10	2	1.10	YES	ASL
alpha-Chlordane	1.7	J	29	*	ug/kg	MT-SL-702-0011	4/10	1800	0.02	NO	BSL
Aroclor-1242	280		280		ug/kg	MT-SL-702-0011	1/10	371	0.75	NO	BSL
Aroclor-1254	4	J	78		ug/kg	MT-SL-702-0011	4/10	371	0.21	NO	BSL
delta-BHC	5.2		5.2		ug/kg	MT-SL-702-0011	1/10	70	0.07	NO	BSL
Dieldrin	4.4		4.4		ug/kg	MT-SL-702-0011	1/10	64	0.07	NO	BSL
Endrin	5.8		5.8		ug/kg	MT-SL-702-0011	1/10	8	0.73	NO	BSL
Endrin Ketone	6.3		6.3		ug/kg	MT-SO-A4-OVCOMP	1/10	8	0.79	NO	BSL
gamma-Chlordane	1.9	J	31	*	ug/kg	MT-SL-702-0011	4/10	1800	0.02	NO	BSL
Heptachlor Epoxide	12		12		ug/kg	MT-SL-702-0011	1/10	476	0.03	NO	BSL
1,2,3,4,6,7,8-HpCDD	10.8		93940	*	ng/kg	MT-SL-702-0011	10/10	315	298	YES	ASL
1,2,3,4,6,7,8-HpCDF	1.2		3230	*	ng/kg	MT-SL-702-0011	10/10	315	10.25	YES	ASL
1,2,3,4,7,8,9-HpCDF	2.8	J	109		ng/kg	MT-SL-702-0011	9/10	315	0.35	NO	BSL
1,2,3,4,7,8-HxCDD	0.88	J	77.1		ng/kg	MT-SL-702-0011	9/10	31.5	2.45	YES	ASL
1,2,3,4,7,8-HxCDF	1.3	J	76		ng/kg	MT-SL-702-0011	9/10	31.5	2.41	YES	ASL

TABLE 2-28 (cont.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Only Areas 2 to 7
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening (2) Toxicity Value	Maximum HQ	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
1,2,3,6,7,8-HxCDD	8.3		1200		ng/kg	MT-SL-702-0011	9/10	31.5	38.10	YES	ASL
1,2,3,6,7,8-HxCDF	0.6	J	32.4	EB	ng/kg	MT-SL-702-0011	9/10	31.5	1.03	YES	ASL
1,2,3,7,8,9-HxCDD	2.2	J	315	EB	ng/kg	MT-SL-702-0011	9/10	31.5	10.00	YES	ASL
1,2,3,7,8,9-HxCDF	0.74	EMPC	10.8	EMPC	ng/kg	MT-SO-A6-OVCOMP	4/10	31.5	0.34	NO	BSL
1,2,3,7,8-PeCDD	1.1	J	15.9	EB	ng/kg	MT-SO-A3-OVCOMP	8/10	3.15	5.05	YES	ASL
1,2,3,7,8-PeCDF	0.27	J	1.1	J	ng/kg	MT-SO-A4-OVCOMP	4/10	63	0.02	NO	BSL
2,3,4,6,7,8-HxCDF	1.3	J	189		ng/kg	MT-SL-702-0011	9/10	31.5	6.00	YES	ASL
2,3,4,7,8-PeCDF	1.1	J	6.9		ng/kg	MT-SL-702-0011	7/10	6.3	1.10	YES	ASL
2,3,7,8-TCDD	0.39	J	25.2	J	ng/kg	MT-SO-A6-OVCOMP	9/10	3.15	8.00	YES	ASL
2,3,7,8-TCDF	0.36	J	9.9		ng/kg	MT-SL-702-0011	7/9	840	0.01	NO	BSL
OCDD	99.9		719310	EB*	ng/kg	MT-SL-702-0011	10/10	31500	22.84	YES	ASL
OCDF	2.6		6820	JEB*	ng/kg	MT-SL-702-0011	10/10	31500	0.22	NO	BSL
Aluminum	3120		6660		mg/kg	MT-SL-603-0007	10/10	3.825	1741	YES	ASL
Antimony	2.3		44.4	J	mg/kg	MT-SL-702-0011	8/10	0.248	179	YES	ASL
Arsenic	1.6	J	15.7		mg/kg	MT-SL-603-0007	10/10	9.9	1.59	YES	ASL
Barium	14.9		657	J	mg/kg	MT-SL-702-0011	10/10	283	2.32	YES	ASL
Beryllium	0.2		0.41	J	mg/kg	MT-SL-603-0007	7/10	2.42	0.17	NO	BSL
Cadmium	16.8		16.8		mg/kg	MT-SL-702-0011	1/10	4	4.20	YES	ASL
Calcium	565		22300		mg/kg	MT-SL-702-0011	10/10	NA	NA	NO	NUT
Chromium	60.9		5280	J	mg/kg	MT-SL-702-0011	10/10	10	528	YES	ASL
Cobalt	2.5		5.6	J	mg/kg	MT-SL-702-0011	10/10	1000	0.01	NO	BSL
Copper	4.4		108		mg/kg	MT-SL-702-0011	10/10	50	2.16	YES	ASL
Iron	3680		25500		mg/kg	MT-SL-702-0011	10/10	200	128	YES	ASL

TABLE 2-28 (cont.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Only Areas 2 to 7
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening Toxicity Value (2)	Maximum HQ	COPC Flag	Rationale for Contaminant Deletion or Selection (3)
Lead	2.7		427		mg/kg	MT-SL-702-0011	10/10	40.5	10.54	YES	ASL
Magnesium	961		2540		mg/kg	MT-SO-A6-OVCOMP	10/10	NA	NA	NO	NUT
Manganese	72.4		207	J	mg/kg	MT-SL-702-0011	10/10	100	2.07	YES	ASL
Mercury	0.03	J	4.5		mg/kg	MT-SL-702-0011	9/10	0.00051	8824	YES	ASL
Nickel	6.5		24.5		mg/kg	MT-SL-702-0011	10/10	30	0.82	NO	BSL
Potassium	373	J	1040	J	mg/kg	MT-SO-A6-OVCOMP	10/10	NA	NA	NO	NUT
Sodium	150	J	150	J	mg/kg	MT-SL-702-0011	1/10	NA	NA	NO	NUT
Vanadium	3.6		43.5		mg/kg	MT-SL-603-0007	10/10	2	21.75	YES	ASL
Zinc	14.5		330		mg/kg	MT-SL-702-0011	9/10	8.5	38.82	YES	ASL
Chromium VI	3	J	28		mg/kg	MT-SO-A6-OVCOMP	2/10	30	0.93	NO	BSL

NOTES:
(1) Minimum/maximum detected concentration.
(2) Selection of screening values presented on Table 2-31.
(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)
No Toxicity Information (NTX)
Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
Not a Toxicological Concern (NT)

Definitions: NA = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
EB = present in equipment blank
HQ = Hazard Quotient
EMPC = Estimated maximum possible concentration
* = From dilution analysis

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TABLE 2-29
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sludge Area 1
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening (2) Toxicity Value	Maximum HQ	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
1,2-Dichlorobenzene	440	J	2100		ug/kg	MT-SL-103-0010-AVG	4/4	340	6.2	YES	ASL
1,4-Dichlorobenzene	150	J	250		ug/kg	MT-SL-103-0010-AVG	2/4	350	0.71	NO	BSL
2-Butanone	1600		2200		ug/kg	MT-SL-101-0010	3/4	40500	0.05	NO	BSL
Acetone	1300		1900	EB	ug/kg	MT-SL-102-0012	4/4	4340	0.44	NO	BSL
Carbon Disulfide	1500		6100		ug/kg	MT-SL-102-0012	4/4	2.66	2293	YES	ASL
Methyl Acetate	2800		8900		ug/kg	MT-SL-102-0012	4/4	NA	NA	YES	NTX
2,4,5-Trichlorophenol	5000	J	22000	, J	ug/kg	MT-SL-102-0012, MT-SL-103-0010	3/4	NA	NA	YES	NTX
2-Methylnaphthalene	21000	J	21000	J	ug/kg	MT-SL-102-0012	1/4	70	300	YES	ASL
4-Methylphenol	550000		1300000	*	ug/kg	MT-SL-102-0012	4/4	37.6	34574	YES	ASL
Pentachlorophenol	9100	J	32000		ug/kg	MT-SL-103-0010-AVG	3/4	879	36	YES	ASL
Phenol	6300	J	23000	J	ug/kg	MT-SL-102-0012	4/4	318	72	YES	ASL
4,4'-DDD	5.9	J	5.9	J	ug/kg	MT-SL-104-0010	1/4	2	3.0	YES	ASL
4,4'-DDE	4.8	J	10	J	ug/kg	MT-SL-101-0010	4/4	2	5.0	YES	ASL
4,4'-DDT	4.4	J	4.4	J	ug/kg	MT-SL-101-0010	1/4	1.58	2.8	YES	ASL
Aldrin	6.1	J	6.1	J	ug/kg	MT-SL-104-0010	1/4	2	3.1	YES	ASL
alpha-BHC	4.9	J	24	J	ug/kg	MT-SL-104-0010	3/4	6	4.0	YES	ASL
alpha-Chlordane	3.5	J	62	*J	ug/kg	MT-SL-104-0010	4/4	7	8.9	YES	ASL
beta-BHC	4.1		4.1		ug/kg	MT-SL-103-0010-AVG	1/4	5	0.82	NO	BSL
Dieldrin	7	J	7	J	ug/kg	MT-SL-104-0010	1/4	64	0.11	NO	BSL
gamma-Chlordane	3.3	J	48	*J	ug/kg	MT-SL-104-0010	4/4	7	6.9	YES	ASL
Heptachlor	28	*J	56	*J	ug/kg	MT-SL-104-0010	2/4	5	11	YES	ASL
1,2,3,4,6,7,8-HpCDD	2580	JEB*	54600		ng/kg	MT-SL-103-0010-AVG	4/4	250	218	YES	ASL
1,2,3,4,6,7,8-HpCDF	1130	JEB	4740		ng/kg	MT-SL-103-0010-AVG	4/4	250	19	YES	ASL
1,2,3,4,7,8,9-HpCDF	53.2	JEB	408		ng/kg	MT-SL-103-0010-AVG	4/4	250	1.6	YES	ASL

