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August 15, 2005

Ms. Kimberly Tisa
EPA New England, Region 1
1 Congress Street
Suite 1100 (CPT)
Boston, MA 02114-2023

Re: McCoy Field – Wetlands Restoration Project
Risk Based Cleanup Request
Response to Versar Review Comments

Dear Ms. Tisa:

This letter responds to the Eco-Risk comments prepared by Versar that you forwarded to us via email on August 4th. The review comments were compiled by Versar, based upon their review of the ecological risk characterization attached to the risk based cleanup plan request submitted to you on June 20, 2005. The comments and our responses are as follows:

General Comment – Congener Analysis versus Total PCBs (as Aroclor 1254)

Response

It is recognized that a dozen PCB congeners (77, 81, 105, 114, 123, 126, 156, 157, 167, 169, and 189) are believed to possess dioxin-like effects and can be assessed using World Health Organization (WHO) 2,3,7,8-TCDD toxic equivalency factors (TEFs) (although these TEFs are not yet endorsed by U.S. EPA, per http://www.epa.gov/toxteam/pcbid/tefs.htm). However, it is not considered appropriate to use composition data from commercial Aroclor mixtures (which vary in composition at any rate) to estimate environmental media concentrations of specific PCB congeners. Dioxin-like PCB congeners differ by up to one to two orders of magnitude in their water solubilities, vapor pressures, K_{OW} values, and Henry's Law constants. Therefore, the composition of PCB mixtures changes over time after release to the environment, through partitioning, chemical transformation, and preferential bioaccumulation. As stated in the National Academy of Sciences review draft of *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds, Part I: Estimating Exposure to Dioxin-Like Compounds, Volume 1: Sources of Dioxin-Like Compounds in the United States* (U.S. EPA 1993):

> " [I]t can be both imprecise and inappropriate to infer concentrations of dioxin-like PCB congeners in an environmental sample based on characterization of the sample's Aroclor content and knowledge of the dioxin-like congener content in the commercial Aroclor. Safe (1994) wrote, "Regulatory agencies and environmental scientists have recognized that the composition of PCBs in most environmental extracts does not resemble the compositions of the commercial product." Similarly, ATSDR (1993) stated, "It is important to recognize that the PCBs to

> which people may be exposed are likely to be different from the original PCB source because of changes in congener and impurity composition resulting from differential partitioning and transformation in the environment and differential metabolism and retention.""

In addition to concentration differences within environmental media, differences in the chemical properties of dioxin-like PCB congeners will affect the extent to which the congener will bind to Site sediments and accumulate in other Site media. Using total PCB soil exposure point concentrations and intakes to estimate a "dioxin-like" risk, results in highly uncertain risk estimates.

Assuming the validity of this extrapolation approach, it is noted that the commenter applied the Aroclor 1254 lot (Lot A-4) with the highest percentage of dioxin-like congeners provided on EPA's website. The table on EPA's website is footnoted as follows: "*Lot A4 Aroclor 1254 from abnormal late production (1974-1977) made by chlorinating A1016 distillate residue and contains elevated percentages of non- and mono-ortho chlorinated congeners relative to "normal" G4 Lot.*" Use of this lot data may overestimate the concentration of dioxin-like congeners on the Site. If the average of the two lots (Lots A4 and G4) is applied, the resultant hazard quotients are reduced, as shown below and in Appendix A):

Based on Total PCB EPC of 2.089 mg/kg				
Basis of Dioxin-Like PCB Concentrations	Robin	Shrew	Hawk	Raccoon
	HQ High (Low)	HQ High (Low)	HQ High (Low)	HQ High (Low)
Extrapolated from Lot A4	5.5 (0.6)	72 (7.2)	0.0005 (0.00005)	0.09 (0.009)
Extrapolated from Average of Lots A4 and G4	2 (0.2)	15 (1.5)	0.0003 (0.00003)	0.02 (0.002)

This reduces the risks to robin, hawk and raccoon to below the maximum acceptable HQ of 1, and the HQs for shrew to 15 (high) and 1.5 (low). As it is, a decision has been made to remove PCBs in wetland soil above 1 mg/kg (TSCA requirement), even though the risk characterization concluded that no significant risks are posed to human or environmental receptors. Assuming that all locations with PCBs at concentrations above 1 mg/kg are remediated to 1 mg/kg and all locations below 1 mg/kg remain the same, the overall exposure point PCB concentration [97.5% Chebyshev (mean, Sd) UCL; Appendix B] declines from 2.089 mg/kg to 0.572 mg/kg, or a nearly four-fold decrease. This will also reduce the dioxin-like PCB concentrations, if present, by a factor of about 4, reducing ecological risks potentially posed by dioxin-like PCBs to levels below the maximum acceptable HQ of 1 for all ecological receptor groups.

