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SUPERFUND &
EMERGENCY
MANAGEMENT DIVISION

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MEMORANDUM

SUBJECT: Errata #2 for Portland Harbor Superfund Site Record of Decision ROD Table 17

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THRU: Lori Houck Cora, Assistant Regional Counsel
U.S. Environmental Protection Agency, Region 10

TO: Portland Harbor site file

This memorandum to the Site File documents errors identified in Table 17 of the Portland Harbor Superfund Site Record of Decision (ROD), dated January 2017 and updates the Table 17 presented in the Errata dated April 3, 2018. In implementing remedial designs at the Site, some errors and omissions to Table 17 were discovered. Several contaminants and their cleanup levels were left off the Table. Additionally, some cleanup levels were erroneously translated from the Portland Harbor Feasibility Study (FS), dated June 2016; the Portland Harbor Remedial Investigation Report (RI), dated February 8, 2016; and the Portland Harbor Baseline Ecological Risk Assessment (BERA), dated December 16, 2013. This Errata #2 is being issued to make those corrections and to be consistent with Section 9.1 of the ROD. Additionally, the revised carcinogenic polycyclic aromatic hydrocarbons (cPAH) sediment cleanup levels documented in the final Explanation of Significant Differences (ESD) are added to the corrected Appendix II, ROD Table 17. Additionally, to provide transparency regarding the basis of the cleanup levels, a new column has been added indicating the applicable RAO that was the basis of each cleanup level. An explanation of the corrections being made to Appendix II, ROD Table 17 follows:

1. The cleanup levels for aldrin, PCBs, and dioxin/furans in surface water should be revised to be shown in scientific notation for clarity.

2. The following groundwater contaminants of concern (COCs) and cleanup levels should be added to the groundwater column. These COCs and preliminary remediation goals (PRGs) were identified in FS Table 2.2-11 and were mistakenly left off the original ROD Table 17. These are ecological risk-based values so an "R_E" should be added to the basis column for these contaminants:

    a. Benzo(g,h,i)perylene cleanup level of 0.4 micrograms per liter (µg/L)

    b. Fluoranthene cleanup level of 6.2 µg/L

    c. Fluorene cleanup level of 3.9 µg/L

    d. 2-Methylnaphthalene cleanup level of 2.1 µg/L

e. Naphthalene cleanup level of 12 µg/L

f. Phenanthrene cleanup level of 6.3 µg/L

g. Pyrene cleanup level of 10 µg/L

3. The groundwater cleanup level for cadmium should be changed from 0.091 to 0.094 µg/L. This appears to be a transcription error from FS Table 2.1-4 referring to the Section 304(a) list of National Recommended Water Quality Criteria (NRWQC).Additionally, the Oregon Water Pollution Act (ORS 468B.048) Aquatic Life Chronic Criteria (OAR 340-41 8033, Table 30) reference on FS 2.1-4 should also be 0.094 µg/L. FS Table 2.2-11 lists the cadmium BERA toxicity reference value (TRV) and ARAR as 0.09 µg/L, which appears to be a rounded value. BERA Table 6-43 lists the source of the TRV as an ambient water quality criteria (AWQC).

4. The basis for the copper surface water cleanup level should be changed from "A" to "R_E" since it is an ecological risk-based value. The basis of the PRG is identified in FS Table 2.2-10.

5. The basis for the dichlorodiphenyltrichloroethane and its derivatives (DDx) groundwater cleanup level should be changed from "A" to "A_{EA}/R_E" since it is an ecological risk-based value and an ARAR. FS Table 2.2-11 identifies the ARAR to be 0.001 µg/L. In addition, FS Table 2.2-11 identifies the "TRV from BERA" to be 0.01 µg/L; however, BERA TRV Table 2 in Attachment 10 notes that the TRV value is 0.001 µg/L with the caveat, "An alternative TRV (0.011 µg/L; see Section 2) was derived because the selected AWQC- based TRV protects birds from dietary exposure (specifically egg-shell thinning) and is not appropriate for the evaluation of aquatic receptors."

