Hudson River PCBs Site
Record of Decision

Tables

Table 8-1: Summary of Chemical of Concern and Medium Specific Exposure Point Concentrations (EPCs) for Cancer Assessment - Fish

Scenario Timeframe: Current/Future for Cancer Assessment
Medium: Fish
Exposure Medium: Fish (Species-weighted fish fillet)

Exposure Point[1]	Chemical of Concern	Concentration Detected[2]		Units[2]	Frequency of Detection[2]	Exposure Point Concentration[3]	Exposure Point Concentration Units	Statistical Measure
		Min.	Max.					
Reasonable Maximum Exposure (RME)								
Upper Hudson (Adult)	PCBs					2.0	mg/kg wet weight	Averaged over adult exposure duration (ED) of 22 years
Upper Hudson (Adolescent)	PCBs					2.5	mg/kg wet weight	Averaged over adolescent ED of 12 years
Upper Hudson (Young Child)	PCBs					3.0	mg/kg wet weight	Averaged over young child ED of 6 years
Central Tendency Exposure (CTE)								
Upper Hudson (Adult)	PCBs					3.0	mg/kg wet weight	Averaged over adult ED of 6 years
Upper Hudson (Adolescent)	PCBs					3.3	mg/kg wet weight	Averaged over adolescent ED of 3 years
Upper Hudson (Young Child)	PCBs					3.3	mg/kg wet weight	Averaged over young child ED of 3 years

(1) Upper Hudson total cancer risk is sum of cancer risks to young child, adolescent and adult.
(2) The EPCs are based on future PCB concentrations in fish forecast by EPA's fate and transport and bioaccumulation models of the Upper Hudson River (HUDTOX and FISHRAND), which were calibrated to a large dataset of PCB concentrations detected in Upper Hudson River fish from 1980 to 1999.
(3) It may be counter-intuitive that the RME EPC is lower than the CTE EPC. This fact is a direct result of the general trend of a projected decline in concentrations of PCBs in fish over time. Due to this decline over time, the average concentration over a longer ED is less than the average concentration over a shorter time period. However, the total lifetime PCB dose, which combined average concentration, ED and other intake factors, is greater for the RME individual than for the average (CTE) individual.

Table 8-2: Summary of Chemical of Concern and Medium Specific Exposure Point Concentrations (EPCs) for Non-Cancer Assessment - Fish

Scenario Timeframe: Current/Future for Non-Cancer Assessment
Medium: Fish
Exposure Medium: Fish (species-weighed fish fillet)

Exposure Point	Chemical of Concern	Concentration Detected[1]		Units[1]	Frequency of Detection[1]	Exposure Point Concentration[2]	Exposure Point Concentration Units	Statistical Measure
		Min.	Max.					
Reasonable Maximum Exposure (RME)								
Upper Hudson (Adult)	PCBs					2.9	mg/kg wet weight	Averaged over adult exposure duration (ED) of 7 years
Upper Hudson (Adolescent)	PCBs					2.9	mg/kg wet weight	Averaged over adolescent ED of 7 years
Upper Hudson (Young Child)	PCBs					3.0	mg/kg wet weight	Averaged over young child ED of 6 years
Central Tendency Exposure (CTE)								
Upper Hudson (Adult)	PCBs					3.0	mg/kg wet weight	Averaged over adult ED of 6 years
Upper Hudson (Adolescent)	PCBs					3.3	mg/kg wet weight	Averaged over adolescent ED of 3 years
Upper Hudson (Young Child)	PCBs					3.3	mg/kg wet weight	Averaged over young child ED of 3 years

(1) The EPCs are based on future PCB concentrations in fish forecast by EPA's fate and transport and bioaccumulation models of the Upper Hudson River (HUDTOX and FISHRAND), which were calibrated to a large dataset of PCB concentrations detected in Upper Hudson River fish from 1980 to 1999.

(2) It may be counter-intuitive that the RME EPC is lower than the CTE EPC. This fact is a direct result of the general trend of a projected decline in concentrations of PCBs in fish over time. Due to this decline over time, the average concentration over a longer ED is less than the average concentration over a shorter time period. However, the total lifetime PCB dose, which combined average concentration, ED and other intake factors, is greater for the RME individual than for the average (CTE) individual.

Table 8-3: Summary of Chemical of Concern and Medium Specific Exposure Point Concentrations (EPCs) for Dioxin-Like PCBs - Fish

Scenario Timeframe: Current/Future for Cancer Assessment
Medium: Fish
Exposure Medium: Fish (species-weighted fish fillet)

Exposure Point	Chemical of Concern	Concentration Detected[1]		Units[1]	Frequency of Detection[1]	Dioxin TEQ Exposure Point Concentration[2]	Exposure Point Concentration Units	Statistical Measure
		Min.	Max.					
Reasonable Maximum Exposure (RME)								
Upper Hudson (Adult)	PCB Congener # 77					9.0 E-07	mg/kg	See Footnote 2.
	PCB Congener #81					NA	mg/kg	See Footnote 2.
	PCB Congener #126					1.94 E-05	mg/kg	See Footnote 2.
	PCB Congener #169					3.60 E-09	mg/kg	See Footnote 2.
	PCB Congener # 105					3.40E-06	mg/kg	See Footnote 2.
	PCB Congener #114					2.20 E-06	mg/kg	See Footnote 2.
	PCB Congener #118					7.00 E-06	mg/kg	See Footnote 2.
	PCB Congener #123					4.80 E-08	mg/kg	See Footnote 2.
	PCB Congener #156					2.20 E-06	mg/kg	See Footnote 2.
	PCB Congener #157					3.50 E-07	mg/kg	See Footnote 2.
	PCB Congener #167					2.40 E-08	mg/kg	See Footnote 2.
	PCB Congener #189					1.72 E-08	mg/kg	See Footnote 2.
	Total Dioxin-Like PCBs					3.6 E-05	mg/kg	See Footnote 2.

(1) The EPCs are based on future PCB concentrations in fish forecast by EPA's fate and transport and bioaccumulation models of the Upper Hudson River (HUDTOX and FISHRAND), which were calibrated to a large dataset of PCB concentrations detected in Upper Hudson River fish from 1980 to 1999.
(2) Dioxin TEQ EPCs were derived using the 1998 WHO/IPCS toxicity TEFs, as described in the Revised Human Health Risk Assessment, pp. 75-76.