Comment #1 Executive Summary (Page i, 4th paragraph).

Response The rationale for selecting the depth of the soil sample is not discussed in the Method 3 Risk Characterization, but is presented in other site documents. Since fill material was not placed directly in the wetland area, the migration pathway was determined to be from erosion of upland portions of the Disposal Site. This resulted in the presence of constituents predominantly in near surface soil. Supplemental sampling to a depth of three feet has been performed recently to verify that assumption.

Comment #2 Section 5.1.3.1 Potential Receptors (page 15)

Response Given the urban environment of the Site, the presence of red fox is not expected to be frequent. However, to demonstrate that this receptor is not at risk, exposure of a red fox was assessed assuming a 100% diet of on-Site shrew and using exposure factors from U.S. EPA (1999) and U.S. EPA (1993) (Appendix C). The High and Low Hazard Indices (HIs) for this receptor group are 0.0006 and 0.0002, respectively, below levels of concern. Based on this screening, the site does not pose a significant risk to red fox.

Comment #3 Section 5.1.3.1 Potential Receptors (page 15)

Response Terrestrial and aquatic plants were not assessed because the area is densely vegetated, directly demonstrating the lack of significant impact to plants. However, a screening assessment is presented in Appendix D in which soil/sediment exposure point concentrations (EPCs) are compared with plant toxicity reference values (TRVs). Note that only PCBs and metals have established plant TRVs; values for PAHs were obtained from the literature. Of the constituents of concern, two exceed their TRV: chromium and lead. The TRV for chromium, however, is based on hexavalent chromium, a more toxic form of chromium not anticipated to be present in Site soil (soil was analyzed for total chromium). In addition, the chromium EPC of 13 mg/kg is below its background level in natural soil [30 mg/kg; MADEP (2002)]. Similarly, the TRV for lead is based on lead chloride, a soluble form of lead. From the same reference (Efromyson et al., 1997), an analogous benchmark for the less soluble lead oxide is 300 mg/kg, which the lead EPC is below. Based on this screening, the site does not pose a significant risk to terrestrial and wetland plants.

Comment #4 Section 5.2.1.2 Sediment Interstitial Water and Surface Water (page 17)

Response The relationship of $C_{SW} = C_{SWI}/10$ was an assumption made to approximate surface water concentrations in the absence of actual surface water data. It is not based on any particular model.

Comment #5 Section 5.2.1.4 Prey Species (page 18)

Response Sample et al. (1998) presents bioaccumulation models for small mammals; however, only for metals and dioxin compounds. U.S. EPA (1999) lists various media-to-receptor bioconcentration factors, but none for soil-to-mammals. An on-line resource review identified no empirically derived uptake factors or bioaccumulation models for organic constituents from

soil to shrew, necessitating the approach [use of a mammalian biotransfer factor per U.S. EPA (1999)] applied in the risk characterization.

Comment #6 Section 5.2.2.1 Terrestrial Invertebrates (page 19)

Response As stated in Section 5.1.4 of the report, survival of aquatic and terrestrial invertebrates, rather than growth and reproduction, was selected as an assessment endpoint because of the *potentially limited habitat* as a result of the intermittent submergence and drying up of the wetland area, not because the intermittent submergence and drying up of the wetland area limits exposure time. However, soil EPCs are compared with chronic TRVs for terrestrial invertebrates in Appendix E. No constituent exceeded its chronic TRV; the EPC for PCBs (2.09 mg/kg) was below its chronic TRV of 2.5 mg/kg. A total HI of 1.9 was derived, indicating a minimal chronic impact to terrestrial invertebrates.

Comment #7 Section 5.2.2.2 Aquatic Invertebrates (page 19)

Response Bulk sediment constituent concentrations were compared with sediment benchmarks in Section 3.3.2 as a screening tool for selecting COCs. As stated in this section, these benchmarks do not consider site-specific factors, such as the organic carbon content of the sediment (that strongly influences the bioavailability of the constituent). Therefore, exceedance of a screening benchmark does not necessarily indicate that the constituent is causing harm at the Site. Since the organic carbon content of soil/sediments is high (average total organic carbon content of 31.4%), these benchmarks were considered an inadequate basis for identifying site-specific risks. For this reason, calculated interstitial water constituent concentrations were used to assess site-specific risks to aquatic invertebrates.