6. The basis for the groundwater cleanup level for copper and should be changed from "A/R" to "R_E" since this is an ecological risk-based value. The basis for the groundwater cleanup levels for lead and zinc should be changed from "A/R" to "A_{EA}/R_E" since these are ecological risk-based values and AWQC values. The basis for the groundwater cleanup level for polychlorinated biphenyls (PCBs) should be changed from "A/R" to "A_{EN}/R_E" since this is an ecological risk-based value and an NRWQC value. The basis of the PRGs for these chemicals is identified in FS Table 2.2-11, with the exception of zinc. The "ARAR or TBC" for zinc is erroneously listed as "NA." Although FS Table 2.2-11 has values for lead and PCBs in the "ARAR or TBC" that match the values in the "TRV from BERA" column, these "ARAR or TBC" values correspond to surface water criteria.

7. The dichlorodiphenyldichloroethene (DDE) river bank soil/sediment cleanup level should be changed to 50 micrograms per kilogram (µg/kg). The 226 µg/kg value is from FS Tables 2.2-9 and B4-2. However, the logistic regression model (LRM) derived sediment quality value (SQV) for 4,4'-DDE in BERA Table 6-11 is 50 µg/kg when the SQV is converted to µg/kg dry weight using the equation in FS Appendix B Section B4.1. This LRM-derived SQV was mistakenly not translated into FS Table 2.2-8, where it should have been selected as the PRG. (The LRM-derived SQV for DDE in FS Table 2.2-8 was erroneously listed as 359 µg/kg.) This is an ecological risk-based value so an "R_E" should be added to the basis column for this contaminant.

8. The cPAH river bank soil/sediment cleanup level should be changed from 12(7) ug/kg to "774/85/1,076" µg/kg along with a reference to note (7). This is a human health risk-based value so the basis for the cPAH river bank soil/sediment cleanup level should be changed from "B" to "R_H". This PRG was revised by ESD Table 1.

9. The river bank soil/sediment cleanup level of 0.01 µg/kg for Dioxins/Furans (2,3,7,8-TCDD eq) should be added. This PRG was identified in FS Table 2.2-4 and was mistakenly left off the ROD Table 17. This is a human health risk-based value so an "R_H" should be added to the basis column for this contaminant along with a reference to note (8).

10. The heading for the fish/shellfish tissue target concentrations should be revised to read "Fish/Shellfish Tissue (4)". While shellfish have always been considered in the development of target values for this column, it was not previously explicitly stated in the title of this column.

11. The following fish/shellfish tissue target concentrations should be corrected:

    a. These targets were identified in FS Table 2.2-5 and appear to be transcription errors:

        i. 0.00008 µg/kg for 1,2,3,4,7,8-HxCDF should be 0.00006 µg/kg.

        ii. 0.000008 µg/kg for 1,2,3,7,8-PeCDD should be 0.000006 µg/kg.

        iii. 0.00003 µg/kg for 2,3,4,7,8-PeCDF should be 0.00002 µg/kg.

        iv. 0.00008 µg/kg for 2,3,7,8-TCDF should be 0.00006 µg/kg.

        v. 0.000008 µg/kg for 2,3,7,8-TCDD should be 0.000006 µg/kg.

    b. 7.1 µg/kg for cPAH (BaP eq) should be 51.6 µg/kg, based on ESD Table 1.

    c. The basis for the fish/shellfish tissue target level for mercury should be changed to "R_H" to indicate that it is a human health risk-based.

    d. The fish/shellfish tissue target level for polybrominated diphenyl ethers (PBDEs) should be changed to 1.28 µg/kg. Although a PRG for PBDEs was calculated in FS Table B3-5, it was mistakenly not translated into FS Table 2.2-4 and the original Table 17. Upon further review, the PRG calculation for PBDEs in FS Table B3-5 was determined to be incorrect because the calculation of noncancer hazard for PBDE through the infant breastmilk consumption pathway should have been calculated by applying an infant risk adjustment factor (IRAF) of 38 to the noncancer hazard estimates for the adult mother in accordance with the methodology described in Appendix F, Attachment F3 of the HHRA.

$$PRG_{tis} = \left[\frac{THQ \times BW_m \times AT_{nc}}{ED_a \times EF \times \frac{1}{RfD} \times CR \times 0.001\ kg/g}\right] \times \left(\frac{1{,}000\ \mu g/mg}{IRAF}\right)$$