TABLE 2-29 (cont.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sludge Area 1
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening (2) Toxicity Value	Maximum HQ	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
1,2,3,4,7,8-HxCDD	40.4	JEB	390		ng/kg	MT-SL-103-0010-AVG	4/4	25	16	YES	ASL
1,2,3,4,7,8-HxCDF	55.2	JEB	319		ng/kg	MT-SL-103-0010-AVG	4/4	25	13	YES	ASL
1,2,3,6,7,8-HxCDD	421	JEB	2460		ng/kg	MT-SL-103-0010-AVG	4/4	25	98	YES	ASL
1,2,3,6,7,8-HxCDF	39.5	J	196		ng/kg	MT-SL-103-0010-AVG	4/4	25	7.8	YES	ASL
1,2,3,7,8,9-HxCDD	135	JEB	1530	JEB	ng/kg	MT-SL-101-0010	4/4	25	61	YES	ASL
1,2,3,7,8-PeCDD	26.5	JEB	395	JEB	ng/kg	MT-SL-101-0010	4/4	2.5	158	YES	ASL
1,2,3,7,8-PeCDF	89.3	EMPC	148		ng/kg	MT-SL-103-0010-AVG	3/4	50	3.0	YES	ASL
2,3,4,6,7,8-HxCDF	48.4	JEB	228		ng/kg	MT-SL-103-0010-AVG	4/4	25	9.1	YES	ASL
2,3,4,7,8-PeCDF	5.7	JEB	24.3	JEB	ng/kg	MT-SL-101-0010	4/4	5	4.9	YES	ASL
2,3,7,8-TCDD	7.3	J	103		ng/kg	MT-SL-103-0010-AVG	4/4	2.5	41	YES	ASL
2,3,7,8-TCDF	3.7	J	13.9	J	ng/kg	MT-SL-101-0010	4/4	25	0.56	NO	BSL
OCDD	19200	JEB*	406000		ng/kg	MT-SL-103-0010-AVG	4/4	25000	16	YES	ASL
OCDF	870	JEB	4900		ng/kg	MT-SL-103-0010-AVG	4/4	25000	0.20	NO	BSL
Aluminum	4540		8770		mg/kg	MT-SL-104-0010	4/4	3.825	2293	YES	ASL
Antimony	4		4		mg/kg	MT-SL-103-0010-AVG	1/3	0.248	16	YES	ASL
Arsenic	3.1		7.6	J	mg/kg	MT-SL-104-0010	4/4	0.25	30	YES	ASL
Barium	26.3		45.7		mg/kg	MT-SL-104-0010	4/4	17.2	2.7	YES	ASL
Beryllium	0.08		0.24		mg/kg	MT-SL-104-0010	4/4	2.42	0.10	NO	BSL
Calcium	75000	J	156000		mg/kg	MT-SL-103-0010-AVG	4/4	NA	NA	NO	NUT
Chromium	18200		25200		mg/kg	MT-SL-104-0010	4/4	0.83	30361	YES	ASL
Cobalt	4.9		7.4	J	mg/kg	MT-SL-104-0010	4/4	NA	NA	YES	NTX
Copper	23.7		34.7		mg/kg	MT-SL-104-0010	4/4	34	1.02	YES	ASL

TABLE 2-29 (cont.)
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sludge Area 1
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Screening Toxicity Value (2)	Maximum HQ	COPC Flag	Rationale for Contaminant Deletion or Selection (3)
Iron	5570		10700		mg/kg	MT-SL-102-0012	4/4	20000	0.54	NO	BSL
Lead	43.5		60.4		mg/kg	MT-SL-103-0010-AVG	4/4	0.94	64	YES	ASL
Magnesium	787		1470		mg/kg	MT-SL-104-0010	4/4	460	3.2	NO	NUT
Manganese	3990		13300		mg/kg	MT-SL-102-0012	4/4	322	41	YES	ASL
Nickel	3.4		10.1	J	mg/kg	MT-SL-104-0010	4/4	20.9	0.48	NO	BSL
Potassium	451		892	J	mg/kg	MT-SL-104-0010	4/4	NA	NA	NO	NUT
Selenium	1.3		1.3		mg/kg	MT-SL-103-0010-AVG	1/4	0.331	3.9	YES	ASL
Silver	1.8	J	6.2	J	mg/kg	MT-SL-102-0012	2/4	1	6.2	YES	ASL
Sodium	8160		11300		mg/kg	MT-SL-102-0012	4/4	NA	NA	NO	NUT
Vanadium	20.6		34		mg/kg	MT-SL-104-0010	4/4	0.714	48	YES	ASL
Zinc	128		183		mg/kg	MT-SL-104-0010	4/4	12	15	YES	ASL

NOTES:
(1) Minimum/maximum detected concentration.
(2) Selection of screening values presented on Table 2-32.
(2) Rationale Codes Selection Reason: Above Screening Levels (ASL)
No Toxicity Information (NTX)
Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
Not a Toxicological Concern (NT)

Definitions: NA = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
EB = present in equipment blank
HQ = Hazard Quotient
EMPC = Estimated maximum possible concentration
* = From dilution analysis

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TABLE 2-30

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Area 1 Surface Water
Exposure Point: Mohawk Tannery Ecological Receptors

Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Detection Frequency	Screening (2) Toxicity Value	Maximum HQ	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
Acetone	8.1	J,L	17	J	ug/L	2/2	1500 *	0.01	NO	BSL
Carbon Disulfide	5	L	5	L	ug/L	1/2	0.92 *	5.43	YES	ASL
2-Methylphenol	0.8	L	0.8	L	ug/L	1/2	13 *	0.06	NO	BSL
4-Methylphenol	11		11		ug/L	1/2	NA	NA	YES	NTX
Phenol	2	L	2	L	ug/L	1/2	110 *	0.02	NO	BSL
Pyrene	0.9	L	0.9	L	ug/L	1/2	NA	NA	YES	NTX
Aluminum	6.7		9.6		ug/L	2/2	87	0.11	NO	BSL
Arsenic	0.62		2.6		ug/L	2/2	150	0.02	NO	BSL
Barium	1.1		2.5		ug/L	2/2	4 *	0.63	NO	BSL
Calcium	52		82		mg/L	2/2	NA	NA	NO	NUT
Chromium	6		22		ug/L	2/2	11	2.00	YES	ASL
Cobalt	0.39		0.5		ug/L	2/2	23 *	0.02	NO	BSL
Copper	0.82		1.1		ug/L	2/2	9	0.12	NO	BSL
Iron	79		277		ug/L	2/2	1000	0.28	NO	BSL
Lead	0.22		0.22		ug/L	1/2	2.5	0.09	NO	BSL
Magnesium	0.57		1.6		mg/L	2/2	NA	NA	NO	NUT
Molybdenum	0.91		0.91		ug/L	1/2	370 *	0.00	NO	BSL
Manganese	1465		4990		ug/L	2/2	120 *	41.58	YES	ASL
Nickel	3		4.7		ug/L	2/2	52	0.09	NO	BSL
Selenium	1.9		10	J	ug/L	2/2	5	2.00	YES	ASL
Vanadium	0.21		0.49		ug/L	2/2	20 *	0.02	NO	BSL

NOTES:

(1) Minimum/maximum detected concentration. Metals results presented are dissolved metals.

(2) Water quality criteria from EPA (1999). If marked with asterisk, from ORNL (1996)

(3) Rationale Codes
- Selection Reason: Above Screening Levels (ASL); No Toxicity Information (NTX)
- Deletion Reason: Below Screening Level (BSL); Essential Nutrient (NUT)

Definitions:
- NA = Not Applicable
- COPC = Chemical of Potential Concern
- J = Estimated Value
- L = Low Bias
- HQ = Hazard Quotient