Table 8-4: Summary of Chemical of Concern and Medium Specific Exposure Point Concentrations (EPCs) for Cancer and Non-Cancer Assessment - Sediment

Scenario Timeframe: Current/Future for Cancer/Non-Cancer Assessment
Medium: Sediment
Exposure Medium: Sediment

Exposure Point[1]	Chemical of Concern	Concentration Detected[2]		Units[2]	Frequency of Detection[2]	Exposure Point Concentration[3,4]	Exposure Point Concentration Units	Statistical Measure
		Min.	Max.					
Reasonable Maximum Exposure (RME)								
Upper Hudson (Adult)	PCBs					3.8	mg/kg	Averaged over adult exposure duration (ED) of 23 years
Upper Hudson (Adolescent)	PCBs					5.2	mg/kg	Averaged over adolescent ED of 12 years
Upper Hudson (Young Child)	PCBs					6.4	mg/kg	Averaged over young child ED of 6 years
Central Tendency Exposure (CTE)								
Upper Hudson (Adult)	PCBs					6.6	mg/kg	Averaged over adult ED of 5 years
Upper Hudson (Adolescent)	PCBs					7.2	mg/kg	Averaged over adolescent ED of 3 years
Upper Hudson (Young Child)	PCBs					7.2	mg/kg	Averaged over young child ED of 3 years

(1) Upper Hudson total cancer risk is sum of cancer risks to young child, adolescent and adult.
(2) The EPCs are based on future PCB concentrations in sediment forecast by EPA's fate and transport model of the Upper Hudson River (HUDTOX), which was calibrated to a large dataset of PCB concentrations in sediments detected in Upper Hudson River.
(3) The RME sediment EPCs were calculated by averaging the modeled sediment concentrations over 23, 12 and 6 years for adult, adolescent, and young child EDs, respectively. These RME EDs sum to 41 years, the 95th percentile residence duration in the five counties surrounding the Upper Hudson River. The sediment concentrations were modeled over the EDs for the adult, adolescent and young child. The CTE or average ED for each age group sum to 11 years, the 50th percentile residence duration in the five counties surrounding the Upper Hudson.
(4) It may be counter-intuitive that the RME EPC is lower than the CTE EPC. This fact is a direct result of the general trend of a projected decline in concentrations of PCBs in fish over time. Due to this decline over time, the average concentration over a longer ED is less than the average concentration over a shorter time period. However, the total lifetime PCB dose, which combined average concentration, ED and other intake factors, is greater for the RME individual than for the average (CTE) individual.

Table 8-5: Summary of Chemical of Concern and Medium Specific Exposure Point Concentrations (EPCs) for Cancer and Non-Cancer Assessment - River Water

Scenario Timeframe: Current/Future for Cancer Assessment
Medium: River Water
Exposure Medium: River Water

Exposure Point[1]	Chemical of Concern	Concentration Detected[2]		Units[2]	Frequency of Detection[2]	Exposure Point Concentration[2,3]	Exposure Point Concentration Units	Statistical Measure
		Min.	Max.					
Reasonable Maximum Exposure (RME)								
Upper Hudson (Adult)	PCBs					3.4 E-05	mg/l	Averaged over adult exposure duration (ED) of 23 years
Upper Hudson (Adolescent)	PCBs					4.0 E-05	mg/l	Averaged over adolescent ED of 12 years
Upper Hudson (Young Child)	PCBs					4.5 E-05	mg/l	Averaged over young child ED of 6 years
Central Tendency Exposure (CTE)								
Upper Hudson (Adult)	PCBs					4.6 E-05	mg/l	Averaged over adult ED of 5 years
Upper Hudson (Adolescent)	PCBs					4.8 E-05	mg/l	Averaged over adolescent ED of 3 years
Upper Hudson (Young Child)	PCBs					4.8 E-05	mg/l	Averaged over young child ED of 3 years

(1) Upper Hudson total cancer risk is sum of cancer risks to young child, adolescent and adult.
(2)The RBMR provides modeled future concentrations of PCBs in the water column over time and distance, assuming baseline conditions of a constant-upstream source of PCBs and provides results for Total PCBs and Tri+ PCBs. The modeled Total PCBs concentrations were used to calculate the EPCs in river water. The high-end RME exposure river water EPCs were calculated by averaging the modeled PCB concentrations in river water over 23, 12 and 6 years for adult, adolescent, and young child exposure durations, respectively. These RME exposure durations sum to 41 years, the 95th percentile residence duration in the five counties surrounding the Upper Hudson River. The sediment concentrations were modeled over the EDs for the adult, adolescent and young child. The CTE or average EDs for each age group sum to 11 years, the 50th percentile residence duration in the five counties surrounding the Upper Hudson.
(3) It may be counter-intuitive that the RME EPC is lower than the CTE EPC. This fact is a direct result of the general trend of a projected decline in concentrations of PCBs in fish over time. Due to this decline over time, the average concentration over a longer ED is less than the average concentration over a shorter time period. However, the total lifetime PCB dose, which combined average concentration, ED and other intake factors, is greater for the RME individual than for the average (CTE) individual.

Table 8-6: Summary of Chemical of Concern and Medium Specific Exposure Point Concentrations (EPCs) for Cancer Assessment - Volatilized PCBs

Scenario Timeframe: Current/Future for Cancer Assessment
Medium: River Water
Exposure Medium: Volatilized PCBs in Air

Exposure Point[1]	Chemical of Concern	Concentration Detected[2]		Units[2]	Frequency of Detection[2]	Exposure Point Concentration[2,3]	Exposure Point Concentration Units	Statistical Measure
		Min.	Max.					
Reasonable Maximum Exposure (RME)								
Upper Hudson (Adult)	PCBs					1.7 E-02	micrograms/ cubic meter	Averaged over adult exposure duration (ED) of 23 years
Upper Hudson (Adolescent)	PCBs					1.7 E-02	micrograms/ cubic meter	Averaged over adolescent ED of 12 years
Upper Hudson (Young Child)	PCBs					1.7 E-02	micrograms/ cubic meter	Averaged over young child ED of 6 years
Central Tendency Exposure (CTE)								
Upper Hudson (Adult)	PCBs					1.0 E-03	micrograms/ cubic meter	Averaged over adult ED of 5 years
Upper Hudson (Adolescent)	PCBs					1.0 E-03	micrograms/ cubic meter	Averaged over adolescent ED of 3 years
Upper Hudson (Young Child)	PCBs					1.0 E-03	micrograms/ cubic meter	Averaged over young child ED of 3 years

(1) Upper Hudson total cancer risk is sum of cancer risks to young child, adolescent and adult.
(2) The concentrations of volatilized PCBs in air were calculated from a combination of historical monitoring data and modeled emissions from the river using an EPA-recommended air dispersion model.
(3) It may be counter-intuitive that the RME EPC is lower than the CTE EPC. This fact is a direct result of the general trend of a projected decline in concentrations of PCBs in fish over time. Due to this decline over time, the average concentration over a longer ED is less than the average concentration over a shorter time period. However, the total lifetime PCB dose, which combined average concentration, ED and other intake factors, is greater for the RME individual than for the average (CTE) individual.