PRG_{tissue} = risk-based PRG in fish/shellfish (µg/kg – wet weight)
THQ = target hazard quotient = 1
BW_m = average body weight – maternal = 66 kg
AT_{nc} = averaging time, noncancer = 10,950 days
RfD = reference dose = 0.0001 mg/kg-day
ED_a = exposure duration – adult = 30 years
EF_a = exposure frequency – adult (maternal exposure) = 350 days/yr
CR = maternal consumption rate of fish = 142 g/day
IRAF = infant risk adjustment factor = 38

Using this methodology, the fish/shellfish tissue target level for PBDEs based on the infant breastmilk consumption pathway is 1.28 µg/kg.

12. The following changes are being made to the notes to provide transparency regarding the cleanup level selection process described in the FS and to facilitate remedial design analysis. Notes 7 and 8 clarify the applicable exposure pathways for the selected values.

    a. The following text should be added to Note (2): "Note: Groundwater cleanup levels are generally the ecological risk-based or human health risk-based concentration that protects the most sensitive receptor that are relevant and protective for receptor exposures to groundwater. An exception to this is if an ARAR (promulgated standard) for a contaminant is higher than a risk-based number, but the ARAR [such as maximum contaminant levels (MCLs)] is determined to be protective, then the less protective ARAR is selected as the cleanup level."

    b. The following text should be added to Note (3): "The lower of the PRG values for RAOs 1, 2 (sediment through Fish/Shellfish Consumption), 5, and 6 were selected as the cleanup level regardless of the exposure pathway."

    c. Note (4) should be revised to read: "Fish/Shellfish Tissue Targets - RAOs 2 and 6. The lower of the PRG values for RAOs 2 and 6 were selected as the target regardless of the exposure pathway."

    d. The following text should be added as Note (7): "The cleanup level for cPAHs of 774 µg/kg is based on direct contact with sediment and is applicable to nearshore sediment exclusive of recreational beaches and navigation channel sediments. The cleanup level applicable to recreational beach sediments is 85 µg/kg and the cleanup level applicable to the navigation channel sediment is 1,076 µg/kg and is based on human consumption of clams."

    e. The following text should be added as Note (8): "The 2,3,7,8-TCDD eq cleanup level for river bank soil/sediment is based on RAO 1, which includes a dietary component (incidental ingestion) in addition to direct exposure. The river bank soil/sediment cleanup levels for the individual dioxin/furan congeners are based on RAO 2, which accounts for bioaccumulation from sediment through the food chain."

f. The following text should be added as Note (9): "This Table 17 identifies fish/shellfish tissue target levels and site-specific cleanup levels for each of the following media: sediment (including beaches), river bank soil, surface water, and groundwater. However, these cleanup levels represent the lowest PRG value identified across all identified site receptors for the indicated RAOs. Since exposure area averaging may impact the concentrations to which a receptor is potentially exposed, Chapter 8 and Table 16 of the ROD should be consulted in the development of remedial actions."

13. In the abbreviations list, the following changes should be made:

a. To provide transparency regarding the basis of the cleanup levels, a new column has been added indicating the applicable RAO that was the basis of each cleanup level. The RAO column is provided to identify the basis of the CUL value, it does not indicate a media application limitation or exposure pathway limitation of the CUL. Due to the numerous additions, these changes are only shown in the updated Table 17 and are not enumerated separately in this memorandum. The definition of the RAOs should be added to the abbreviation list as follows:

i. "RAO1 – Reduce cancer and non-cancer risks to people from incidental ingestion of and dermal contact with COCs in sediment and beaches to exposure levels that are acceptable for fishing, occupational, recreational, and ceremonial uses."

ii. "RAO2 – Reduce cancer and non-cancer risks to acceptable exposure levels (direct and indirect) for human consumption of COCs in fish and shellfish."

iii. "RAO3 - Reduce cancer and noncancer risks to people from direct contact (ingestion, inhalation, and dermal contact) with COCs in surface water to exposure levels that are acceptable for fishing, occupational, recreational, and potential drinking water supply."

iv. "RAO4 - Reduce migration of COCs in groundwater to sediment and surface water such that levels are acceptable in sediment and surface water for human exposure."