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TABLE 2-31
SURFACE SOIL SCREENING LEVELS (AREAS 2 - 7)
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Parameter	Area						Effects Data						
	2	3	4	5	6	7	ORNL[1] inverte-brates	ORNL[2] plants	ORNL[3] wildlife (in food)	ORNL[4] wildlife PRG	TEF for mam-mals[5]	Best wildlife value	Lowest overall value[6]
Volatile Organic Compounds (ug/kg)													
1,2-Dichlorobenzene					X								NA
1,4-Dichlorobenzene					X		20000						20000
Chlorobenzene					X		40000						40000
Chloroform	X		X						55000			55000	55000
Methyl Acetate	X		X		X								NA
Toluene	X							200000	51500			51500	51500
Semi-volatile Organic Compounds (ug/kg)													
bis(2-Ethylhexyl)phthalate						X			910			910	910
Di-n-Butylphthalate				X				200000	90			90	90
Pesticides and PCBs (ug/kg)													
4,4'-DDE						X			2			2	2
4,4'-DDT					X	X			2			2	2
alpha-Chlordane	X				X	X			1800			1800	1800
Aroclor-1242						X		40000	329	371		371	371
Aroclor-1254			X	X		X		40000	111	371		371	371
delta-BHC						X			70			70	70
Dieldrin						X			64			64	64
Endrin						X			8			8	8
Endrin Ketone			X						8			8	8
gamma-Chlordane	X				X	X			1800			1800	1800
Heptachlor Epoxide						X			476			476	476
Dioxins and Furans (ng/kg)													
1,2,3,4,6,7,8-HpCDD	X	X	X	X	X	X			30	315	0.01	315	315
1,2,3,4,6,7,8-HpCDF	X	X	X	X	X	X			30	315	0.01	315	315
1,2,3,4,7,8,9-HpCDF	X	X	X	X	X	X			30	315	0.01	315	315
1,2,3,4,7,8-HxCDD	X	X	X	X	X	X			3	31.5	0.1	31.5	31.5
1,2,3,4,7,8-HxCDF	X	X	X	X	X	X			3	31.5	0.1	31.5	31.5
1,2,3,6,7,8-HxCDD	X	X	X	X	X	X			3	31.5	0.1	31.5	31.5
1,2,3,6,7,8-HxCDF	X	X	X	X	X	X			590	31.5	0.1	31.5	31.5
1,2,3,7,8,9-HxCDD	X	X	X	X	X	X			3	31.5	0.1	31.5	31.5
1,2,3,7,8,9-HxCDF		X	X	X	X				3	31.5	0.1	31.5	31.5
1,2,3,7,8-PeCDD	X	X	X	X	X	X			0.3	3.15	1	3.15	3.15
1,2,3,7,8-PeCDF	X	X	X	X					590	63	0.05	63	63
2,3,4,6,7,8-HxCDF	X	X	X	X	X	X			3	31.5	0.1	31.5	31.5
2,3,4,7,8-PeCDF	X	X	X		X	X			60	6.3	0.5	6.3	6.3
2,3,7,8-TCDD	X	X	X	X	X	X			0.3	3.15	1	3.15	3.15
2,3,7,8-TCDF	X	X	X	X		X			0.8	840	0.1	840	840
OCDD	X	X	X	X	X	X			3000	31500	0.0001	31500	31500
OCDF	X	X	X	X	X	X			3000	31500	0.0001	31500	31500

TABLE 2-31 (cont.)
SURFACE SOIL SCREENING LEVELS (AREAS 2 - 7)
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Parameter	Area						Effects Data						
	2	3	4	5	6	7	ORNL[1] invertebrates	ORNL[2] plants	ORNL[3] wildlife (in food)	ORNL[4] wildlife PRG	TEF for mammals[5]	Best wildlife value	Lowest overall value[6]
Metals (mg/kg)													
Aluminum	X	X	X	X	X	X	600	50	3.825			3.825	3.825
Antimony	X	X	X	X	X	X		5	0.248			0.248	0.248
Arsenic	X	X	X	X	X	X	60	10	0.25	9.9		9.9	9.9
Barium	X	X	X	X	X	X	3000	500	17.2	283		283	283
Beryllium	X	X	X	X	X	X		10	2.42			2.42	2.42
Cadmium						X	20	4	1.2	4.2		4.2	4
Calcium	X	X	X	X	X	X							NA
Chromium	X	X	X	X	X	X	10		0.83	16.1		16.1	10
Cobalt	X	X	X	X	X	X	1000						1000
Copper	X	X	X	X	X	X	50	100	38.9	370		370	50
Iron	X	X	X	X	X	X	200						200
Lead	X	X	X	X	X	X	500	50	0.94	40.5		40.5	40.5
Magnesium	X	X	X	X	X	X							NA
Manganese	X	X	X	X	X	X	100	500	322			322	100
Mercury	X	X	X	X	X	X	0.1	0.3	0.005	0.00051		0.00051	0.00051
Nickel	X	X	X	X	X	X	90	30	64.1	121		121	30
Potassium	X	X	X	X	X	X							NA
Sodium						X							NA
Vanadium	X	X	X	X	X	X	20	2	0.714	55		55	2
Zinc	X	X	X	X	X	X	100	50	12	8.5		8.5	8.5
Chromium VI				X	X		0.4		12			12	0.4

NOTES:
[1]Efroymson, et al. (1997a)
[2]Efroymson, et al. (1997b)
[3]Sample et al. (1996). Most dioxin/furans adjusted by TEFs for mammals applied to value for TCDD
[4]Efroymson, et al. (1997c). Most dioxin/furans adjusted by TEFs for mammals applied to value for TCDD
[5]van den Berg, 1998
[6]among invertebrate, plant, and best wildlife values

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TABLE 2-32
SEDIMENT SCREENING LEVELS (AREA 1)
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Parameter	Effects Data										
	EPA (1993a) SQC (@ 1% OC)	Long et al. (1995) ER-L	OMEE (1993) LEL	EPA (1996) Ecotox	Calcu-lated with EqP[1]	EPA (1993b) aquatic life[2]	ORNL[3] wildlife (in food)	EPA (1993b) semi-aquatic wildlife[4]	TEF for Fish[5]	TEF for Mam-mals[5]	Lowest Screening Value
Volatile Organic Compounds (ug/kg)											
1,2-Dichlorobenzene				340							340
1,4-Dichlorobenzene				350							350
2-Butanone					40500						40500
Acetone					4340		36600				4340
Carbon Disulfide					2.66						2.66
Methyl Acetate											NA
Semi-Volatile Organic Compounds (ug/kg)											
2,4,5-Trichlorophenol											NA
2-Methylnaphthalene		70									70
4-Methylphenol					37.6						37.6
Pentachlorophenol					11900		879				879
Phenol					318						318
Pesticides (ug/kg)											
4,4'-DDD			8				2				2
4,4'-DDE		2.2					2				2
4,4'-DDT		1.58					2				1.58
Aldrin			2				733				2
alpha-BHC			6				70				6
alpha-Chlordane			7				1800				7
beta-BHC			5				1470				5
Dieldrin	110						64				64
gamma-Chlordane			7				1800				7
Heptachlor			5				476				5
Dioxins and Furans (ng/kg)											
1,2,3,4,6,7,8-HpCDD						60000		250	0.001	0.01	250
1,2,3,4,6,7,8-HpCDF						6000		250	0.01	0.01	250
1,2,3,4,7,8,9-HpCDF						6000		250	0.01	0.01	250
1,2,3,4,7,8-HxCDD						120		25	0.5	0.1	25
1,2,3,4,7,8-HxCDF						600		25	0.1	0.1	25
1,2,3,6,7,8-HxCDD						6000		25	0.01	0.1	25
1,2,3,6,7,8-HxCDF						600		25	0.1	0.1	25
1,2,3,7,8,9-HxCDD						6000		25	0.01	0.1	25
1,2,3,7,8-PeCDD						60		2.5	1	1	2.5
1,2,3,7,8-PeCDF						1200		50	0.05	0.05	50
2,3,4,6,7,8-HxCDF						600		25	0.1	0.1	25
2,3,4,7,8-PeCDF						120		5	0.5	0.5	5
2,3,7,8-TCDD						60		2.5	1	1	2.5
2,3,7,8-TCDF						1200		25	0.05	0.1	25
OCDD						600000		25000	1E-04	1E-04	25000
OCDF						600000		25000	1E-04	1E-04	25000

TABLE 2-32 (cont.)
SEDIMENT SCREENING LEVELS (AREA 1)
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Parameter	Effects Data										
	EPA (1993a) SQC (@ 1% OC)	Long et al. (1995) ER-L	OMEE (1993) LEL	EPA (1996) Ecotox	Calcu-lated with EqP[1]	EPA (1993b) aquatic life[2]	ORNL[3] wildlife (in food)	EPA (1993b) semi-aquatic wildlife[4]	TEF for Fish[5]	TEF for Mam-mals[5]	Lowest Screening Value
Metals and Inorganic Compounds (mg/kg)											
Aluminum							3.825				3.825
Antimony							0.248				0.248
Arsenic		8.2					0.25				0.25
Barium							17.2				17.2
Beryllium							2.42				2.42
Calcium											NA
Chromium		81					0.83				0.83
Cobalt											NA
Copper		34					38.9				34
Iron			20000								20000
Lead		46.7					0.94				0.94
Magnesium			460								460
Manganese							322				322
Nickel		20.9					64.1				20.9
Potassium											NA
Selenium							0.331				0.331
Silver		1									1
Sodium											NA
Vanadium							0.714				0.714
Zinc		150					12				12
Sulfide											NA

[1]EPA's (1993c) equilibrium partitioning (EqP) and a complementary approach explained in text and presented on Table 2-33.
[2]Dioxin/furans adjusted by TEFs for fish applied to value for TCDD
[3]Sample et al. (1996)
[4]Dioxin/furans adjusted by TEFs for mammals applied to value for TCDD
[5]van den Berg, 1998
The first five columns of effects data are in order of preference, from left to right.

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TABLE 2-33
SEDIMENT SCREENING LEVELS FOR ORGANIC COMPOUNDS FROM EQUILIBRIUM PARTITIONING AND WATER-TO-SEDIMENT ASSIGNATION
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Chemical	$\log_{10}K_{ow}$[1]	K_{ow}	K_{oc}	WQG (mg/L)	SQG_{EP} (mg/kg)	SQG_{w-s} (mg/kg)
Pentachlorophenol	5.12	131,826	107,954	0.011	11.9*	0.0318
4-Methylphenol	1.95	89.1	82.6	0.013	0.0107	.0376*
Carbon Disulfide	1.94	87.1	80.8	0.000920	0.000743	0.00266*
Phenol	1.46	28.8	27.3	0.11	0.0300	0.318*
2-Butanone	0.29	1.95	1.93	14	0.270	40.5*
Acetone	-0.24	0.575	0.58	1.5	0.00872	4.34*

NOTES:

[1] K_{ow}s obtained from HSDB at http://toxnet.nlm.nih.gov/

WQG = water quality quideline (either chronic ambient water quality criteria or secondary chronic values from ORNL [Suter and Tsao, 1996], except pentachlorophenol, which is a CAWQC from EPA [1999], calculated using pH=7.5, the median value for sludge in Area 1. Also, the SCV for 2-methylphenol was used for 4-methylphenol.)