Comment #9 Section 5.2.2.3 Amphibians (pages 19-20).

Response As stated in Section 5.1.3.2, amphibian species are directly exposed to impacted media, which includes surface water and sediments. However, benchmark values were not available in sediment form. Since all of the TRVs applied were based on tests performed on the egg or tadpole stage (Table 17) and since frogs typically lay their eggs on the water surface or attached to floating or submerged vegetation and tadpoles stay within the water column (Section 5.5.3), use of an estimated surface water concentration was judged a reasonable approach to assess site-specific risks.

Comment #10 Section 5.2.3 Exposure and Risk Characterization Equations.

Response Agreed; these units have been expanded, as recommended. This does not change the results of the risk characterization.

Comment #11 Table 2 – Summary of Wetland Soil/Sediment Analytical Results

Response This discrepancy is a result of averaging results from locations WD-25, WD-25A, WD-25B, WD-25C, and WD-25D on Table 2, which was done to avoid over-presenting this location. This averaging was not done when using Pro-UCL. Table 2 has been changed to remove this averaging, making the number of samples, mean, and median the same on Table 2 and the

ProUCL output. The PCB UCL on Table 2 was changed from 2.09 mg/kg to 2,089 µg/kg for unit consistency. This does not change the results of the risk characterization.

Comment #12 Appendix D and Appendix E, Risk Calculations for the Red-Tailed Hawk, Short Tailed Shrew and Raccoon.

Response Agreed; the units have been changed. This does not change the results of the risk characterization.

Comment #13 Appendix E, Table E-1. Risk Calculations for the Short-tailed Shrew

Response Agreed; this calculation inadvertently applied IR_{soil} rather than C_{soil}, and has been corrected. As noted in the comment, this does not change the total exposure and risk levels.

Despite some of the uncertainties associated with the ecological risk characterization, we believe that removal of PCB-impacted sediment to a target cleanup level of 1 ppm will reduce the risk to the environment by a factor of at least 4. Even under the most conservative assumptions regarding the individual congener composition of the 1254 Aroclor, the resulting HI for all ecological receptor groups is below 1 after the proposed remediation.

We trust the above responses address the concerns raised in Versar's review. Please call either Cyndee Fuller (401/330-1220) or Al Hanscom (781/255-1982) with any questions related to the above responses, or any further comments that may arise.

Very truly yours,

BETA GROUP, INC.

Alan D. Hanscom, P.E., LSP
Associate

ESS GROUP, INC.

Cynthia Fuller
Risk Assessor

Attachments

Cc: Scott Alfonse, City of New Bedford
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APPENDIX A
EXTRAPOLATION OF DIOXIN-LIKE PCB CONCENTRATIONS FROM AROCLOR 1254 COMPOSITION DATA AND ASSOCIATED RISK TO ECOLOGICAL RECEPTORS
Former McCoy Field
New Bedford, Massachusetts

Congener No.	Aroclor 1254 Composition Data [1] (weight percent)			1997 WHO TEF [2] (mammals)	2,3,7,8-TEQ (Weight Fraction) (mammals)	1997 WHO TEF [2] (birds)	2,3,7,8-TEQ (Weight Fraction) (birds)
	Lot A4	Lot G4	Average				
77	0.2	0.03	0.11	0.0001	1.15E-07	0.05	5.75E-05
81	0.003	-	0.003	0.0001	2.85E-09	0.1	2.85E-06
105	7.37	3.0	5.2	0.0001	5.18E-06	0.0001	5.18E-06
114	0.50	0.18	0.34	0.0005	1.72E-06	0.0001	3.43E-07
118	13.6	7.35	10.5	0.0001	1.05E-05	0.00001	1.05E-06
123	0.32	0.15	0.24	0.0001	2.35E-07	0.00001	2.35E-08
126	0.016	0.0017	0.009	0.1	8.77E-06	0.1	8.77E-06
156	1.13	0.82	0.97	0.0005	4.86E-06	0.0001	9.71E-07
157	0.30	0.19	0.25	0.0005	1.24E-06	0.0001	2.48E-07
167	0.35	0.27	0.31	0.00001	3.09E-08	0.00001	3.09E-08
169	-	-	-	0.01	-	0.001	-
189	0.009	0.011	0.010	0.0001	9.83E-09	0.00001	9.83E-10
Sum =	**24**	**12**	**17.9**	**--**	**3.26E-05**	**--**	**7.70E-05**