v. "RAO5 – Reduce risk to benthic organisms from ingestion of and direct contact with COCs in sediment to acceptable exposure levels."

vi. "RAO6 – Reduce risks to ecological receptors that consume COCs in prey to acceptable exposure levels."

vii. "RAO7 - Reduce risks to ecological receptors from ingestion of and direct contact with COCs in surface water to acceptable exposure levels."

viii. "RAO8 - Reduce migration of COCs in groundwater to sediment and surface water such that levels are acceptable in sediment and surface water for ecological exposure."

b. To provide additional transparency regarding the sources of the cleanup levels, the basis descriptions have been appended with subscripts indicating the sources of the selected cleanup levels. Due to the numerous additions, these changes are only shown in the updated Table 17 and are not enumerated separately in this memorandum. To explain the subscripts, the following abbreviations should be added:

   i. "A_{EA} - ARAR based value from ODEQ OAR 340-41-8033, Table 30: Aquatic Life Water Quality Criteria for Toxic Pollutants (effective August 4, 2015)"

   ii. "A_{EN} - ARAR based value from EPA National Recommended Water Quality Criteria – Aquatic Life Criteria Table (chronic)"

   iii. "A_{HA} - ARAR based value from ODEQ OAR 340-41-8033, Table 40: Human Health Water Quality Criteria for Toxic Pollutants (effective April 18, 2014). (chronic, organism+water)"

   iv. "A_{HN} - ARAR based value from EPA's National Recommended Water Quality Criteria (NRWQC) (organism+water)"

   v. "A_{HM} - ARAR based value from Maximum Contaminant Level (MCL) as listed in EPA Regional Screening Levels (RSLs)"

   vi. Abbreviation for "R" should be deleted and replaced by:

      1. "R_E - ecological risk-based number"

      2. "R_H – human health risk-based number"

c. Abbreviation for "MCL - maximum contaminant level" should be added.

d. Abbreviation for "RSL - regional screening level" should be added.

References for this memorandum are documented in the administrative record (i.e., Portland Harbor Feasibility Study, Portland Harbor Baseline Ecological Risk Assessment, and Portland Harbor Explanation of Significant Differences) and support the corrections for each of the items above.

Attachments

- ROD Table 17 with Redlined Revisions for Errata #2

References

- Portland Harbor Feasibility Study, dated June 2016 (related Tables)
  - Table 2.2-4 RAO 1 PRG Derivation
  - Table 2.2-5 RAO 2 PRG Derivation
  - Table 2.2-7 RAO 4 PRG Derivation
  - Table 2.2-10 RAO 7 PRG Derivation
  - Table 2.2-11 RAO 8 PRG Derivation

- Portland Harbor Explanation of Significant Differences Table 1. cPAH (BaPeq) CUL and Highly Toxic PTW Thresholds
- Portland Harbor Baseline Ecological Risk Assessment TRV Table 2 in Attachment 10