SQG_{EP} = sediment quality guideline from equilibrium partitioning

SQG_{w-s} = sediment quality guideline from water-to-sediment assignation

* Selected screening value (used on Table 2-32). Explanation of rationale for selection presented in text.

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TABLE 2-34
NH RCMP BACKGROUND CONCENTRATIONS OF METALS IN SOIL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Metal	NH RCMP Background Concentration
Aluminum	--
Antimony	1.64
Arsenic	11
Barium	--
Beryllium	0.95
Cadmium	1.9
Calcium	--
Chromium	33
Cobalt	--
Copper	--
Iron	--
Lead	51
Magnesium	--
Manganese	--
Mercury	0.31
Nickel	23
Potassium	--
Sodium	--
Vanadium	--
Zinc	98
Chromium VI	--

NOTES:
NHDES RCMP Background Concentrations of Metals in Soil; Section 1.5(4)(c), Table 1; January 1998, revised April 2001.
-- Background concentration not established for this metal.

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TABLE 3-1
SELECTION OF PRELIMINARY REMEDIATION GOALS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Contaminants of Concern[1]	Units	PRG[1] based on CR=10-6	PRG[1] based on CR=10-5	PRG[1] based on CR=10-4	PRG[1] based on HI=0.1	PRG[1] based on HI=1.0	NH RCMP Background Soil Conc.[2]	NH S-1[3]	Proposed PRG[4]
Benzo(a)Pyrene	ug/kg	145	1450	14500				700	145
Pentachlorophenol	ug/kg	6958	69580	695800				3300	6958
4-Methylphenol	ug/kg				71289	712890		5000	712891
Dioxin TEQ	ng/kg	16.7*	167*	1670*					1000[+]
Antimony	mg/kg				7.3	73	1.64	8	73
Arsenic	mg/kg	0.91	9.1	91	5.1	51	11	11	51
Barium	mg/kg				1278	12780		750	12780
Cadmium	mg/kg				8.2	82	1.9	32	82
Chromium[#]	mg/kg				27375	273750	33	1000	273750
Manganese	mg/kg				1278	12775			12775
Vanadium	mg/kg				128	1278			1278

PRG = Preliminary Remediation Goal
CR = Cancer Risk
HI = Hazard Index

1 The COCs and risk-based PRGs were determined based on the Streamlined Human Health Risk Evaluation presented in Section 2.4. The COCs include all compounds that have a cancer risk greater than 1.0E-06 or a non-cancer HI greater than 1.0 for any exposure scenario. The risk-based PRGs were calculated based on the future residential exposure scenario. See Section 3.2 and 3.2 for additional details.

2 NHDES RCMP Background Concentrations of Metals in Soil; Section 1.5, Table 1; January 1998, revised April 2001.

3 NHDES RCMP Method 1 Standards for Category S-1 Soil; Section 7.5, Table 3; January 1998, revised April 2001. The NH S-1 standards are presented here for reference; however they were not used in selecting the proposed PRGs because they are non-promulgated criteria used as default standards in cases where a site-specific risk assessment has not been performed. Because a site-specific risk evaluation was conducted for this site, the calculated risk-based PRGs are used in place of the S-1 standards.

4 The proposed PRGs for all contaminants except dioxin TEQ are the lower of the site-specific PRGs calculated for a cancer risk of 1.0E-6 and hazard index of 1.0. If the selected risk-based value is below the NH RCMP background soil concentration, then the background concentration is selected as the proposed value.

\+ The proposed PRG for dioxin TEQ is EPA's recommended cleanup goal for residential settings (EPA OSWER Directive 9200.4-26: Approach for Addressing Dioxins in Soil at CERCLA and RCRA Sites, U.S. EPA, 1998). This value is proposed for use pending completion of EPA's comprehensive reassessment of the toxicity of dioxin.

* The identified PRGs for dioxin TEQs were calculated using the currently available cancer slope factor (CSF) from IRIS (2002). If the CSF proposed in EPA's recently prepared Draft Dioxin Reassessment (1.0E+6) were used to calculate the PRGs the values would be: 2.5 ng/kg for CR=10-6, 25 ng/kg for CR=10-5, and 250 ng/kg for CR=10-4.

\# The PRGs for chromium are based on trivalent chromium because hexavalent chromium was detected at the site only sporadically and at low concentrations (below screening levels).

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TABLE 4-1
REMOVAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS, TECHNOLOGY TYPES, AND PROCESS OPTIONS
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Environmental Media	Removal Action Objectives	General Response Actions	Technology Types	Process Options
Sludge/Soil	Protection of Human Health Prevent, to the extent practicable, direct contact with, ingestion of, and inhalation of contaminants in tannery sludge and associated soil at concentrations exceeding PRGs. Protection of the Environment Prevent, to the extent practicable, ecological receptor exposure to contaminants exceeding PRGs in tannery sludge and associated soil. Prevent, to the extent practicable, migration of contaminants exceeding PRGs from tannery sludge and associated soil to site groundwater and the Nashua River. Site Restoration Address tannery sludge and associated soil with contaminants exceeding PRGs to restore the site to its intended use for residential purposes.	• Limited Action	• Limited Action Technologies - Access restrictions - Environmental Monitoring - Institutional controls	- fencing - groundwater , surface water, and sediment monitoring - deed restrictions, zoning ordinances
		• Containment	• Containment Technologies: - Horizontal barriers - Vertical barriers	- low permeability cap, permeable cover - slurry wall, grout injection, sheet piling
		• In-Situ Treatment	• In-Situ Technologies: - Thermal Treatment - Physical/Chemical Treatment - Biological treatment	- vitrification, thermal desorption - solidification/stabilization, soil flushing - aerobic biodegradation, anaerobic biodegradation
		• Ex-Situ Treatment	• Ex-situ Treatment Technologies: - Immobilization - Thermal treatment - Physical/Chemical Treatment - Biological treatment	- solidification/stabilization - vitrification, thermal desorption, incineration - soil washing, solvent extraction - aerobic biodegradation, anaerobic biodegradation
		• Disposal	• Disposal Technologies: - Landfill - Land disposal/backfill	- off-site landfill, on-site landfill - on-site disposal/backfill of treated sludge/soil

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TABLE 4-2
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Limited Action	Access Restrictions	Fencing	Installation and/or repair of site fencing to restrict access to contaminated areas.	Eliminated as a primary technology because it would not be effective in protecting ecological receptors or environment. However, may be used with other technologies such as on-site landfill to prevent access to a particular area of the site.
	Environmental Monitoring	Environmental Monitoring	Monitoring of groundwater, surface water, and sediment to determine whether contaminants are migrating from site sludge/soil.	Eliminated as a primary technology because it would not be effective in achieving any RAOs. However, may be used to monitor the effectiveness of other technologies such as on-site landfilling.
	Institutional Controls	Deed Restrictions	Administrative action used to restrict future site activities on individual properties. Activities such as excavation or residential development could be restricted under property deeds.	Eliminated. Would not prevent direct contact with overlying soil and/or sludge. Would not protect ecological receptors or the environment or promote restoration of site to residential use.
		Zoning Ordinances	Administrative action by municipality to change permitted use of land to prevent particular types of development such as residential use. Typically applicable to an area, not an individual parcel.	Eliminated. Would not prevent direct contact with overlying soil and/or sludge. Would not protect ecological receptors or the environment or promote restoration of site to residential use.

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Containment	Horizontal Barriers	Low permeability cap	Clay, asphalt, concrete, or multi-media cover over areas of contamination to prevent direct contact and minimize leaching of contaminants from the sludge/waste into groundwater and subsequent discharge to the Nashua River.	Eliminated. Not effective for preventing the release of contaminants to environment due to sludge/waste located below the water table in Areas 1 and 2. May not be viable in floodplain area (Area 2); would alter flood capacity.
		Permeable cover	Crushed stone or vegetative cover to prevent direct contact and minimize erosion and surface migration of sludge/waste contaminants.	Eliminated. Not effective for preventing the release of contaminants to environment because infiltration not restricted and sludge/waste located below the water table in Areas 1 and 2. May not be viable in floodplain area (Area 2); would alter flood capacity.
	Vertical Barriers	Slurry Walls	Trench filled with clay or cement slurry to form low permeability wall to restrict horizontal migration of sludge/waste contaminants.	Eliminated. Not effective for reducing contaminant leaching from unsaturated sludge/waste and limited effectiveness in a flood area (Area 2). Would not prevent direct contact with overlying soil and/or sludge.
		Grout Injection	Use of pressure-injected cement grout to form impermeable or semi-permeable barrier to restrict horizontal migration of sludge/waste contaminants.	Eliminated. Not effective for reducing contaminant leaching from unsaturated sludge/waste and limited effectiveness in a flood area (Area 2). Would not prevent direct contact with overlying soil and/or sludge.