PCB Exposure Point Concentration (EPC) (mg/kg) [3] =	2.089
2,3,7,8-TCDD TEQ EPC (mammals) (mg/kg) = PCB EPC x Sum TCDD TEQ Wt Fraction =	6.82E-05
2,3,7,8-TCDD TEQ EPC (birds) (mg/kg) = PCB EPC x Sum TCDD TEQ Wt Fraction =	1.61E-04

Receptor Group	Total PCB Intake [3] (mg/kg-BW-day)	PCB Exposure Point Concentration (EPC) [3] (mg/kg)	Intake Factor (kg-kgBW-dy)	2,3,7,8-TEQ Exposure Point Concentration (EPC) (mg/kg)	2,3,7,8-TCDD TEQ Intake (mg/kg-BW-day)	2,3,7,8-TCDD TRV-Low [4] (mg/kg-BW-dy)	HQ-High (unitless)	2,3,7,8-TCDD TRV-High [4] (mg/kg-BW-dy)	HQ-Low (unitless)
Robin	4.26E-01	2.089	2.04E-01	1.61E-04	3.28E-05	0.000014	2	0.00014	0.2
Hawk	4.91E-05	2.089	2.35E-05	1.61E-04	3.78E-09	0.000014	0.0003	0.00014	0.00003
Shrew	1.01E+00	2.089	4.84E-01	6.82E-05	3.30E-05	0.0000022	15	0.000022	1.5
Raccoon	1.33E-03	2.089	6.37E-04	6.82E-05	4.34E-08	0.0000022	0.02	0.000022	0.002

Intake Factor = Total PCB Intake / PCB EPC
2,3,7,8-TCDD TEQ Intake = Intake Factor x 2,3,7,8-TCDD EPC
HQ-High = 2,3,7,8-TCDD TEQ Intake/TRV-Low
HQ-Low = 2,3,7,8-TCDD TEQ Intake/TRV-High

1. Aroclor composition data from http://www.epa.gov/toxteam/pcbid/aroclor_comp_frame.htm.
2. From: http://www.epa.gov/toxteam/pcbid/tefs.htm.
3. From Method 3 Risk Characterization.
4. 2,3,7,8-TCDD TRVs from Sample et al. (1996). Toxicological Benchmarks for Wildlife: 1996 Revision.

APPENDIX B
PROUCL PRINTOUT
REMOVAL TO 1 MG/KG OR LOWER
Former McCoy Field
New Bedford, Massachusetts

Data File	J:\B345-000 Beta McCoy\Risk Stuff\Wetlands	Variable:	Post

Raw Statistics	
Number of Valid Samples	128
Number of Unique Samples	83
Minimum	3.5
Maximum	1000
Mean	357.5898
Median	120.5
Standard Deviation	388.7592
Variance	151133.7
Coefficient of Variation	1.087165
Skewness	0.809334

Gamma Statistics	
k hat	0.661141
k star (bias corrected)	0.650854
Theta hat	540.8674
Theta star	549.4162
nu hat	169.2522
nu star	166.6187
Approx.Chi Square Value (.05)	137.7657
Adjusted Level of Significance	0.048125
Adjusted Chi Square Value	137.4692

Log-transformed Statistics	
Minimum of log data	1.252763
Maximum of log data	6.907755
Mean of log data	4.957897
Standard Deviation of log data	1.611887
Variance of log data	2.598181