Table 17. Summary of Cleanup Levels or Targets by Media

	Surface Water (1)				Groundwater (2)				River Bank Soil/Sediment (3)				Fish/Shellfish Tissue (4)			
Contaminant	**Unit**	**Conc.**	**RAO**	**Basis**	**Unit**	**Conc.**	**RAO**	**Basis**	**Unit**	**Conc.**	**RAO**	**Basis**	**Unit**	**Conc.**	**RAO**	**Basis**
Aldrin	µg/L	~~0.00000077~~ 7.7E-07	RAO3	A_{HN}					µg/kg	2	RAO2	R_H	µg/kg	0.06	RAO2	R_H
Arsenic	µg/L	0.018	RAO3	A_{HN}	µg/L	0.018	RAO4	A_{HN}	mg/kg	3	RAO1	B	mg/kg	0.001	RAO2	R_H
Benzene					µg/L	0.44	RAO4	A_{HA}								
BEHP	µg/L	0.2	RAO3	A_{HA}					µg/kg	135	RAO6	R_E	µg/kg	72	RAO2	R_H
Cadmium					µg/L	~~0.091~~ 0.094	RAO8	A_{EA}/R_E(5)	mg/kg	0.51	RAO5	R_E				
Chlordanes	µg/L	0.000081	RAO3	A_{HA}					µg/kg	1.4	RAO5	R_E	µg/kg	3	RAO2	R_H
Chlorobenzene					µg/L	64	RAO8	R_E								
Chromium	µg/L	100	RAO3	A_{HM}	µg/L	11	RAO8	A_{EN}								
Copper	µg/L	2.74	RAO7	~~A~~ R_E	µg/L	2.74	RAO8	~~A/~~R_E	mg/kg	359	RAO5	R_E				
Cyanide					µg/L	4	RAO4	A_{HN}								
DDx	µg/L	0.01	RAO7	R_E	µg/L	0.001	RAO8	A_{EN}/R_E	µg/kg	6.1	RAO2	R_H	µg/kg	3	RAO2	R_H
DDD	µg/L	0.000031	RAO3	A_{HA}	µg/L	0.000031	RAO4	A_{HA}	µg/kg	114	RAO5	R_E				
DDE	µg/L	0.000018	RAO3	A_{HN}	µg/L	0.000018	RAO4	A_{HN}	µg/kg	~~226~~ 50	RAO5	R_E				
DDT	µg/L	0.000022	RAO3	A_{HA}	µg/L	0.000022	RAO4	A_{HA}	µg/kg	246	RAO5	R_E				
1,1-Dichloroethene					µg/L	7	RAO4	A_{HM}								
cis-1,2-Dichloroethene					µg/L	70	RAO4	A_{HM}								
Dieldrin									µg/kg	0.07	RAO2	R_H	µg/kg	0.06	RAO2	R_H
2,4-Dichlorophenoxyacetic acid					µg/L	70	RAO4	A_{HM}								
Ethylbenzene	µg/L	7.3	RAO7	R_E	µg/L	7.3	RAO8	R_E								
Hexachlorobenzene	µg/L	0.000029	RAO3	A_{HA}									µg/kg	0.6	RAO2	R_H
Lindane									µg/kg	5	RAO5	R_E				
Lead					µg/L	0.54	RAO8	A_{EA}/R_E	mg/kg	196	RAO5	R_E				
Manganese					µg/L	430	RAO4	R_H								
MCPP	µg/L	16	RAO3	R_H												
Mercury									mg/kg	0.085	RAO5	R_E	mg/kg	0.03	RAO2	~~A~~ R_H
Pentachlorophenol	µg/L	0.03	RAO3	A_{HN}	µg/L	0.03	RAO4	A_{HN}					µg/kg	2.5	RAO2	R_H
Perchlorate					µg/L	15	RAO4	A_{HM}								
PBDEs													µg/kg	1.28 ~~26~~	RAO2	R_H
PCBs	µg/L	~~0.0000064~~ 6.4E-6	RAO3	A_{HA}	µg/L	0.014	RAO8	A_{EN}/R_E	µg/kg	9	RAO2	B	µg/kg	0.25 (6)	RAO2	R_H
PAHs									µg/kg	23000	RAO5	R_E				
cPAHs (BaP eq)	µg/L	0.00012	RAO3	A_{HN}	µg/L	0.00012	RAO4	A_{HN}	µg/kg	774/85/1,076 (7)	RAO1	~~B~~ R_H	µg/kg	51.6 ~~7.1~~	RAO2	R_H
Acenaphthene					µg/L	23	RAO8	R_E								
Acenaphthylene																
Anthracene					µg/L	0.73	RAO8	R_E								
Benzo(a)anthracene	µg/L	0.0012	RAO3	A_{HN}	µg/L	0.0012	RAO4	A_{HN}								
Benzo(a)pyrene	µg/L	0.00012	RAO3	A_{HN}	µg/L	0.00012	RAO4	A_{HN}								
Benzo(b)fluoranthene	µg/L	0.0012	RAO3	A_{HN}	µg/L	0.0012	RAO4	A_{HN}								
Benzo(g,h,i)perylene					µg/L	0.4	RAO8	R_E								
Benzo(k)fluoranthene	µg/L	0.0013	RAO3	A_{HA}	µg/L	0.0013	RAO4	A_{HA}								
Chrysene	µg/L	0.0013	RAO3	A_{HA}	µg/L	0.0013	RAO4	A_{HA}								
Dibenz(a,h)anthracene	µg/L	0.00012	RAO3	A_{HN}	µg/L	0.00012	RAO4	A_{HN}								
Fluoranthene					µg/L	6.2	RAO8	R_E								
Fluorene					µg/L	3.9	RAO8	R_E								
Indeno(1,2,3-c,d)pyrene	µg/L	0.0012	RAO3	A_{HN}	µg/L	0.0012	RAO4	A_{HN}								
2-Methylnaphthalene					µg/L	2.1	RAO8	R_E								
Naphthalene	µg/L	12	RAO7	R_E	µg/L	12	RAO8	R_E								
Phenanthrene					µg/L	6.3	RAO8	R_E								
Pyrene					µg/L	10	RAO8	R_E								
Dioxins/Furans (2,3,7,8-TCDD eq)	µg/L	~~0.00000000051~~ 5.1E-10	RAO3	A_{HA}					µg/kg	0.01	RAO1	R_H (8)				
1,2,3,4,7,8-HxCDF									µg/kg	0.0004	RAO2	B	µg/kg	~~0.00008~~ 0.00006	RAO2	R_H
1,2,3,7,8-PeCDD									µg/kg	0.0002	RAO2	B	µg/kg	~~0.000008~~ 0.000006	RAO2	R_H
2,3,4,7,8-PeCDF									µg/kg	0.0003	RAO2	B	µg/kg	~~0.00003~~ 0.00002	RAO2	R_H
2,3,7,8-TCDF									µg/kg	0.00040658	RAO2	R_H	µg/kg	~~0.00008~~ 0.00006	RAO2	R_H
2,3,7,8-TCDD									µg/kg	0.0002	RAO2	B	µg/kg	~~0.000008~~ 0.000006	RAO2	R_H
Tetrachloroethene					µg/L	0.24	RAO4	A_{HA}								
Toluene					µg/L	9.8	RAO8	R_E								
TPH-Diesel									mg/kg	91	RAO5	R_E				
Aliphatic Hydrocarbons C10-C12					µg/L	2.6	RAO8	R_E								
Tributyltin	µg/L	0.063	RAO7	A_{EA}					µg/kg	3080	RAO5	R_E				
Trichloroethene					µg/L	0.6	RAO4	A_{HN}								
2,4,5-TP (Silvex)					µg/L	50	RAO4	A_{HM}								
Vanadium					µg/L	20	RAO8	R_E								
Vinyl Chloride					µg/L	0.022	RAO4	A_{HN}								
Xylenes					µg/L	13	RAO8	R_E								
Zinc	µg/L	36.5	RAO7	A_{EA}/R_E	µg/L	36.5	RAO8	A_{EA}/R_E	mg/kg	459	RAO5	R_E				