Table 8-7: Conceptual Site Model (Table 2.1 from HHRA)

Scenario Timeframe	Source Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Fish	Fish	Upper Hudson Fish	Angler	Adult Adolescent Child	Ingestion Ingestion Ingestion	On-Site On-Site On-Site	Quant Quant Quant	PCBs have been widely detected in fish.
	Sediment	Sediment	Banks of Upper Hudson	Recreator	Adult Adolescent Child	Ingestion Dermal Ingestion Dermal Ingestion Dermal	On-Site On-Site On-Site On-Site On-Site On-Site	Quant Quant Quant Quant Quant Quant	Recreators may ingest or otherwise come in contact with contaminated river sediment while engaging in activities along the river.
	River Water	Drinking Water	Upper Hudson River	Resident	Adult Adolescent Child	Ingestion Ingestion Ingestion	On-Site On-Ste On-Site	Qual Qual Qual	Considered in Phase 1 Risk Assessment and determined to have de minimis risk. Concentrations below the MCL do not pose a risk during occasional exposure, such as during swimming. Not evaluated further in this HHRA.
		River Water	Upper Hudson River (wading/swimming)	Recreator	Adult Adolescent Child	Dermal Dermal Dermal	On-Site On-Site On-Site	Quant Quant Quant	Recreators may come in contact with contaminated river water while wading or swimmming.
		Oudoor Air	Upper Hudson River (River and near vicinity)	Recreator	Adult Adolescent Child	Inhalation Inhalation Inhalation	On-Site On-Site On-Site	Quant Quant Quant	Recreators may inhale volatilized PCBs while engaging in river-related activities.
				Resident	Adult Adolescent Child	Inhalation Inhalation Inhalation	On-Site On-Site On-Site	Quant Quant Quant	Nearby residents may inhale volatilized PCBs outside their home.
	Floodplain Soil	Cow's milk, Cattle beef, Home-grown Crops, etc.	Flood plain of Upper Hudson River	Resident	Adult Adolescent Child	Ingestion Ingestion Ingestion	On-Site On-Site On-Site	Qual Qual Qual	Limited data in cattle. Studies show non-detect PCB levels in cow's milk in N.Y Lim ited data in crops. Studies show low PCB uptake in forage crops. (See ROD Section 1.1).
	Other Non-Fish Biota	Turtles, ducks, etc.	Along Upper Hudson River	Resident	Adult Adolescent Child	Ingestion Ingestion Ingestion	On-Site On-Site On-Site	Qual Qual Qual	Limited data; ingestion of animals other than Hudson River fish likely to be minimal.

Table 8-8: Cancer Toxicity Data Summary

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/ Cancer Guidelines Description (1)	Source	Date (mm/dd/yyyy)
Pathway: Ingestion, Dermal						
Polychlorinated Biphenyls (RME)	2.0	2.0	$(mg/kg\text{-}day)^{-1}$	B2 (likely)	IRIS	6/1/97
Polychlorinated Biphenyls (CTE)	1.0	1.0	$(mg/kg\text{-}day)^{-1}$	B2 (likely)	IRIS	6/1/97
Polychlorinated biphenyls dioxin-like compounds	150,000	-	$(mg/kg\text{-}day)^{-1}$	B2 (likely)	HEAST	1997 Update
Pathway: Inhalation						
Polychlorinated Biphenyls (RME)	0.4	-	$(mg/kg\text{-}day)^{-1}$	B2 (likely)	IRIS	6/1/97
Polychlorinated Biphenyls (CTE)	0.3	-	$(mg/kg\text{-}day)^{-1}$	B2 (likely)	IRIS	6/1/97
Polychlorinated biphenyls dioxin-like compounds	150,000	-	$(mg/kg\text{-}day)^{-1}$	B2 (likely)	HEAST	1997 Update

Key:

-: No information available.
IRIS: Integrated Risk Information System (USEPA)
HEAST: Health Effects Assessment Summary Table.

Notes:

(1) The B2 designation specifies a probable human carcinogen indicating there is sufficient evidence in animals and either inadequate or inadequate but suggestive evidence in humans.

Table 8-9: Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal									
Chemical of Concern	**Chronic/ Subchronic**	**Oral RfD**	**Oral RfD Units**	**Dermal RfD**	**Dermal RfD Units**	**Primary Target Organ**	**Combined Uncertainty/ Modifying Factors**	**Sources of RfD: Target Organ (1)**	**Dates of RfD Target Organ (MM/DD/YYYY**
Aroclor 1254	Chronic	2.0 E-05 (2)	mg/kg-day	NA	NA	Immune System/Eye Gland	300	IRIS	06/01/97
Aroclor 1016	Chronic	7.0 E-05 (3)	mg/kg-day	7.0 E-05 (3)	mg/kg-day	Reduced Birth Weight	100	IRIS	06/01/97

(1) Current Integrated Risk Information System (IRIS) values in PCB file.
(2) Oral RfD for Aroclor 1254; there is no RfD available for total PCBs. PCBs in Hudson River fish are most like Aroclor 1254.
(3) Oral RfD for Aroclor 1016; there is no RfD available for total PCBs. PCBs in Hudson River sediment and water samples are most like Aroclor 1016.

Key: NA = Not applicable
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level

Table 8-10: Risk Characterization Summary for RME Exposures Exceeding 1 x 10E-6 in the Upper Hudson River - Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child (1 to 6 years old)

Medium	Exposure Medium	Chemical of Concern	Ingestion	Inhalation	Dermal	External Radiation	Exposure Routes Total
Fish	Fish	PCBs	3.6 x 10E-4	NA	NA	NA	3.6 x10E-4

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adolescent

Medium	Exposure Medium	Chemical of Concern	Ingestion	Inhalation	Dermal	External Radiation	Exposure Routes Total
Fish	Fish	PCBs	4.3 x 10E-4	NA	NA	NA	4.3 x 10E-4

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Chemical of Concern	Ingestion	Inhalation	Dermal	External Radiation	Exposure Routes Total
Fish	Fish	PCBs	5.8 x 10E-4	NA	NA	NA	5.8 x 10E-4

Total Cancer Risk (apportioned as young child, adolescent and adult) - Fish Ingestion: 1 x 10E-3

Table 8-10 Continued

Table 8-10: Risk Characterization Summary for RME Exposures Exceeding 1 x 10E-6 in the Upper Hudson River - Carcinogens