RECOMMENDATION
Data are Non-parametric (0.05)
Use 97.5% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Lilliefors Test Statisitic	0.249051
Lilliefors 5% Critical Value	0.078312
Data not normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t UCL	414.5253
Gamma Distribution Test	
A-D Test Statistic	3.579251
A-D 5% Critical Value	0.803805
K-S Test Statistic	0.133779
K-S 5% Critical Value	0.085993
Data do not follow gamma distribution at 5% significance level	
95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	432.4817
Adjusted Gamma UCL	433.4145
Lognormal Distribution Test	
Lilliefors Test Statisitic	0.113202
Lilliefors 5% Critical Value	0.078312
Data not lognormal at 5% significance level	
95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	777.9718
95% Chebyshev (MVUE) UCL	968.2043
97.5% Chebyshev (MVUE) UCL	1166.497
99% Chebyshev (MVUE) UCL	1556.005
95% Non-parametric UCLs	
CLT UCL	414.1099
Adj-CLT UCL (Adjusted for skewness)	416.7365
Mod-t UCL (Adjusted for skewness)	414.9349
Jackknife UCL	414.5253
Standard Bootstrap UCL	413.9577
Bootstrap-t UCL	415.6973
Hall's Bootstrap UCL	416.7264
Percentile Bootstrap UCL	412.0938
BCA Bootstrap UCL	413.7656
95% Chebyshev (Mean, Sd) UCL	507.3694
97.5% Chebyshev (Mean, Sd) UCL	572.1791
99% Chebyshev (Mean, Sd) UCL	699.4853

APPENDIX C
RISK CHARACTERIZATION
RED FOX
Former McCoy Field Wetland Area
New Bedford, Massachusetts

$Intake_{soil}$ = $C_{soil} \times IR_{soil} \times BA_{soil/food} \times A/FA$
$Intake_{food}$ = $(C_{food1} \times F_1) \times IR_{food} \times BA_{soil/food} \times A/FA$
$Intake_{water}$ = $C_{water} \times IR_{water} \times A/FA$
$Intake_{total}$ = $Intake_{soil} + Intake_{food} + Intake_{water}$
HI-High = $Intake_{total}/TRV\text{-}Low$
HI-Low = $Intake_{total}/TRV\text{-}High$

		Value		Source
HI-High =	High estimate of hazard index (unitless)	Calculated		--
HI-Low =	Low estimate of hazard index (unitless)	Calculated		--
TRV-Low =	Toxicity Reference Value - low (mg/kgBW-dy)	Constituent-specific		See associated table
TRV-High =	Toxicity Reference Value - High (mg/kgBW-dy)	Constituent-specific		See associated table
$Intake_{total}$ =	Total intake of constituent from all pathways (mg/kgBW-dy)	Calculated		--
$Intake_{food}$ =	Intake of constituent from food ingestion (mg/kgBW-dy)	Calculated		--
$Intake_{water}$ =	Intake of constituent from water ingestion (mg/kgBW-dy)	Calculated		--
C_{soil} =	Soil constituent concentration (mg/kgDW)	Constituent-specific		--
IR_{soil} =	Soil ingestion rate (kgDW/kgBW-day)	0.00151		U.S. EPA (1999)
$BA_{soil/food}$ =	Bioavailability from soil and food (unitless)	Constituent-specific		See associated table
$C_{food\,i}$ =	Constituent concentration in *ith* food (mg/kg WW)	Calculated		-
$F_{food\,i}$	Fraction of diet for *ith* food (unitless) F_{food1} =	1	mammals	U.S. EPA (1993)
$IR_{food\,i}$ =	Total food ingestion rate (kgWW/kgBW-day)	0.168		U.S. EPA (1999)
C_{water} =	Water constituent concentration (mg/L)	Constituent-specific		--
IR_{water} =	Water ingestion rate (L/kgBW-day)	0.0863		U.S. EPA (1999)
A =	On-site foraging area (acres)	4		Site estimate
FA =	Total foraging area for organism (acres)	237		U.S. EPA (1993)

$C_{food\ (mammal)}$ = $BA_{mammal}\ [(C_{soil} \times BCF_{ssi} \times BA_{soil/food} \times IR_{food\text{-}shrew}) + (C_{soil} \times BA_{soil/food} \times IR_{soil\text{-}shrew}) + (C_{SW} \times IR_{SW\text{-}shrew})]$

where:

BA_{mammal} = Mammal biotransfer factor (dy/kg)
BCF_{ssi} = Soil to soil invertebrate bioaccumulation factor [(mg/kg WW)/(mg/kg soil)]
$IR_{food\text{-}shrew}$ = Shrew consumption rate of food (kg/dy) (assumed all invertebrates)
$IR_{soil\text{-}shrew}$ = Shrew consumption rate of soil (kg/dy)
$IR_{SW\text{-}shrew}$ = Shrew consumption rate of surface water (L/dy)