Notes:

(1) Surface Water Cleanup Levels - RAOs 3 and 7

(2) Groundwater Cleanup Levels - RAOs 4 and 8. Note: Groundwater cleanup levels are generally the ecological risk-based or human health risk-based concentration that protects the most sensitive receptor that are relevant and protective for receptor exposures to groundwater. An exception to this is if an ARAR (promulgated standard) for a contaminant is higher than a risk-based number, but the ARAR [such as maximum contaminant levels (MCLs)] is determined to be protective, then the less protective ARAR is selected as the cleanup level.

(3) Sediment Cleanup Levels - RAOs 1, 2, ~~and~~ 5, and 6. The lower of the PRG values for RAOs 1, 2 (sediment through Fish/Shellfish Consumption), 5, and 6 were selected as the cleanup level regardless of the exposure pathway.

(4) Fish/Shellfish Tissue Targets - RAOs 2 and 6. The lower of the PRG values for RAOs 2 and 6 were selected as the target regardless of the exposure pathway.

(5) A/R indicates that the ARARs-based number and the risk-based number are the same.

(6) The tissue target is a risk-based number and does not represent background levels. Additional data will be collected to determine background fish tissue concentrations for PCBs during design and construction of the Selected Remedy.

(7) The cleanup level for cPAHs of 774 µg/kg is based on direct contact with sediment and is applicable to nearshore sediment exclusive of recreational beaches and navigation channel sediments. The cleanup level applicable to recreational beach sediments is 85 µg/kg and the cleanup level applicable to the navigation channel sediment is 1,076 µg/kg and is based on human consumption of clams.