TABLE 4-2 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Containment (cont'd)	Vertical Barriers (cont'd)	Sheet Piling	Steel or precast concrete sheet piles used to form barrier to restrict horizontal migration of contaminants	Eliminated. Not effective for reducing contaminant leaching from unsaturated sludge/waste and limited effectiveness in a flood area (Area 2). Would not prevent direct contact with overlying soil and/or sludge.
In-Situ Treatment	Thermal Treatment	In-Situ Vitrification	An electrical network is used to melt contaminated soils in-place. Metals are immobilized within a vitreous mass, organics are destroyed by pyrolysis.	Eliminated. Not suitable due to high moisture content of sludge and presence of saturated sludge. Would require excessive energy consumption (and cost) to be effective.
		In-Situ Thermal Desorption	Use of electrically heated in-situ blanket and/or well system to volatilize and oxidize organic contaminants.	Eliminated. Not applicable to inorganic site contaminants of concern. Effectiveness for organics is limited by presence of fine-grained constituents, which increase reaction time due to binding of contaminants.
	Physical/ Chemical Treatment	In-Situ Solidification/ Stabilization	Mixing equipment is used to apply treatment reagents to contaminated soils. Contaminants are physically and/or chemically immobilized in a cement-like mass.	Eliminated. Not applicable to organic site contaminants of concern. Solidification/ stabilization of sludge below the water table would be difficult to implement effectively. May not be viable in floodplain area (Area 2); would alter flood capacity.

TABLE 4-2 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
In-Situ Treatment (cont'd)	Physical/ Chemical Treatment (cont.)	Soil Flushing	In-situ process which employs a water-based extraction fluid and an injection/extraction well system to flush contaminants.	Eliminated. Less effective in low permeability materials such as site sludge. Not suitable in Areas 1, 2, and 3 due to site hydrogeology (proximity to river). May be difficult to control and direct flow of extraction fluid.
	Biological Treatment	In-Situ Enhanced Bioremediation	Indigenous or inoculated microorganisms (e.g., fungi, bacteria, and other microbes) degrade (metabolize) organic contaminants found in soil/sludge, converting them to less harmful end products. Water, nutrients, and/or electron receptors (such as oxygen or nitrate) may be added to enhance degradation. Biodegradation may be aerobic or anaerobic depending on contaminants present and soil/sludge matrix.	Eliminated. Not applicable to inorganic site contaminants of concern. Bioremediation of organic site contaminants may be possible, but process would likely be difficult to enhance and control due to low permeability sludge matrix and close proximity to river.
Ex-Situ Treatment	Immobilization	Solidification/ Stabilization	Mixing of excavated contaminated materials with treatment reagents to physically and/or chemically bind and decrease the mobility of contaminants. Common treatment reagents include cement, pozzolanic materials, thermoplastics, polymers, and asphalt.	Potentially applicable for secondary treatment of residuals from thermal treatment of sludge/soil. Eliminated as a primary treatment option due to inability to effectively treat organic site contaminants of concern.
	Thermal Treatment	Vitrification	Melting of wastes to entrain contaminants in a stable vitreous residual.	Eliminated. Not suitable due to high moisture content of site sludge. Not applicable to wastes containing >25% moisture content (causes excessive fuel consumption).

TABLE 4-2 (cont.)
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SLUDGE/WASTE
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Ex-Situ Treatment (cont'd)	Thermal Treatment (cont.)	Thermal Desorption	Contaminated soils are treated at elevated temperatures to volatilize organics, which are subsequently removed and captured or destroyed.	Eliminated. Effectiveness is reduced by binding of contaminants to fine particles in sludge. Not applicable to inorganic site contaminants of concern. Applicability to dioxin waste is limited.
		Incineration	Contaminated soils are heated extremely high temperatures where organic compounds are destroyed through oxidation.	Eliminated as on-site treatment alternative. Not implementable in densely developed residential area. Retained as an off-site treatment alternative.
	Physical/ Chemical Treatment	Soil Washing	Water-based process in which soils are separated into coarse and fine fractions to reduce the volume of materials requiring intensive treatment or disposal.	Eliminated. Complex waste mixtures (e.g., metals with organics) make soil washing difficult and costly. Abundance of fine particles in sludge (onto which contaminants tend to bind) would hinder volume reduction during sludge separation, rendering soil washing ineffective.
		Solvent Extraction	Desorption of contaminants through washing with a solvent solution.	Eliminated. Complex waste mixtures (e.g., metals with organics) make formulating an effective washing fluid difficult and costly. Effectiveness reduced by binding of contaminants to fine particles.

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Ex-Situ Treatment (cont'd)	Biological Treatment	Slurry Phase Biological Treatment	Sludge is combined with water and other additives to create a slurry that is mixed into a bioreactor to keep solids suspended and microorganisms in contact with the sludge contaminants. Oxygen, nutrients, and microorganisms may be added to the bioreactor to optimize the rate of biodegredation. Upon completion of the process, the slurry is dewatered and the treated solids are disposed of.	Eliminated. Not applicable to inorganic site contaminants of concern. Adundance of fine constituents in site sludge would make mixing and aeration difficult and not cost-effective.
Disposal	Landfill	Off-Site Landfill	Transport and disposal of untreated or treated sludge/waste off-site to an approved hazardous waste or solid waste landfill.	Retained.
		On-Site Landfill	Disposal of sludge/waste in a specially constructed hazardous waste or solid waste landfill on-site.	Retained.
	Land Disposal/ Backfill	On-Site Disposal	On-site use of treated soil/sludge as fill material.	Eliminated. Not feasible for materials that are treated off-site.

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TABLE 4-3
KEY FEATURES OF PROPOSED REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

Project Key Feature	Alternative							
	1A	1B	1C	2A	2B	2C	3-US	3-CAN
PRE-DESIGN INVESTIGATION								
Treatability Study to determine optimal design for odor control system	X	X	X	X	X	X	X	X
Treatability Study to determine optimal mixture of moisture control agent	X	X	X	X	X	X	X	X
SITE PREPARATION								
Clear and Grub all work areas	X	X	X	X	X	X	X	X
Establish Erosion and Sedimentation Controls	X	X	X	X	X	X	X	X
Construct/Improve temporary site access road and on-site haul roads	X	X	X	X	X	X	X	X
Demolish/remove clarifier building and concrete slabs/structures in Area	X	X	X	X	X	X	X	X
Construct overlying soil stockpiling area	X	X	X	X	X	X	X	X
Construct sludge/waste stockpiling area	X	X	X	X	X	X	X	X
Construct vehicle/equipment and personnel decontamination areas	X	X	X	X	X	X	X	X
Prepare in-situ dewatering system	X	X	X	X	X	X	X	X
Clear and grade location of on-site landfill				X	X	X		
Construct landfill liner system				X	X	X		
EXCAVATION AND DISPOSAL								
Excavate and Stockpile overlying soil for use as backfill	X	X	X	X	X	X	X	X
Dewater Area 1 Lagoon	X	X	X	X	X	X	X	X
Excavate sludge/waste and stockpile for pre-treatment	X	X	X	X	X	X*	X	X
Excavate sludge/waste, haul and dump into on-site landfill				X	X	X*		
Dewater excavation areas and sludge stockpiles, if necessary	X	X	X	X	X	X	X	X
Perform odor control during excavation and handling of sludge	X	X	X	X	X	X	X	X
Perform air monitoring during site work	X	X	X	X	X	X	X	X
Dispose of sludge/waste at off-site RCRA D facility	X	X	X					
Dispose of Area 1 sludge at RCRA C facility		X						
Dispose of Area 1 sludge at Canadian landfill facility			X			X		
Transport sludge/waste to American incineration facility							X	
Transport sludge/waste to Canadian off-site incineration facility								X
SITE RESTORATION								
Backfill excavations with overlying soil and clean fill from an off-site sour	X	X	X	X	X	X	X	X
Place and compact backfill to final grade	X	X	X	X	X	X	X	X
Vegetate all disturbed areas by hydroseeding	X	X	X	X	X	X	X	X
Construct landfill cover system				X	X	X		
Install fencing at perimeter of landfill and secure all access points				X	X	X		
POST-REMOVAL SITE CONTROL								
Quarterly site inspections for 5 years (erosion controls and vegetation)	X	X	X	X	X	X	X	X
Post-Closure Care Plan for operation and maintenance of landfill				X	X	X		

Notes:
Alternative 1: Excavation and Off-Site Disposal
Alternative 2: Excavation and Consolidation into On-Site Landfill
--Alts. 1 & 2: A: All waste non-hazardous; B: Area 1 waste hazardous; C: Area 1 waste hazardous, land-ban applicable
Alternative 3: Excavation, Off-Site Treatment and Disposal - A: United States, B: Canada

* Under Alternative 2C, Area 1 sludge would be disposed off-site at Canadian landfill, all other sludge/waste would be placed into the on-site landfill

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TABLE 5-1
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Criteria, Advisories, and Guidance	EPA Region IX Preliminary Remediation Goals (PRGs)	To Be Considered	The Region IX PRGs are generic, risk-based concentrations derived from standardized equations, combining exposure information assumptions and EPA toxicity data. PRGs are typically used for site screening and as initial cleanup goals, if applicable. The Region IX PRGs should be viewed as Agency guidelines rather than legally enforceable standards.	Region IX PRGs were used as preliminary project screening criteria to identify contaminants of potential concern for the human health risk evaluation and EE/CA data evaluation.
	OSWER Directive 9200.4-26, *Approaches for Addressing Dioxins in Soil at CERCLA and RCRA Sites* (April 13, 1998)	To Be Considered	This Directive provides guidance in establishing cleanup levels for dioxins. It recommends a cleanup goal of 1 µg/kg (ppb) of dioxins (as 2,3,7,8-TCDD TEQ) for soils involving residential exposure scenarios, and a cleanup range of 5 to 20 µg/kg of dioxin (as 2,3,7,8-TCDD TEQ) for commercial and industrial exposure scenarios.	OSWER Directive 9200.4-26 was used as a preliminary project screening criterion for dioxin-contaminated sludge and soil in the data evaluation. The 1 ppb cleanup level is also recommended as the preliminary removal goal for site sludge/waste.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To Be Considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.
	EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to compute the non-carcinogenic risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.