Scenario Timeframe:	**Current/Future**						
Receptor Population:	**Recreator**						
Receptor Age:	**Young Child (1 to 6 years old)**						
Medium	**Exposure Medium**	**Chemical of Concern**	**Ingestion**	**Inhalation**	**Dermal**	**External Radiation**	**Exposure Routes Total**
Sediment	Sediment	PCBs	2.6 x 10E-07	NA	2.0 x 10E-07	NA	4.6 x 10E-07
River Water	River Water	PCBs	NA	NA	3.2 x 10E-08	NA	3.2 x 10E-08
River Water	Outdoor Air	PCBs	NA	6.6 x 10E-09	NA	NA	6.6 x 10E-09
						Total Cancer Risk Across All Media and All Exposure Routes	5.0 x 10E-07
Scenario Timeframe:	**Current/Future**						
Receptor Population:	**Recreator**						
Receptor Age:	**Adolescent**						
Medium	**Exposure Medium**	**Chemical of Concern**	**Ingestion**	**Inhalation**	**Dermal**	**External Radiation**	**Exposure Routes Total**
Sediment	Sediment	PCBs	2.2 x 10 E-07	NA	6.6 x 10E-07	NA	8.8 x 10E-07
River Water	River Water	PCBs	NA	NA	1.1 x 10E-07	NA	1.1 x 10E-07
River Water	Outdoor Air	PCBs	NA	1.9 x 10E-08	NA	NA	1.9 x 10E-08
						Total Cancer Risk Across All Media and All Exposure Routes	1.0 x 10E-06
Scenario Timeframe:	**Current/Future**						
Receptor Population:	**Recreator**						
Receptor Age:	**Adult**						
Medium	**Exposure Medium**	**Chemical of Concern**	**Ingestion**	**Inhalation**	**Dermal**	**External Radiation**	**Exposure Routes Total**
Sediment	Sediment	PCBs	6.4 x 10 E-08	NA	3.3 x 10E-07	NA	3.9 x 10E-07
River Water	River Water	PCBs	NA	NA	5.1 x 10E-08	NA	5.1 x 10E-08
River Water	Outdoor Air	PCBs	NA	7.3 x 10E-09	NA	NA	7.3 x 10E-09
						Total Cancer Risk Across All Media and All Exposure Routes	4.5 x 10E-07

Total Cancer Risk for Recreator (apportioned as young child, adolescent and adult): 2.0 x 10E-6

Table 8-10 Continued

Table 8-10: Risk Characterization Summary for RME Exposures Exceeding 1 x 10E-6 in the Upper Hudson River - Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Avid Recreator
Receptor Age: Young Child (1 to 6 years old)

Medium	Exposure Medium	Chemical of Concern	Ingestion	Inhalation	Dermal	External Radiation	Exposure Routes Total
Sediment	Sediment	PCBs	2.1x 10 E-06	NA	1.6 x 10E-06	NA	3.7 x 10E-06
River Water	River Water	PCBs	NA	NA	2.5 x 10E-07	NA	2.5 x 10E-07
River Water	Outdoor Air	PCBs	NA	6.6 x 10E-09	NA	NA	6.6 x 10E-09
						Total Cancer Risk Across All Media and All Exposure Routes	4.0 x 10E-06

Scenario Timeframe: Current/Future
Receptor Population: Avid Recreator
Receptor Age: Adolescent

Medium	Exposure Medium	Chemical of Concern	Ingestion	Inhalation	Dermal	External Radiation	Exposure Routes Total
Sediment	Sediment	PCBs	5.9 x 10 E-07	NA	1.8 x 10E-06	NA	2.4 x 10E-06
River Water	River Water	PCBs	NA	NA	3.0 x 10E-07	NA	3.0 x 10E-07
River Water	Outdoor Air	PCBs	NA	1.9 x 10E-08	NA	NA	1.9 x 10E-08
						Total Cancer Risk Across All Media and All Exposure Routes	2.7 x 10E-06

Scenario Timeframe: Current/Future
Receptor Population: Avid Recreator
Receptor Age: Adult

Medium	Exposure Medium	Chemical of Concern	Ingestion	Inhalation	Dermal	External Radiation	Exposure Routes Total
Sediment	Sediment	PCBs	5.1x 10 E-07	NA	2.6 x 10E-06	NA	3.1 x 10E-06
River Water	River Water	PCBs	NA	NA	4.1 x 10E-07	NA	4.1 x 10E-07
River Water	Outdoor Air	PCBs	NA	7.3 x 10E-09	NA	NA	7.3 x 10E-09
						Total Cancer Risk Across All Media and All Exposure Routes	3.5 x 10E-6

Total Cancer Risk (apportioned as young child, adolescent and adult) for Avid Recreator is: 1 x 10E-05

Table 8-11: Risk Characterization Summary for CT Exposures Exceeding 1 x 10E-6 in the Upper Hudson River - Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Young Child (1 to 6 years old)

Medium	Exposure Medium	Chemical of Concern	Ingestion	Inhalation	Dermal	External Radiation	Exposure Routes Total
Fish	Fish	PCBs	9.9 x 10E-6	NA	NA	NA	9.9 x10E-6

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adolescent

Medium	Exposure Medium	Chemical of Concern	Ingestion	Inhalation	Dermal	External Radiation	Exposure Routes Total
Fish	Fish	PCBs	7.2 x 10E-6	NA	NA	NA	7.2 x10E-6

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Chemical of Concern	Ingestion	Inhalation	Dermal	External Radiation	Exposure Routes Total
Fish	Fish	PCBs	1.2 x 10E-5	NA	NA	NA	1.2 x10E-5

Total Cancer Risk (apportioned as young child, adolescent and adult) - Fish Ingestion: 3.0 x 10E-05

Table 8-12: Risk Characterization Summary for RME Exposures > HI = 1
for Upper Hudson River - Non-Cancer

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Young Child (1 to 6 years old)

					Non-Cancer Hazard Index			
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Fish	Fish	Upper Hudson Fish	PCBs	LOAEL	104	NA	NA`	104

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adolescent

					Non-Cancer Hazard Index			
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Fish	Fish	Upper Hudson Fish	PCBs	LOAEL	71	NA	NA`	71

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

					Non-Cancer Hazard Index			
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Fish	Fish	Upper Hudson Fish	PCBs	LOAEL	65	NA	NA`	65

Table 8-13: Risk Characterization Summary for CT Exposures > HI = 1
for Upper Hudson River - Non-Cancer

Scenario Timeframe:	**Current/Future**							
Receptor Population:	**Angler**							
Receptor Age:	**Young Child (1 to 6 years old)**							
					Non-Cancer Hazard Index			
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Fish	Fish	Upper Hudson Fish	PCBs	LOAEL	12	NA	NA`	12

Scenario Timeframe:	**Current/Future**							
Receptor Population:	**Angler**							
Receptor Age:	**Adolescent**							
					Non-Cancer Hazard Index			
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Fish	Fish	Upper Hudson Fish	PCBs	LOAEL	8	NA	NA`	8

Scenario Timeframe:	**Current/Future**							
Receptor Population:	**Angler**							
Receptor Age:	**Adult**							
					Non-Cancer Hazard Index			
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Fish	Fish	Upper Hudson Fish	PCBs	LOAEL	7	NA	NA`	7