(8) The 2,3,7,8-TCDD eq cleanup level for river bank soil/sediment is based on RAO 1, which includes a dietary component (incidental ingestion) in addition to direct exposure. The river bank soil/sediment cleanup levels for the individual dioxin/furan congeners are based on RAO 2, which accounts for bioaccumulation from sediment through the food chain.

(9) This Table 17 identifies fish/shellfish tissue target levels and site-specific cleanup levels for each of the following media: sediment (including beaches), river bank soil, surface water, and groundwater. However, these cleanup levels represent the lowest PRG value identified across all identified site receptors for the indicated RAOs. Since exposure area averaging may impact the concentrations to which a receptor is potentially exposed, Chapter 8 and Table 16 of the ROD should be consulted in the development of remedial actions.

Table 17. Summary of Cleanup Levels or Targets by Media

Abbreviations:

2,4,5-TP (Silvex) - 2-(2,4,5-Trichlorophenoxy)propionic acid, also known as Silvex

A_{FA} - ARAR based value from ODEQ OAR 340-41-8033, Table 30: Aquatic Life Water Quality Criteria for Toxic Pollutants (effective August 4, 2015)

A_{FN} - ARAR based value from EPA National Recommended Water Quality Criteria (NRWQC) – Aquatic Life Criteria Table (chronic)

A_{HA} - ARAR based value from ODEQ OAR 340-41-8033, Table 40: Human Health Water Quality Criteria for Toxic Pollutants (effective April 18, 2014). (chronic, organism+water)

A_{HN} - ARAR based value from EPA's National Recommended Water Quality Criteria (NRWQC) (organism+water)

A_{HM} - ARAR based value from Maximum Contaminant Level (MCL) as listed in EPA Regional Screening Levels (RSLs)

ARAR - applicable or relevant and appropriate requirement

B - Background-based number

BEHP - bis(2-ethylhexyl)phthalate

BaP eq - benzo(a)pyrene equivalent

C - carbon

Conc - concentration

cPAH - carcinogenic polycyclic aromatic hydrocarbon

DDD - dichlorodiphenyldichloroethane

DDE - dichlorodiphenyldichloroethene

DDT - dichlorodiphenyltrichloroethane

DDx - DDD + DDE + DDT

HxCDF - hexachlorodibenzofuran

MCL - maximum contaminant level

MCPP - 2-(4-chloro-2-methylphenoxy)propanoic acid

mg/kg - milligram per kilogram

PAH - polycyclic aromatic hydrocarbon

PBDE - polybrominated diphenyl ether

PCB - polychlorinated biphenyl

PeCDD - pentachlorodibenzo-p-dioxin

PeCDF - pentachlorodibenzofuran

~~R - risk based number~~

R_E - ecological risk-based number

R_H - human health risk-based number

RAO - remedial action objective

RAO1 - Reduce cancer and non-cancer risks to people from incidental ingestion of and dermal contact with COCs in sediment and beaches to exposure levels that are acceptable for fishing, occupational, recreational, and ceremonial uses.

RAO2 - Reduce cancer and non-cancer risks to acceptable exposure levels (direct and indirect) for human consumption of COCs in fish and shellfish.

RAO3 - Reduce cancer and noncancer risks to people from direct contact (ingestion, inhalation, and dermal contact) with COCs in surface water to exposure levels that are acceptable for fishing, occupational, recreational, and potential drinking water supply.

RAO4 - Reduce migration of COCs in groundwater to sediment and surface water such that levels are acceptable in sediment and surface water for human exposure.

RAO5 - Reduce risk to benthic organisms from ingestion of and direct contact with COCs in sediment to acceptable exposure levels.

RAO6 - Reduce risks to ecological receptors that consume COCs in prey to acceptable exposure levels.

RAO7 - Reduce risks to ecological receptors from ingestion of and direct contact with COCs in surface water to acceptable exposure levels.

RAO8 - Reduce migration of COCs in groundwater to sediment and surface water such that levels are acceptable in sediment and surface water for ecological exposure.

RSL - regional screening level

TCDD - tetrachlorodibenzo-p-dioxin

TCDF - tetrachlorodibenzofurans

TPH - total petroleum hydrocarbons

µg/kg - microgram per kilogram

µg/L - microgram per liter