TABLE 5-1 (cont.)
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Criteria, Advisories, and Guidance	NH DES RCMP Background Concentrations of Metals in Soil (Subsection 1.5(4)(c), Table 1)	To Be Considered	This table identifies background concentrations of metals that have been observed in New Hampshire soils that can be attributed to natural geological and ecological processes rather than anthropogenic contaminant sources. The values presented in Table 1 are considered representative of non-urban locations in New Hampshire.	NH DES background concentrations of metals were used to assess the source of inorganic constituents that were detected at elevated concentrations in overlying soil at the site. The background concentrations were considered in selection of the recommended PRGs.

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TABLE 5-2
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Regulatory Requirements	Protection of Wetlands (Executive Order 11990), 40 CFR 6.302(a) and 40 CFR 6, App. A (Policy on Implementing E.O. 11990)	Applicable	Federal agencies are required to minimize the destruction, loss or degradation of wetlands, and the order emphasizes the importance of avoiding new construction or harm to wetlands unless there is no practicable alternative to such construction.	There are no designated wetlands within the boundaries of the removal action. Steps will be taken to protect other wetland areas at the site from indirect impacts.
	Floodplain Management (Executive Order 11988, 40 CFR 6.302(b) and 40 CFR 6, App. A (Policy on Implementing E.O. 11988)	Applicable	Federal agencies are required to avoid impacts associated with the occupancy and modification of a floodplain and avoid support of floodplain development wherever there is a practicable alternative.	Areas 1 and 2 are located within the 100-year floodplain and, thus, work within the floodplain cannot be avoided. Steps will be taken to prevent effects on floodplain capacity.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices (40 CFR 257.3-1)	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Engineering controls will be used during the excavation and stockpiling of sludge/waste to comply with these requirements.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate *	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.

TABLE 5-2 (cont.)
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 - EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Regulatory Requirements	Rules Relative to Prevention of Pollution from Dredging, Filling, Mining, Transporting, and Construction (Env-Ws 415)	Applicable	These rules establish criteria for the protection of surface water quality resulting from activities that occur in or on the border of surface water or within a distance of surface water such that direct or immediate degradation may result to water quality.	Alternative 1 will comply with the substantive requirements of this regulation. Alternative 1 will involve erosion and sedimentation controls to prevent impacts to the Nashua River. Site restoration will include measures to prevent alteration of site topography.
	New Hampshire Siting Requirements for Hazardous Waste Facilities (Env-Wm 353.08 and 353.09)	Relevant and Appropriate *	These rules impose restrictions on where hazardous waste facilities can be located, specifically locations near geologic fault areas, or in or near floodplains.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

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TABLE 5-3
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 – EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Regulatory Requirements	CWA - Pre-treatment Regulations (40 CFR 403)	Applicable	These regulations impose restrictions on the discharge of pollutants to Publicly Owned Treatment Works (POTW) and mandate that discharges must comply with the local pretreatment program.	Surface water and groundwater dewatering effluent that would be discharged or disposed of at a POTW would be tested to ensure compliance with these regulations. Alternative 1 would comply.
State Regulatory Requirements	New Hampshire Collection, Storage and Transfer Facility Requirements (Env-Wm 2100)	Relevant and Appropriate	These regulations establish design and operating requirements for collection, storage and transfer facilities.	The removal action will be designed and operated in a manner that is compliant with the substantive provisions of these regulations.
	New Hampshire Fugitive Dust Control (Env-A 1002)	Applicable	These regulations require precautions to prevent, abate, and control fugitive dust during specified activities, including excavation, construction, and bulk hauling.	Alternative 1 would comply with this ARAR since fugitive dust emissions would be controlled and monitored during remedial activities.
	New Hampshire Regulated Toxic Air Pollutants (Env-A 1400)	Applicable	These rules establish Ambient Air Limits (AALs) and air quality impact analyses to protect the public from concentrations of pollutants in ambient air that may cause adverse health effects.	Excavation, stockpiling, transportation, and disposal activities would be implemented to prevent air emissions in excess of AALs. If AALs are not met, then corrective action would be taken to reduce emissions as a result of the removal action.

TABLE 5-3 (cont.)
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 1 – EXCAVATION AND OFF-SITE DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Regulatory Requirements (Cont'd)	Identification and Listing of Hazardous Wastes (Env-Wm 400)	Applicable	These regulations establish the characteristics used to identify solid wastes that are subject to regulation as hazardous waste.	Env-Wm 400, along with 40 CFR 261, would be used to characterize sludge/waste as it is stockpiled during the removal action.
	New Hampshire Requirements for Hazardous Waste Generators (Env-Wm 500)	Applicable*	These regulations outline characterization, recordkeeping, manifesting, labeling, marking and storage requirements for generators of hazardous waste.	If the excavated waste is characterized as hazardous, Alternative 1 will comply with the substantive provisions of these regulations.
	New Hampshire General Requirements for Owners and Operators of Hazardous Waste Facilities (Env-Wm 702)	Relevant and Appropriate *	All hazardous waste treatment and transfer facilities are to meet these environmental, health and design requirements.	If the excavated waste is characterized as hazardous, Alternative 1 will comply with the substantive provisions of these regulations.
	New Hampshire General Operation Requirements (Env-Wm 708)	Relevant and Appropriate *	These rules establish requirements for hazardous waste facility operation.	If the excavated waste is characterized as hazardous, the removal action will be operated in a manner that is compliant with the substantive provisions of these regulations.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

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TABLE 5-4
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 2
Federal Criteria, Advisories, and Guidance	EPA Region IX Preliminary Remediation Goals (PRGs)	To Be Considered	The Region IX PRGs are generic, risk-based concentrations derived from standardized equations, combining exposure information assumptions and EPA toxicity data. PRGs are typically used for site screening and as initial cleanup goals, if applicable. The Region IX PRGs should be viewed as Agency guidelines rather than legally enforceable standards.	Region IX PRGs were used as preliminary project screening criteria to identify contaminants of potential concern for the human health risk evaluation and EE/CA data evaluation.
	OSWER Directive 9200.4-26, *Approaches for Addressing Dioxins in Soil at CERCLA and RCRA Sites* (April 13, 1998)	To Be Considered	This Directive provides guidance in establishing cleanup levels for dioxins. It recommends a cleanup goal of 1 µg/kg (ppb) of dioxins (as 2,3,7,8-TCDD TEQ) for soils involving residential exposure scenarios, and a cleanup range of 5 to 20 µg/kg of dioxin (as 2,3,7,8-TCDD TEQ) for commercial and industrial exposure scenarios.	OSWER Directive 9200.4-26 was used as a preliminary project screening criterion for dioxin-contaminated sludge and soil in the data evaluation. The 1 ppb cleanup level is also recommended as the preliminary removal goal for site sludge/waste.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To Be Considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.
	EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to compute the non-carcinogenic risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.

TABLE 5-4 (cont.)
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 2
State Criteria, Advisories, and Guidance	NH DES RCMP Background Concentrations of Metals in Soil (Subsection 1.5(4)(c), Table 1)	To Be Considered	This table identifies background concentrations of metals that have been observed in New Hampshire soils that can be attributed to natural geological and ecological processes rather than anthropogenic contaminant sources. The values presented in Table 1 are considered representative of non-urban locations in New Hampshire.	NH DES background concentrations of metals were used to assess the source of inorganic constituents that were detected at elevated concentrations in overlying soil at the site. The background concentrations were considered in selection of the recommended PRGs.

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TABLE 5-5
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 2
Federal Regulatory Requirements	Protection of Wetlands (Executive Order 11990), 40 CFR 6.302(a) and 40 CFR 6, App. A (Policy on Implementing E.O. 11990)	Applicable	Federal agencies are required to minimize the destruction, loss or degradation of wetlands, and the order emphasizes the importance of avoiding new construction or harm to wetlands unless there is no practicable alternative to such construction.	There are no designated wetlands within the boundaries of the removal action. Steps will be taken to protect other wetland areas at the site from indirect impacts.
	Floodplain Management (Executive Order 11988, 40 CFR 6.302(b) and 40 CFR 6, App. A (Policy on Implementing E.O. 11988)	Applicable	Federal agencies are required to avoid impacts associated with the occupancy and modification of a floodplain and avoid support of floodplain development wherever there is a practicable alternative.	Areas 1 and 2 are located within the 100-year floodplain and, thus, work within the floodplain cannot be avoided. Steps will be taken to prevent effects on floodplain capacity.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices (41 CFR 257.3-1)	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Engineering controls will be used during the excavation and stockpiling of sludge/waste to comply with these requirements.