TABLE 8-14

NYS RARE AND LISTED SPECIES AND HABITATS OCCURRING IN THE VICINITY OF THE HUDSON RIVER

Common Name	Scientific Name	NYS Status	State Rank	Precision Value
Plants - known occurrences (i.e., precision value S)				
American waterwort	*Elantine americana*	Endangered	S1	S
Bicknell's sedge	*Carex bicknelli*	Rare	S2/S3	S
Blunt-lobe grape fern*	*Botrychium oneidense*	Endangered	S1/S3	S
Carey's smartweed	*Polygonum careyi*	Unprotected	S2	S
Clustered sedge	*Carex cumulata*	Rare	S2S3	S
Corn-salad	*Valerianella umbilicata*	Unprotected	SH	S
Davis' sedge	*Carex davisii*	Rare	S1	S
Estuary beggar-ticks		Threatened	S3	S
False hop sedge	*Carex lupiformes*	Rare	S3	S
Fissidens (non-vascular)	*Fissidens Fontanus*	Unprotected	S3?	S
Frank sedge	*Carex frankii*	Unprotected	S1	S
Glaucous sedge	*Carex Flaccosperma var. glaucodea*	Rare	S1	S
Golden club	*Orontium aquaticum*	Unprotected	S2	S
Golden seal	*Hydrastis canadensis*	Threatened	S2	S
Gypsy-wort	*Lycopus rubellus*	Unprotected	S1	S
Heartleaf plantain	*Plantago cordata*	Threatened	S3	S
Illinois pinweed	*Lechea racemulosa*	Rare	S3	S
Liliaeopsis	*Lilaeopsis chinensis*	Unprotected	S2	S
Lined sedge	*Carex striatula*	Unprotected	S1	S
Marsh straw sedge	*Carex hormathodes*	Rare	S2/S3	S
Midland sedge	*Carex mesocorea*	Unprotected	S1	S
Mock-pennyroyal	*Hedeoma hispidum*	Rare	S2/S3	S
Narrow-leaved sedge	*Carex amphibola var. amphibola*	Unprotected	S1	S
Saltmarsh aster	*Aster subulatus*	Threatened	S2	
Saltmarsh bulrush	*Scirpus novae-angliae*	Endangered	S1	S
Schweinitz's flatsedge	*Cyperus schweinitizii*	Rare	S3	S
Slender crabgrass	*Digitaria filiformis*	Threatened	S2	S

Table 8-14 Continued

NYS RARE AND LISTED SPECIES AND HABITATS OCCURRING IN THE VICINITY OF THE HUDSON RIVER

Common Name	Scientific Name	NYS Status	State Rank	Precision Value
Small-flowered crowfoot	*Ranunculus micranthus*	Unprotected	S2	S
Smooth bur-marigold	*Bidens laevis*	Rare	S2	S
Southern yellow flax	*Linum medium var. texanum*	Threatened	S2	S
Southern dodder	*Cuscata obtusiflora car. glandulosa*	Unprotected	S1	S
Long's bittercress	*Cardamine longii*	Unprotected	S2	S
Spongy arrowhead	*Sagittaria calycina var. spongiosa*	Rare	S2	S
Starwort	*Callitriche terrestris*	Unprotected	S2S3	S
Swamp lousewort	*Pedicularis lanceolata*	Rare	S2	S
Swamp cottonwood	*Populus heterophylla*	Threatened	S2	S
Taxiphyllum (non-vascular)	*Taxiphyllum taxirameum*	Unprotected	S1	S
Violet wood-sorrel	*Oxalis violacea*	Unprotected	S1S2	S
Violet lespedeza	*Lespedeza violacea*	Rare	S3	S
Water pigmyweed	*Crassula aquatica*	Endangered	S1	S
Weak stellate sedge	*Carex seorsa*	Rare	S2	S
Invertebrates				
American rubyspot dragonfly	*Hetaerina americana*	Unprotected	S2/S3	S
Arrowhead spiketail dragonfly	*Cordulegaster obliqua*	Unprotected	S2S3	S
Gray petaltail dragonfly	*Tachopteryx thoreyi*	Unprotected	S2	S
Spatterdock darner	*Aeshna mutata*	Unprotected	S2	
Tawny emperor butterfly	*Asterocampa clyton*	Unprotected	S3	S
Riverine clubtail	*Stylurus amnicola*	Unprotected	SH	M
Fish				
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered	S1	S
Bluespotted sunfish	*Enneacanthus gloriosus*	Unprotected	S2	M
Reptiles				
Bog turtle	*Clemmys muhlenbergii*	Endangered	S2	M
Blanding's turtle	*Emydoidea blandingii*	Threatened	S2	M
Fence lizard	*Sceloporus undulatus*	Unprotected	S1	S

Table 8-14 Continued

NYS RARE AND LISTED SPECIES AND HABITATS OCCURRING IN THE VICINITY OF THE HUDSON RIVER

Common Name	Scientific Name	NYS Status	State Rank	Precision Value
Timber rattlesnake	***Crotalus horridus***	**Threatened**	**S3**	**M**
Birds				
Peregrine falcon	***Falco peregrinus***	**Endangered**	**S2**	**S**
Bald eagle*	***Haliaeetus Leucocephalus***	**Endangered**	**S1B, S1N**	**S**
Least bittern	***Ixobrychus Exilis***	**Threatened**	**S3B, S1N**	
King rail	***Rallus elegans***	**Protected**	**S1**	**M**
Barn Owl	***Tyto alba***	**Protected-Special Concern**	**S3**	**M**
Short-eared owl*	***Asio flammeus***	**Protected-Special Concern**	**S2**	**S**
Osprey*	***Pandion halietus***	**Threatened**	**S4**	**M**
Mammals				
Eastern woodrat	***Neotoma magister***	**Endangered**	**SH**	**M**
Communities				
17 Freshwater Intertidal Mudflats Communities				**S**
21 Freshwater Tidal Marsh Communities				**S**
9 Freshwater Tidal Swamp Communities				**S**
6 Freshwater Intertidal Shore Communties				**S**
7 Brackish Intertidal Mudflats Communities				**S**
7 Brackish Tidal Marsh Communities				**S**
1 Brackish Subtidal Aquatic Bed Community				**S**
1 Calcareous Cliff Community				**S**
Areas of Concern				
16 Anadromous Fish Concentration Areas				**S**
12 Waterfowl Concentration Areas				**S**
3 Raptor Concentration Areas*				**S**
1 Warm Water Fish Concentration Area				**S**

Table 8-14 Continued

NYS RARE AND LISTED SPECIES AND HABITATS OCCURRING IN THE VICINITY OF THE HUDSON RIVER

Common Name	Scientific Name	NYS Status	State Rank	Precision Value
Notes: * Indicates sighted in the Upper Hudson River (above Federal Dam). State Rank: S1 = Typically 5 or fewer occurrences, very few remaining individuals, acres or miles of stream in NYS S2 = Typically 6 to 20 occurrences, very few remaining individuals, acres or miles of stream in NYS S3 = Typically 21 to 100 occurrences, limited acreage or miles of stream in NYS S4 = Apparently secure in NYS S5 = Demostrably secure in NYS Precision Rank: A precision value of "S" or a blank indicates that a species is known to be found along the Hudson River. A precision value of "M" indicates that a species may occur along the Hudson River in an appropriate habitat. Source: NYSDEC, July 27, 2000.				