[A/FA]= 1 or less

Constituent	C_{soil} (mg/kg)	$BA_{soil/food}$ (unitless)	IR_{soil} (kg/kgBW-dy)	BCF_{SSI} (mg/kgWW)/(mg/kgDW soil)	BA_{mammal} (day/kgWW tissue)	$IR_{food\text{-}shrew}$ (kg/dy)	$IR_{soil\text{-}shrew}$ (kg/dy)	$IR_{SW\text{-}shrew}$ (L/dy)	$C_{food\ (mammal)}$ (mg/kgWW)	$F_{food(mammal)}$ (unitless)	IR_{food} (kg/kgBW-dy)	C_{SW} (mg/L)	IR_{water} (L/kgBW-day)	A/FA (unitless)	$Intake_{soil}$ (mg/kgBW-dy)	$Intake_{food}$ (mg/kgBW-dy)	$Intake_{water}$ (mg/kgBW-dy)	$Intake_{total}$ (mg/kgBW-dy)	TRV-Low (mg/kgBW-dy)	HI-High (unitless)	TRV-High (mg/kgBW-dy)	HI-Low (unitless)
PCBs (as Aroclor 1254)	2.09	1	0.0015	1.13	2.69E-02	0.0075	0.0002	0.0023	4.89E-04	1	0.168	6.67E-07	0.0863	0.017	5.33E-05	1.39E-06	9.71E-10	5.47E-05	0.36	0.0002	1.28	0.00004
Acenaphthene	0.191	1	0.0015	0.05	2.09E-04	0.0075	0.0002	0.0023	2.37E-08	1	0.168	2.56E-05	0.0863	0.017	4.87E-06	6.71E-11	3.72E-08	4.90E-06	17.5	0.0000003	17.5	0.0000003
Anthracene	0.221	1	0.0015	0.05	8.71E-04	0.0075	0.0002	0.0023	1.14E-07	1	0.168	9.15E-06	0.0863	0.017	5.63E-06	3.23E-10	1.33E-08	5.65E-06	100	0.00000006	100	0.00000006
Benzo(a)anthracene	0.401	1	0.0015	0.03	2.19E-02	0.0075	0.0002	0.0023	3.88E-06	1	0.168	1.25E-06	0.0863	0.017	1.02E-05	1.10E-08	1.82E-09	1.02E-05	0.167	0.00006	0.167	0.00006
Benzo(b)fluoranthene	0.274	1	0.0015	0.07	1.58E-02	0.0075	0.0002	0.0023	3.22E-06	1	0.168	1.20E-06	0.0863	0.017	6.98E-06	9.14E-09	1.74E-09	6.99E-06	4	0.000002	4	0.000002
Benzo(k)fluoranthene	0.218	1	0.0015	0.08	2.51E-02	0.0075	0.0002	0.0023	4.48E-06	1	0.168	5.74E-07	0.0863	0.017	5.56E-06	1.27E-08	8.36E-10	5.57E-06	7.2	0.0000008	7.2	0.0000008
Benzo(g,h,i)perylene	0.213	1	0.0015	0.05	7.94E-02	0.0075	0.0002	0.0023	1.00E-05	1	0.168	2.18E-07	0.0863	0.017	5.43E-06	2.84E-08	3.18E-10	5.46E-06	7.2	0.0000008	7.2	0.0000008
Benzo(a)pyrene	0.395	1	0.0015	0.07	2.75E-02	0.0075	0.0002	0.0023	8.08E-06	1	0.168	9.60E-07	0.0863	0.017	1.01E-05	2.29E-08	1.40E-09	1.01E-05	1.31	0.000008	32.8	0.0000003
Chrysene	0.377	1	0.0015	0.04	7.76E-03	0.0075	0.0002	0.0023	1.51E-06	1	0.168	1.47E-06	0.0863	0.017	9.61E-06	4.29E-09	2.15E-09	9.61E-06	0.17	0.00006	0.17	0.00006
Fluoranthene	0.329	1	0.0015	0.05	4.17E-03	0.0075	0.0002	0.0023	8.13E-07	1	0.168	3.77E-06	0.0863	0.017	8.38E-06	2.30E-09	5.49E-09	8.39E-06	12.5	0.0000007	12.5	0.0000007
Fluorene	0.203	1	0.0015	0.05	3.80E-04	0.0075	0.0002	0.0023	4.57E-08	1	0.168	1.66E-05	0.0863	0.017	5.17E-06	1.30E-10	2.41E-08	5.20E-06	12.5	0.0000004	12.5	0.0000004
Indeno(1,2,3-cd)pyrene	0.208	1	0.0015	0.08	2.51E-01	0.0075	0.0002	0.0023	4.27E-05	1	0.168	8.28E-08	0.0863	0.017	5.30E-06	1.21E-07	1.21E-10	5.42E-06	7.2	0.0000008	7.2	0.0000008
Phenanthrene	0.446	1	0.0015	0.05	9.33E-04	0.0075	0.0002	0.0023	2.47E-07	1	0.168	1.74E-05	0.0863	0.017	1.14E-05	6.99E-10	2.54E-08	1.14E-05	100	0.0000001	100	0.0000001
Pyrene	0.623	1	0.0015	0.05	3.80E-03	0.0075	0.0002	0.0023	1.40E-06	1	0.168	7.72E-06	0.0863	0.017	1.59E-05	3.98E-09	1.12E-08	1.59E-05	7.5	0.000002	7.5	0.000002
Barium	83	0.07	0.0015	0.01	9.43E-03	0.0075	0.0002	0.0023	1.66E-05	1	0.168	2.63E-02	0.0863	0.017	1.48E-04	3.29E-09	3.83E-05	1.86E-04	2.8	0.00007	10.5	0.00002
Cadmium	1.17	0.01	0.0015	0.96	7.54E-03	0.0075	0.0002	0.0023	6.55E-07	1	0.168	5.86E-05	0.0863	0.017	2.98E-07	1.86E-11	8.54E-08	3.84E-07	0.19	0.000002	5.1	0.00000008
Chromium (total)	13	0.005	0.0015	0.01	3.45E-01	0.0075	0.0002	0.0023	6.57E-06	1	0.168	1.72E-05	0.0863	0.017	1.66E-06	9.31E-11	2.51E-08	1.68E-06	2.4	0.0000007	2.4	0.0000007
Lead	138	0.12	0.0015	0.03	1.88E-02	0.0075	0.0002	0.0023	1.38E-04	1	0.168	3.47E-04	0.0863	0.017	4.22E-04	4.69E-08	5.05E-07	4.23E-04	4.22	0.0001	241	0.000002
Mercury	0.18	0.07	0.0015	0.04	3.26E-01	0.0075	0.0002	0.0023	2.13E-06	1	0.168	2.27E-06	0.0863	0.017	3.21E-07	4.23E-10	3.30E-09	3.25E-07	0.69	0.0000005	4	0.00000008
Selenium	0.92	0.44	0.0015	0.01	1.43E-01	0.0075	0.0002	0.0023	1.69E-05	1	0.168	2.31E-05	0.0863	0.017	1.03E-05	2.11E-08	3.37E-08	1.04E-05	0.076	0.0001	1.21	0.000009
																			HI =	**0.0006**	**HI =**	**0.0002**