TABLE 5-5 (cont.)
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 2
Federal Regulatory Requirements (cont.)	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate*	A hazardous waste treatment, storage or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout. The on-site landfill would not be constructed in the 100-year floodplain so as not to create a risk of contaminant migration through washout.
State Regulatory Requirements	Rules Relative to Prevention of Pollution from Dredging, Filling, Mining, Transporting, and Construction (Env-Ws 415)	Applicable	These rules establish criteria for the protection of surface water quality resulting from activities that occur in or on the border of surface water or within a distance of surface water such that direct or immediate degradation may result to water quality.	Alternative 2 will comply with the substantive requirements of this regulation. Alternative 2 will involve erosion and sedimentation controls to prevent impacts to the Nashua River. Site restoration will include measures to prevent alternation of site topography.
	New Hampshire Siting Requirements for Hazardous Waste Facilities (Env-Wm 353.09 and 353.10)	Relevant and Appropriate*	These rules impose restrictions on where hazardous waste facilities can be located, specifically locations near geologic fault areas, or in or near floodplains.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout. The on-site landfill will not be located within the 100-year flood plain.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

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TABLE 5-6
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE EE/CA
Federal Regulatory Requirements	RCRA – Waste-Specific Prohibitions-Dioxin-Containing Wastes (40 CFR 268.31)	Applicable*	This regulation, applicable to hazardous wastes only, establishes restrictions on land disposal of certain wastes.	A contingency alternative (Alternative 2C) was analyzed to evaluate the potential implications of the land disposal ban.
	CWA - Pre-treatment Regulations (40 CFR 403)	Applicable	These regulations impose restrictions on the discharge of pollutants to Publicly Owned Treatment Works (POTW) and mandate that discharges must comply with the local pretreatment program.	Surface water and groundwater dewatering effluent that would be discharged or disposed of at a POTW would be tested to ensure compliance with these regulations. Alternative 2 would comply.
State Regulatory Requirements	New Hampshire Requirements for Hazardous Waste Generators (Env-Wm 500)	Applicable*	These regulations outline characterization, recordkeeping, manifesting, labeling, marking and storage requirements for generators of hazardous waste.	If the excavated waste is characterized as hazardous, Alternative 2 will comply with the substantive provisions of these regulations.
	New Hampshire Fugitive Dust Control (Env-A 1002)	Applicable	These regulations require precautions to prevent, abate, and control fugitive dust during specified activities, including excavation, construction, and bulk hauling.	Fugitive dust emissions would be controlled during remedial activities.
	New Hampshire Regulated Toxic Air Pollutants (Env-A 1400)	Applicable	These rules establish Ambient Air Limits (AALs) and air quality impact analyses to protect the public from concentrations of pollutants in ambient air that may cause adverse health effects.	Excavation, stockpiling, transportation, and disposal activities would be implemented to prevent air emissions in excess of AALs. If AALs are not met, then corrective action would be taken to reduce emissions as a result of the removal action.

TABLE 5-6 (cont.)
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE EE/CA
State Regulatory Requirements (cont.)	Identification and Listing of Hazardous Wastes (Env-Wm 400)	Applicable	These regulations establish the characteristics used to identify solid waste that is subject to regulation as hazardous waste.	Env-Wm 400, along with 40 CFR 261, would be used to characterize sludge/waste as it is stockpiled during the removal action.
	New Hampshire General Requirements for Owner and Operators of Hazardous Waste Facilities (Env-Wm 702)	Relevant and Appropriate*	All hazardous waste treatment and transfer facilities are to meet these environmental, health and design requirements.	The design of the on-site landfill, excavation plan, and other engineering controls necessary to implement Alternative 2 would comply with this ARAR.
	New Hampshire General Operation Requirements (Env-Wm 708)	Relevant and Appropriate*	These rules establish requirements for hazardous waste facility operation.	If the excavated waste is characterized as hazardous, the removal action will be operated in a manner that is compliant with the substantive provisions of these regulations.
	New Hampshire Collection, Storage and Transfer Facility Requirements (Env-Wm 2100)	Relevant and Appropriate	These regulations establish design and operating requirements for collection, storage and transfer facilities.	The removal action will be designed and operated in a manner that is compliant with the substantive provisions of these regulations.

TABLE 5-6 (cont.)
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 2 – EXCAVATION AND CONSOLIDATION INTO ON-SITE LANDFILL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE EE/CA
State Regulatory Requirements (cont.)	New Hampshire Landfill Requirements (Env-Wm 2500)	Relevant and Appropriate	These regulations establish the design requirements for municipal solid waste landfills that are constructed in the State of New Hampshire.	The on-site landfill would be designed according to the requirements outlined in 40 CFR 258 and this state regulation.
	New Hampshire Groundwater Protection Rules, Water Quality Sampling, Analysis, and Reporting; Groundwater Monitoring Wells (Env-Ws 410.30 and 410. 31)	Applicable	These rules establish the requirements for sampling and monitoring groundwater, and specify monitoring well design and installation.	Sampling and monitoring of groundwater monitoring wells under the post-closure care program would be conducted according to these requirements.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

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TABLE 5-7
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Criteria, Advisories, and Guidance	EPA Region IX Preliminary Remediation Goals (PRGs)	To Be Considered	The Region IX PRGs are generic, risk-based concentrations derived from standardized equations, combining exposure information assumptions and EPA toxicity data. PRGs are typically used for site screening and as initial cleanup goals, if applicable. The Region IX PRGs should be viewed as Agency guidelines rather than legally enforceable standards.	Region IX PRGs were used as preliminary project screening criteria to identify contaminants of potential concern for the human health risk evaluation and EE/CA data evaluation.
	OSWER Directive 9200.4-26, *Approaches for Addressing Dioxins in Soil at CERCLA and RCRA Sites* (April 13, 1998)	To Be Considered	This Directive provides guidance in establishing cleanup levels for dioxins. It recommends a cleanup goal of 1 μg/kg (ppb) of dioxins (as 2,3,7,8-TCDD TEQ) for soils involving residential exposure scenarios, and a cleanup range of 5 to 20 μg/kg of dioxin (as 2,3,7,8-TCDD TEQ) for commercial and industrial exposure scenarios.	OSWER Directive 9200.4-26 was used as a preliminary project screening criterion for dioxin-contaminated sludge and soil in the data evaluation. The 1 ppb cleanup level is also recommended as the preliminary removal goal for site sludge/waste.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To Be Considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.
	EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to compute the non-carcinogenic risk resulting from exposure to contaminants and in the development of acceptable contaminant levels.

TABLE 5-7 (cont.)
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Criteria, Advisories, and Guidance	NH DES RCMP Background Concentrations of Metals in Soil (Subsection 1.5(4)(c), Table 1)	To Be Considered	This table identifies background concentrations of metals that have been observed in New Hampshire soils that can be attributed to natural geological and ecological processes rather than anthropogenic contaminant sources. The values presented in Table 1 are considered representative of non-urban locations in New Hampshire.	NH DES background concentrations of metals were used to assess the source of inorganic constituents that were detected at elevated concentrations in overlying soil at the site. The background concentrations were considered in selection of the recommended PRGs.

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TABLE 5-8
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Regulatory Requirements	Protection of Wetlands (Executive Order 11990), 40 CFR 6.302(a) and 40 CFR 6, App. A (Policy on Implementing E.O. 11990)	Applicable	Federal agencies are required to minimize the destruction, loss or degradation of wetlands, and the order emphasizes the importance of avoiding new construction or harm to wetlands unless there is no practicable alternative to such construction.	There are no designated wetlands within the boundaries of the removal action. Steps will be taken to protect other wetland areas at the site from indirect impacts.
	Floodplain Management (Executive Order 11988, 40 CFR 6.302(b) and 40 CFR 6, App. A (Policy on Implementing E.O. 11988)	Applicable	Federal agencies are required to avoid impacts associated with the occupancy and modification of a floodplain and avoid support of floodplain development wherever there is a practicable alternative.	Areas 1 and 2 are located within the 100-year floodplain and, thus, work within the floodplain cannot be avoided. Steps will be taken to prevent effects on floodplain capacity.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices (40 CFR 257.3-1)	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Engineering controls will be used during the excavation and stockpiling of sludge/waste to comply with these requirements.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate*	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.

TABLE 5-8 (cont.)
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Regulatory Requirements	Rules Relative to Prevention of Pollution from Dredging, Filling, Mining, Transporting, and Construction (Env-Ws 415)	Applicable	These rules establish criteria for the protection of surface water quality resulting from activities that occur in or on the border of surface water or within a distance of surface water such that direct or immediate degradation may result to water quality.	Alternative 3 will comply with the substantive requirements of this regulation. Alternative 3 will involve erosion and sedimentation controls to prevent impacts to the Nashua River. Site restoration will include measures to prevent alteration of site topography.
	New Hampshire Siting Requirements for Hazardous Waste Facilities (Env-Wm 353.08 and 353.09)	Relevant and Appropriate*	These rules impose restrictions on where hazardous waste facilities can be located, specifically locations near geologic fault areas, or in or near floodplains.	Some sludge/waste will need to be excavated from areas of the site located within the 100-year floodplain. If the waste is characterized as hazardous, engineering controls will be used to minimize the risk of contaminant migration through washout.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

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TABLE 5-9
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
Federal Regulatory Requirements	CWA - Pre-treatment Regulations (40 CFR 403)	Applicable	These regulations impose restrictions on the discharge of pollutants to Publicly Owned Treatment Works (POTW) and mandate that discharges must comply with the local pretreatment program.	Surface water and groundwater dewatering effluent that would be discharged or disposed of at a POTW would be tested to ensure compliance with these regulations. Alternative 3 would comply.
State Regulatory Requirements	New Hampshire Collection, Storage and Transfer Facility Requirements (Env-Wm 2100)	Relevant and Appropriate	These regulations establish design and operating requirements for collection, storage and transfer facilities.	The removal action will be designed and operated in a manner that is compliant with the substantive provisions of these regulations.
	New Hampshire Fugitive Dust Control (Env-A 1002)	Applicable	These regulations require precautions to prevent, abate, and control fugitive dust during specified activities, including excavation, construction, and bulk hauling.	Alternative 3 would comply with this ARAR since fugitive dust emissions would be controlled and monitored during remedial activities.
	New Hampshire Regulated Toxic Air Pollutants (Env-A 1400)	Applicable	These rules establish Ambient Air Limits (AALs) and air quality impact analyses to protect the public from concentrations of pollutants in ambient air that may cause adverse health effects.	Excavation, stockpiling, transportation, and disposal activities would be implemented to prevent air emissions in excess of AALs. If AALs are not met, then corrective action would be taken to reduce emissions as a result of the removal action.