TABLE 8-15
ECOLOGICAL ASSESSMENT AND MEASUREMENT ENDPOINTS

Assessment Endpoint	Representative Receptor	Measures	
		Exposure	Effect
Benthic community structure as food source for local fish and wildlife.	- Benthic macroinvertebrate community	- Ecological community indices diversity, evenness, dominance) - PCB levels in sediments and water column	- Differences in benthic community indices - Exceedance of ambient water quality criteria (AWQC) and sediment guidelines
Survival, growth, and reproduction of local forage fish populations.	- Spottail shiner - Pumpkinseed	- Measured PCB body burdens - Modeled PCB body burdens - PCB concentrations in sediments and water column	- Estimated exceedance of TRVs - Exceedance of AWQC and sediment guidelines - Field observations
Survival, growth, and reproduction of local piscivorous/semi-piscivorous fish populations.	- Yellow perch - White perch - Largemouth bass - Striped bass	- Measured PCB body burdens - Modeled PCB body burdens - PCB concentrations in sediments and water column	- Estimated exceedance of TRVs - Exceedance of AWQC and sediment guidelines - Field observations
Survival, growth, and reproduction of local omnivorous fish populations.	- Brown bullhead	- Measured PCB body burdens - Modeled PCB body burdens - PCB concentrations in sediments and water column	- Estimated exceedance of TRVs - Exceedance of AWQC and sediment guidelines - Field observations
Protection (i.e., survival and reproduction) of insectivorous birds and mammals.	- Tree swallow - Little brown bat	- Measured PCB concentrations in prey items (aquatic insects/benthic invertebrates) - Modeled PCB concentrations in prey items (aquatic insects) - PCB concentrations in the water column	- Estimated exceedance of TRVs - Exceedance of AWQC for the protection of wildlife - Field observations
Protection (i.e., survival and reproduction) of waterfowl.	- Mallard	- Measured PCB concentrations in prey invertebrates, macrophytes) - Modeled PCB concentrations in prey (invertebrates, macrophytes) - PCB concentrations in the water column	- Estimated exceedance of TRVs - Exceedance of AWQC for the protection of wildlife - Field observations
Protection of piscivorous/semi-piscivorous birds and mammals.	- Belted kingfisher - Great blue heron - Mink - River Otter	- Measured PCB concentrations in prey (forage fish, invertebrates) - Modeled PCB concentrations in prey (forage fish, invertebrates) - PCB concentrations in sediments and water column	- Estimated exceedance of TRVs - Exceedance of AWQC for the protection of wildlife - Field observations
Protection of omnivorous mammals.	- Raccoon	- Measured PCB concentrations in prey items (fish, invertebrates) - PCB concentrations in the water column	- Estimated exceedance of TRVs - Exceedance of AWQC for the protection of wildlife - Field observations

Notes: 1: Individual-level effects are considered to occur when the TQ is greater to or equal to one. Receptor species are surrogates, representative of a wide range of species likely to use the Hudson River as habitat or foraging source.

Table 8-16: Average Fish Tissue Concentrations from 1998 NYSDEC Sampling in the Upper Hudson River, Reported as mg/kg Wet Weight and Converted to a Consistent Estimator of Tri+ PCBs

Species	Thompson Island Pool RM 188 - 193	Stillwater Reach RM 168 –– 176	Waterford Reach RM 155 –– 157	Below Federal Dam RM 142 — 153.2
Brown Bullhead	11.2	8.25	2.98	1.85
Carp	28.64	41.25	18.92	11.01
Largemouth Bass	16.06	6.92	3.27	9.7
Pumpkinseed	8.64	4.77	-	4.5
Yellow Perch	7.59	1.62	-	1.16

Table 8-17: Observed Avian Total PCB Concentrations

1994 USFWS Tree Swallow Concentrations in mg/kg						
	Lock 9	Remnant 4	SA13	Saratoga NHP		
Eggs	0.9	6.6	29.6	18.5		
	2.6	22.9	77.3	2.4		
	5.7	12.9	17.6	15.7		
	16	4.6	44	13		
EGG AVERAGE	6.28	11.7	42.1	12.4		
Nestlings	0.51	31.1	54.8	9.8		
	0.244	27.1	56.8	0.7		
NESTLING AVERAGE	0.377	29.1	55.8	5.3		
1997-1999 USFWS Tree Swallow Concentrations in ng/g						
	WI (Ref. Station)	Remnant 4	SA13	Saratoga NHP	Ravena (Alb.Co.)	Lower Hudson
Nestlings	42	7600	8500	6400	2300	750
	56	7600	12000	4500	1800	890
		7800	9600	9100		160
		8500	9700	7300		160
						290
						330
						170
						450
NESTLING AVERAGE	49	7875	9950	6825	2050	400
Adults		9700	16000	2300		
		8000	11000	5400		
		7500	5400	3600		
ADULT AVERAGE		8400	10800	3767		

Table 8-17 Continued

1997-1999 USFWS Great Blue Heron Concentrations in ng/g

	Castleton Island (Lower River)			Saratoga NHP		
Nestling Brains	560			1000		
	35					
	140					
	60					
	150					
NESTLING BRAIN AVERAGE	189			1000		

1997-1999 USFWS Eagle Blood Concentrations in ng/g

Bald Eagle Blood	Serum	Whole Blood	Serum			
	Lower River	Lower River	Lock 1			
Minimum	471	214				
Maximum	14240	755				
Average	2288	440	1009			
Number of Samples	13	5	1			

Source: 1994 data from USFWS, 1997; 1997- 1999 data from USGS 2000a and 2000c.

Table 8-18: Dry Weight Sediment Concentrations Based on USEPA Phase 2 Dataset

	Tri+ PCB		Avian Based TEF		Mammalian Based TEF	
	Average	95% UCL	Average	95% UCL	Average	95% UCL
	Sediment Conc.	Sediment Conc.	Sediment Conc.	Sediment Conc .	Sediment Conc.	Sediment Conc.
Location	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Upper River						
Thompson Island Pool (189)	11.879	17.381	3.30E-02	4.83E-02	9.24E-03	1.35E-02
Stillwater (168)	31.030	54.170	8.62E-02	1.50E-01	2.41E-02	4.21E-02
Federal Dam (154)	2.793	4.684	7.76E-03	1.30E-02	2.17E-03	3.64E-03
Lower River						
143.5	0.860	0.942	1.88E-03	2.06E-03	2.12E-04	2.32E-04
137.2	1.519	3.069	3.32E-03	6.71E-03	3.74E-04	7.56E-04
122.4	0.963	1.069	2.10E-03	2.34E-03	2.37E-04	2.63E-04
113.8	1.009	1.667	2.21E-03	3.64E-03	2.48E-04	4.11E-04
100	0.399		8.72E-04	1.88E-02	9.82E-05	2.12E-03
88.9	0.781	8.613	1.71E-03	4.99E-03	1.92E-04	5.62E-04
58.7	0.252	2.794	5.51E-04	6.11E-03	6.20E-05	6.88E-04
47.3	1.537	6.000	3.36E-03	1.31E-02	3.79E-04	1.48E-03
25.8	0.578	1.563	1.26E-03	3.42E-03	1.42E-04	3.85E-04
Source: Hudson River Database Release 5.0						