U.S. EPA (1999). Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A, August.
U.S. EPA (1993). Wildlife Exposure Factors Handbook, Volume I. EPA/600/R-93/187a, December.

APPENDIX D
RISK CHARACTERIZATION
TERRESTRIAL AND WETLAND VEGETATION
Former McCoy Field Wetland Area
New Bedford, Massachusetts

Constituent	Environmental Soil/Sediment Exposure Point Concentration ($C_{soil-sed}$) (mg/kg)	Screening Benchmark Concentrations for Plants (TRV) (mg/kg)		Is TRV Exceeded?	Hazard Quotient[1] (HQ) (unitless)	Background Level in Natural Soil [2] (mg/kg)	Is Background Level Exceeded?
PCBs (as Aroclor 1254)	2.09	40	[3]	No	0.05	NE	--
Acenaphthene	0.191	20	[3]	No	0.01	0.5	No
Anthracene	0.221	37	[5]	No	0.006	1	No
Benzo(a)anthracene	0.401	116	[5]	No	0.003	2	No
Benzo(b)fluoranthene	0.274	1.2	[4]	No	0.2	2	No
Benzo(k)fluoranthene	0.218	93	[5]	No	0.002	1	No
Benzo(g,h,i)perylene	0.213	84	[5]	No	0.003	1	No
Benzo(a)pyrene	0.395	1.2	[4]	No	0.3	2	No
Chrysene	0.377	85	[5]	No	0.004	2	No
Fluoranthene	0.329	206	[5]	No	0.002	4	No
Fluorene	0.203	10.7	[5]	No	0.02	1	No
Indeno(1,2,3-cd)pyrene	0.208	76	[5]	No	0.003	1	No
Phenanthrene	0.446	84	[5]	No	0.005	3	No
Pyrene	0.623	146	[5]	No	0.004	4	No
Barium	83	500	[3]	No	0.2	50	**Yes**
Cadmium	1.17	4	[3]	No	0.3	2	No
Chromium (total) [6]	13	1	[3]	**Yes**	13	30	No
Lead [7]	138	50	[3]	**Yes**	3	100	**Yes**
Mercury	0.18	0.3	[3]	No	0.6	0.3	No
Selenium	0.92	1	[3]	No	0.9	0.5	**Yes**
Total Hazard Index (HI)					**18**		