TABLE 5-9 (cont.)
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE 3 – EXCAVATION, OFF-SITE TREATMENT AND DISPOSAL
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR ALTERNATIVE 1
State Regulatory Requirements (Cont'd)	Identification and Listing of Hazardous Wastes (Env-Wm 400)	Applicable	These regulations establish the characteristics used to identify solid wastes that are subject to regulation as hazardous waste.	Env-Wm 400, along with 40 CFR 261, would be used to characterize sludge/waste as it is stockpiled during the removal action.
	New Hampshire Requirements for Hazardous Waste Generators (Env-Wm 500)	Applicable*	These regulations outline characterization, recordkeeping, manifesting, labeling, marking and storage requirements for generators of hazardous waste.	If the excavated waste is characterized as hazardous, Alternative 3 will comply with the substantive provisions of these regulations.
	New Hampshire General Requirements for Owners and Operators of Hazardous Waste Facilities (Env-Wm 702)	Relevant and Appropriate*	All hazardous waste treatment and transfer facilities are to meet these environmental, health and design requirements.	If the excavated waste is characterized as hazardous, Alternative 3 will comply with the substantive provisions of these regulations.
	New Hampshire General Operation Requirements (Env-Wm 708)	Relevant and Appropriate*	These rules establish requirements for hazardous waste facility operation.	If the excavated waste is characterized as hazardous, the removal action will be operated in a manner that is compliant with the substantive provisions of these regulations.

* These regulations will be applicable or relevant and appropriate only if the waste is characterized as hazardous.

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TABLE 5-10
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS			
Overall Protection of Human Health and the Environment	Would meet NTCRA removal action objectives and be consistent with long-term remedial actions.	Would meet NTCRA removal action objectives, but would be less acceptable than Alternatives 1 and 3 in meeting the future residential use RAO.	Same as Alternative 1.
	Would prevent direct contact with and ingestion of contaminated sludge/waste, prevent contaminant leaching to groundwater, and reduce erosion and off-site migration of contamination.	Same as Alternative 1 provided that the landfill is properly operated and maintained and is not allowed to erode or degrade.	Same as Alternative 1.
	No unacceptable short-term impacts would be anticipated.	Same as Alternative 1.	Same as Alternative 1.
Compliance with ARARs	Discharge of dewatering effluent to the Nashua sewer system would be implemented to comply with all federal, state and local requirements.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with federal and state floodplain regulations.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with state testing and waste identification regulations.	Same as Alternative 1.	Same as Alternative 1.

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS (cont.)			
Compliance with ARARs (cont.)	Would comply with state regulations for generators of hazardous waste.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with federal and state regulations for solid and hazardous waste storage facilities.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with state air pollution control regulations.	Same as Alternative 1.	Same as Alternative 1.
	Would comply with state solid waste regulations.	Same as Alternative 1.	Same as Alternative 1.
Long-term Effectiveness and Permanence	No residual risks, above selected PRGs, would remain at the site.	Residual risk would exist in the form of contaminated sludge/waste in the on-site landfill. If degradation or failure of the engineered landfill liner system were to occur, contaminants could pose a threat to the environment and human and ecological receptors.	Same as Alternative 1.

TABLE 5-10 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS (cont.)			
Long-term Effectiveness and Permanence (cont.)	Would be effective in the long term and would be permanent.	Would be effective in the long term and would be permanent provided that the landfill system is properly operated and maintained. Long-term operation and maintenance of the landfill is required to ensure Alternative 2's continued effectiveness.	Same as Alternative 1.
Reduction of Toxicity, Mobility, or Volume Through Treatment	No treatment involved under Alternative 1.	No treatment involved under Alternative 2.	Off-site treatment performed under Alternative 3 (incineration) would reduce the toxicity and volume of contamination in sludge/waste through treatment. Stabilization of treatment residuals (if necessary) would reduce the mobility of contaminants in sludge/waste residuals.
	Would not satisfy statutory preference for treatment.	Same as Alternative 1.	Would satisfy statutory preference for treatment.

TABLE 5-10 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
EFFECTIVENESS (cont.)			
Short-term Effectiveness	Limited impacts to community, on-site workers, and environment.	Same as Alternative 1.	Same as Alternative 1.
	Increase in heavy vehicle traffic in site vicinity anticipated. Would be addressed through traffic control and coordination with community and state agencies.	Comparable to Alternative 1. Alternative 2 would require less truck traffic to and from the site since excavated sludge/waste would not be transported off of the site. However, duration of site work would be longer.	Same as Alternative 1.
	Potential for sulfide odor and dust emissions (metals, SVOCs, dioxins) during excavation. Emissions monitoring and control measures would prevent or minimize potential problems.	Same as Alternative 1. Emissions issues could be slightly more problematic due to additional onsite handling of sludge/waste during landfill construction.	Same as Alternative 1.
	Increased noise due to site and construction activities. Would coordinate with community to lessen impacts.	Same as Alternative 1.	Same as Alternative 1.
	Estimated duration of on-site removal activities: 11 months.	Estimated duration of on-site removal activities: 16 months.	Estimated duration of on-site removal activities: 11 months.

TABLE 5-10 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
IMPLEMENTABILITY			
Technical Feasibility	Excavation of sludge/waste below the water table could be technically difficult and adversely impact production rates, but would be technically feasible. Excavation of wastes in vicinity of sewer interceptor would require extra caution, but would be feasible. All other aspects of the Alternative would be readily implementable.	Excavation difficulties same as Alternative 1. May be difficult to design and construct on-site landfill that would contain large volume of waste, and be aesthetically acceptable to nearby residents.	Same as Alternative 1.
	Additional response actions could be implemented, if needed.	Similar to Alternative 1, but additional actions may be more difficult and costly if actions involve modifying the on-site landfill.	Same as Alternative 1.
	Would contribute to the site’s long-term remedial action.	Comparable to Alternative 1. Contaminated sludge/waste would remain on site, but would be contained by the landfill liner and cover systems.	Same as Alternative 1.

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
IMPLEMENTABILITY (cont.)			
Administrative Feasibility	No permits for on-site work needed.	Approval process for the construction of the on-site landfill may be difficult and time-consuming.	Same as Alternative 1.
	Alternative 1A: Administrative feasibility for off-site disposal of non-hazardous waste would be high. Alternative 1B: Off-site disposal of Area 1 sludge at a RCRA C facility would not provide any additional administrative feasibility issues beyond those for Alternative 1A. Alternative 1C: Administrative issues related to the disposal of Area 1 sludge at a Canadian landfill would be slightly more difficult than those for Alternatives 1A and 1B.	Alternatives 2A and 2B: Since no off-site disposal of sludge/waste would be performed under Alternatives 2A and 2B, no administrative action would be required for disposal. Alternative 2C: Administrative issues related to the off-site disposal of Area 1 sludge at a Canadian landfill would make Alternative 2C more difficult to implement from an administrative standpoint.	Alternative 3-US: Administrative actions required for off-site treatment and disposal of non-hazardous or hazardous waste at an American facility would not be difficult. Alternative 3-CAN: Administrative actions required for the off-site treatment and disposal of sludge/waste at a Canadian incinerator would be more difficult to implement than for Alternative 3-US.
	Administrative approval and analytical data required for discharge of dewatering effluent to the city sewer system.	Same as Alternative 1.	Same as Alternative 1.
	Would require coordination with NHDES and the City of Nashua for construction of the site access road and for traffic controls on Broad Street.	Same as Alternative 1.	Same as Alternative 1.

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
IMPLEMENTABILITY (cont.)			
Availability of Services and Materials	Qualified contractors for all on-site activities would be available for competitive bidding.	Same as Alternative 1.	Same as Alternative 1.
	Qualified national off-site disposal facilities (RCRA D, RCRA C, and in Canada) capable and willing to receive dioxin-containing waste have been identified during preparation of the EE/CA. Final acceptability of site sludge/waste at any facility would be contingent on the results of waste characterization samples collected during the removal action.	No off-site disposal of sludge/waste would be necessary under Alternatives 2A and 2B. Qualified Canadian facilities have been identified that would be capable of receiving dioxin-containing waste should Alternative 2C be implemented.	Qualified national and international off-site incineration facilities capable and willing to receive dioxin-bearing wastes have been identified during preparation of the EE/CA. Fewer facilities are available than for Alternative 1, particularly in United States. Final acceptability of site sludge/waste at any facility would be contingent on the results of waste characterization samples collected during the removal action.
State Acceptance	To be addressed after close of public comment period.	Same as Alternative 1.	Same as Alternative 1.
Community Acceptance	To be addressed after close of public comment period.	Same as Alternative 1.	Same as Alternative 1.

TABLE 5-10 (cont.)
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
FINAL ENGINEERING EVALUATION/COST ANALYSIS
MOHAWK TANNERY SITE
NASHUA, NEW HAMPSHIRE

CRITERION	ALTERNATIVE 1: EXCAVATION and OFF-SITE DISPOSAL	ALTERNATIVE 2: CONSOLIDATION into ON-SITE LANDFILL	ALTERNATIVE 3: EXCAVATION, OFF-SITE TREATMENT, and DISPOSAL
COST			
Capital Costs	Alternative 1A: $14,939,000 Alternative 1B: $20,428,000 Alternative 1C: $22,819,000	Alternative 2A: $5,572,000 Alternative 2B: $5,572,000 Alternative 2C: $18,428,000	Alternative 3-US: $69,715,000 Alternative 3-CAN: $50,152,000
Annual PRSC Costs	Years 1-2: $4,000 Years 3-30: $0	Years 1-2: $155,275 Years 3-5: $60,075 Years 6-30: $37,275	Years 1-2: $4,000 Years 3-30: $0
Total Present Worth Costs	Alternative 1A: $14,946,000 Alternative 1B: $20,435,000 Alternative 1C: $22,826,000	Alternative 2A: $6,300,000 Alternative 2B: $6,300,000 Alternative 2C: $19,156,000	Alternative 3-US: $69,722,000 Alternative 3-CAN: $50,160,000