Table 8-19 Whole Water Concentrations Based on USEPA Phase 2 Dataset

Hudson River	Tri+ PCB		Avian Based TEF		Mammalian Based TEF	
Location	Average Conc. Water mg/L	95% UCL Conc. In Water mg/L	Average Conc. in Water mg/L	95% UCL Conc. In Water mg/L	Average Conc. in Water mg/L	95% UCL Conc. In Water mg/L
Upper River						
Thompson Island Pool (189)	7.36E-05	2.33E-04	6.01E-07	1.90E-06	4.66E-07	0.000001
Stillwater (168)	1.31E-04	4.15E-04	1.07E-06	3.39E-06	8.27E-07	0.000003
Federal Dam (154)	9.14E-05	1.96E-04	7.46E-07	1.60E-06	5.78E-07	0.000001
Lower River						
143.5	7.07E-05	7.70E-04	6.01E-08	6.55E-07	4.62E-08	0
137.2	7.07E-05	7.70E-04	6.01E-08	6.55E-07	4.62E-08	0
122.4	3.24E-05	4.15E-04	2.75E-08	3.53E-07	2.11E-08	0
113.8	3.24E-05	4.15E-04	2.75E-08	3.53E-07	2.11E-08	0
100	3.24E-05	4.15E-04	2.75E-08	3.53E-07	2.11E-08	0
88.9	2.13E-05	9.48E-05	1.81E-08	8.06E-08	1.39E-08	0
58.7	2.13E-05	9.48E-05	1.81E-08	8.06E-08	1.39E-08	0
47.3	2.13E-05	9.48E-05	0	8.06E-08	1.39E-08	0
25.8	2.13E-05	0.0000948	1.81E-08	8.06E-08	1.39E-08	0

Note: Water concentrations estimated from Phase 2 dataset – data averaged across appropriate lower river water column sampling locations.

Source: Hudson River Database Release 5.0

TABLE 8-20: Benthic Invertebrate Concentrations Based On USEPA Phase 2 Datatset

Location	Tri+ PCB		Avian Based TEF		Mammalian Based TEF	
	Average Benthic Invert Conc. mg/Kg	95% UCL Benthic Conc. mg/Kg	Average Benthic Invert Conc. mg/Kg	95% UCL Benthic Conc. mg/Kg	Average Benthic Invert Conc. mg/Kg	95% UCL Benthic Conc. mg/Kg
Upper River						
Thompson Island	14.138	22.210	7.53E-04	1.18E-03	4.20E-04	6.59E-04
Stillwater (168)	26.377	45.912	1.41E-03	2.45E-03	7.83E-04	1.36E-03
Federal Dam (154)	6.286	10.942	3.35E-04	5.83E-04	1.87E-04	3.25E-04
Lower River						
143.5	0.876	1.524	1.21E-04	2.11E-04	9.45E-05	1.64E-04
137.2	1.725	3.002	2.39E-04	4.16E-04	1.86E-04	3.24E-04
122.4	0.804	2.021	1.11E-04	2.80E-04	8.68E-05	2.18E-04
113.8	0.691	1.203	9.57E-05	1.67E-04	7.45E-05	1.30E-04
100	0.380	2.598	5.27E-05	3.60E-04	4.10E-05	2.80E-04
88.9	0.191	0.339	2.64E-05	4.69E-05	2.06E-05	3.65E-05
58.7	0.491	0.854	6.80E-05	1.18E-04	5.29E-05	9.21E-05
47.3	0.666	4.891	9.23E-05	6.78E-04	7.19E-05	5.28E-04
25.8	0.197	0.335	2.73E-05	4.64E-05	2.13E-05	3.61E-05

Source: Hudson River Database Release 5.0

Table 8-21: Ratio of Modeled Dietary Doses to Toxicity Benchmarks for Female Mink for Tri+ Congeners for the Period 1993-2018

Year	LOAEL 189 Average	NOAEL 189 Average	LOAEL 168 Average	NOAEL 168 Average	LOAEL 154 Average	NOAEL 154 Average	LOAEL 152 Average	NOAEL 152 Average	LOAEL 113 Average	NOAEL 113 Average	LOAEL 90 Average	NOAEL 90 Average	LOAEL 50 Average	NOAEL 50 Average
1993	**26**	**257**	**13**	**134**	**4.3**	**43**	**3.4**	**34**	**2.4**	**24**	**2.0**	**20**	**1.7**	**17**
1994	**23**	**233**	**12**	**123**	**3.9**	**39**	**2.7**	**27**	**2.2**	**22**	**1.8**	**18**	**1.5**	**15**
1995	**21**	**213**	**11**	**107**	**3.5**	**35**	**2.5**	**25**	**1.9**	**19**	**1.6**	**16**	**1.4**	**14**
1996	**16**	**157**	**8.8**	**88**	**3.1**	**31**	**2.8**	**28**	**2.0**	**20**	**1.6**	**16**	**1.3**	**13**
1997	**13**	**127**	**7.7**	**77**	**2.8**	**28**	**2.4**	**24**	**1.8**	**18**	**1.4**	**14**	**1.2**	**12**
1998	**14**	**141**	**7.5**	**75**	**2.9**	**29**	**4.7**	**47**	**3.8**	**38**	**3.1**	**31**	**2.6**	**26**
1999	**13**	**127**	**6.9**	**69**	**2.7**	**27**	**2.0**	**20**	**1.7**	**17**	**1.4**	**14**	**1.2**	**12**
2000	**10**	**99**	**5.9**	**59**	**2.4**	**24**	**1.9**	**19**	**1.4**	**14**	**1.2**	**12**	**1.0**	**10**
2001	**8.5**	**85**	**4.9**	**49**	**2.0**	**20**	**1.9**	**19**	**1.4**	**14**	**1.1**	**11**	0.9	**9**
2002	**9.1**	**91**	**4.3**	**43**	**1.9**	**19**	**1.8**	**18**	**1.4**	**14**	**1.1**	**11**	0.9	**9**
2003	**9.2**	**92**	**3.9**	**39**	**1.7**	**17**	**1.7**	**17**	**1.3**	**13**	**1.1**	**11**	0.9	**9**
2004	**11**	**105**	**3.8**	**38**	**1.6**	**16**	**1.5**	**15**	**1.3**	**13**	**1.0**	**10**	0.9	**9**
2005	**8.6**	**86**	**3.6**	**36**	**1.5**	**15**	**1.5**	**15**	**1.2**	**12**	1.0	**10**	0.8	**8**
2006	**7.5**	**75**	**3.2**	**32**	**1.4**	**14**	**1.5**	**15**	**1.2**	**12**	0.9	**9**	0.7	7
2007	**7.3**	**73**	**3.0**	**30**	**1.3**	**13**	**1.4**	**14**	**1.1**	**11**	0.8	**8**	0.7	7
2008	**8.3**	**83**	**2.9**	**29**	**1.2**	**12**	**1.4**	**14**	**1.2**	**12**	0.9	**9**	0.7	7
2009	**8.8**	**88**	**2.8**	**28**	**1.1**	**11**	**1.4**	**14**	**1.1**	**11**	0.9	**9**	0.7	7
2010	**6.3**	**63**	**2.5**	**25**	**1.0**	**10**	**1.2**	**12**	1.0	**10**	0.7	7	0.6	**6**
2011	**6.0**	**60**	**2.3**	**23**	0.9	**9**	**1.3**	**13**	**1.0**	**10**	0.8	**8**	0.6	**6**
2012	**5.5**	**55**	**2.3**	**23**	0.8	**8**	**1.3**	**13**	**1.0**	**10**	0.8	**8**	0.6	**6**
2013	**5.2**	**52**	**2.3**	**23**	0.7	7	**1.3**	**13**	**1.0**	**10**	0.7	7	0.6	**6**
2014	**5.2**	**52**	**2.1**	**21**	0.7	7	**1.3**	**13**	1.0	**10**	0.7	7	0.6	**6**
2015	**5.1**	**51**	**2.0**	**20**	0.7	7	**1.2**	**12**	0.9	**9**	0.7	7	0.6	**6**
2016	**6.3**	**63**	**2.0**	**20**	0.7	7	**1.2**	**12**	1.0	**10**	0.8	**8**	0.6	**6**
2017	**6.2**	**62**	**2.0**	**20**	0.6	**6**	**1.2**	**12**	0.9	**9**	0.7	7	0.6	**6**
2018	**6.5**	**65**	**2.0**	**20**	0.7	7	**1.1**	**11**	0.9	**9**	0.7	7	0.6	**6**