mg/kg = milligrams per kilogram.

NE = Not established.

1. HQ = $C_{soil-sed}$/TRV; HI = sum of all HQs.
2. MADEP (2002). Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil. May.
3. Efromyson et al. (1997). Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants.
4. U.S. EPA (1999). Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Volume 3, Appendix E, Table E-6. EPA-530-DD-99-001A, August.
5. Fismes et al. (2001). Soil-to-Root Transfer and Translocation of Polycyclic Aromatic Hydrocarbons by Vegetables Grown on Industrial Contaminated Soils. Journal of Environmental Quality 31: 1649-1656 (2002). Soil contained the stated PAH concentrations in a 22.4% clay; 35.7% silt, and 38.1% sand soil. No phytotoxicity symptoms were observed.
6. The TRV is based on hexavalent chromium; total chromium was quantified in soil.
7. The TRV is based on lead chloride, a soluble form, which is not the form of lead expected at the Site. Tests on less soluble lead oxide showed no effect at 300 mg/kg.

APPENDIX E
RISK CHARACTERIZATION
TERRESTRIAL INVERTEBRATES - CHRONIC EFFECTS
Former McCoy Field Wetland Area
New Bedford, Massachusetts

Constituent	Environmental Soil/Sediment Exposure Point Concentration ($C_{soil-sed}$) (mg/kg)	Chronic Terrestrial Invertebrate Toxicity Reference Value (TRV) (mg/kg)		Is TRV Exceeded?	Hazard Quotient[5] (HQ) (unitless)
PCBs (as Aroclor 1254)	2.09	2.51	[1]	No	0.8
Acenaphthene	0.191	50	[2]	No	0.004
Anthracene	0.221	50	[2]	No	0.004
Benzo(a)anthracene	0.401	25	[1]	No	0.02
Benzo(b)fluoranthene	0.274	25	[1]	No	0.01
Benzo(k)fluoranthene	0.218	25	[1]	No	0.009
Benzo(g,h,i)perylene	0.213	50	[2]	No	0.004
Benzo(a)pyrene	0.395	25	[1]	No	0.02
Chrysene	0.377	25	[1]	No	0.02
Fluoranthene	0.329	50	[2]	No	0.007
Fluorene	0.203	50	[2]	No	0.004
Indeno(1,2,3-cd)pyrene	0.208	25	[1]	No	0.008
Phenanthrene	0.446	50	[2]	No	0.009
Pyrene	0.623	50	[2]	No	0.01
Barium	83	330	[3]	No	0.3
Cadmium	1.17	20	[2]	No	0.06
Chromium (total)	13	57	[4]	No	0.2
Lead	138	500	[2]	No	0.3
Mercury	0.18	2.5	[1]	No	0.07
Selenium	0.92	70	[2]	No	0.01
Total Hazard Index (HI)					**1.9**

mg/kg = milligrams per kilogram.

1. U.S. EPA (1999). Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Volume 3, Appendix E, Table E-6. EPA-530-DD-99-001A, August.
2. Efroymson RA et al. (1997). Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process. Value for earthworms applied for cadmium, lead, selenium. Value for fluorene was a no observed effect level for Eisenia fetida for cocoon production; applied to all on-carcinogenic PAHs. An uncertainty factor of 10 was applied because medium was horse manure.
3. U.S. EPA (2005b). Ecological Soil Screening Levels (http://www.epa.gov/ecotox/ecossl/).
4. Not EcoSSL, but study cited in source document [maximum acceptable toxicant concentration (MATC)] (U.S. EPA 2005b).
5. HQ = $C_{soil-sed}$/TRV; HI = sum of all HQs.