Bold values indicate exceedances

Table 8–22: Ratio of Modeled Dietary Dose to Toxicity Benchmarks for Female Otter for Tri+ Congeners for the Period 1993-2018

Year	LOAEL 189 Average	NOAEL 189 Average	LOAEL 168 Average	NOAEL 168 Average	LOAEL 154 Average	NOAEL 154 Average	LOAEL 152 Average	NOAEL 152 Average	LOAEL 113 Average	NOAEL 113 Average	LOAEL 90 Average	NOAEL 90 Average	LOAEL 50 Average	NOAEL 50 Average
1993	133	1329	39	390	16	155	46	459	31	307	7.1	71	6.6	66
1994	91	909	35	351	14	144	33	328	26	265	6.3	63	5.9	59
1995	105	1051	32	322	13	132	28	282	24	236	5.7	57	5.3	53
1996	65	652	25	245	11	105	34	339	22	223	5.3	53	4.8	48
1997	64	643	22	220	10	104	30	303	21	211	4.8	48	4.4	44
1998	51	513	22	221	10	101	56	559	45	452	10	105	9.5	95
1999	50	499	21	212	9.8	98	23	230	18	180	4.5	45	4.1	41
2000	40	405	17	168	8.1	81	20	199	15	151	3.8	38	3.5	35
2001	35	351	15	149	7.5	75	22	219	15	148	3.5	35	3.1	31
2002	34	343	13	128	6.7	67	21	211	15	154	3.5	35	3.2	32
2003	31	307	12	122	6.3	63	19	185	14	140	3.3	33	3.0	30
2004	41	413	13	126	6.3	63	16	156	13	130	3.2	32	2.9	29
2005	35	351	11	111	5.5	55	15	147	12	118	2.9	29	2.6	26
2006	28	277	9.7	97	5.0	50	16	161	11	113	2.7	27	2.4	24
2007	34	336	9.5	95	4.8	48	15	147	11	109	2.6	26	2.3	23
2008	34	339	9.6	96	4.5	45	15	151	12	117	2.8	28	2.4	24
2009	34	337	9.2	92	4.3	43	13	133	11	108	2.6	26	2.3	23
2010	32	319	7.9	79	3.7	37	12	123	9.1	91	2.2	22	2.0	20
2011	25	251	7.4	74	3.5	35	14	142	10	100	2.3	23	2.0	20
2012	25	249	7.5	75	3.0	30	13	128	9.8	98	2.2	22	1.9	19
2013	20	204	7.0	70	2.8	28	14	140	10	101	2.3	23	2.0	20
2014	23	227	6.5	65	2.6	26	13	129	9.8	98	2.2	22	1.9	19
2015	21	209	6.2	62	2.5	25	12	119	9.2	92	2.1	21	1.8	18
2016	24	241	6.8	68	2.6	26	12	119	9.5	95	2.3	23	2.0	20
2017	27	270	6.8	68	2.6	26	11	110	8.9	89	2.2	22	1.9	19
2018	25	246	6.6	66	2.6	26	10	101	8.0	80	1.9	19	1.7	17

Bold values indicate exceedances

Table 8-23: Ratio of Modeled Dietary Doses to Toxicity Benchmarks for Female Mink on a TEQ Basis for the Period 1993-2018

Year	LOAEL 189 Average	NOAEL 189 Average	LOAEL 168 Average	NOAEL 168 Average	LOAEL 154 Average	NOAEL 154 Average	LOAEL 152 Average	NOAEL 152 Average	LOAEL 113 Average	NOAEL 113 Average	LOAEL 90 Average	NOAEL 90 Average	LOAEL 50 Average	NOAEL 50 Average
1993	***26***	***737***	***10***	***284***	***3.1***	***87***	***7.1***	***199***	***5.1***	***142***	***4.1***	***114***	***3.5***	***99***
1994	***24***	***672***	***9.3***	***262***	***2.8***	***79***	***5.6***	***157***	***4.6***	***129***	***3.7***	***104***	***3.2***	***89***
1995	***22***	***616***	***8.2***	***229***	***2.6***	***72***	***5.1***	***144***	***4.0***	***112***	***3.7***	***103***	***2.9***	***81***
1996	***17***	***479***	***6.8***	***190***	***2.3***	***63***	***5.8***	***164***	***4.1***	***114***	***3.5***	***99***	***2.7***	***76***
1997	***14***	***401***	***5.8***	***164***	***2.0***	***57***	***5.0***	***141***	***3.8***	***106***	***3.0***	***83***	***2.5***	***70***
1998	***15***	***422***	***5.7***	***158***	***2.1***	***59***	***9.7***	***272***	***7.8***	***219***	***6.5***	***182***	***5.5***	***154***
1999	***14***	***386***	***5.3***	***148***	***1.9***	***54***	***4.2***	***118***	***3.4***	***96***	***2.8***	***79***	***2.4***	***67***
2000	***11***	***317***	***4.5***	***126***	***1.7***	***48***	***3.8***	***108***	***3.0***	***84***	***2.4***	***68***	***2.1***	***58***
2001	***10***	***274***	***3.7***	***105***	***1.5***	***42***	***3.9***	***110***	***2.9***	***82***	***2.3***	***63***	***1.9***	***53***
2002	***10***	***280***	***3.3***	***92***	***1.4***	***38***	***3.8***	***105***	***3.0***	***84***	***2.3***	***65***	***1.9***	***54***
2003	***10***	***276***	***3.0***	***83***	***1.2***	***35***	***3.5***	***97***	***2.7***	***77***	***2.2***	***62***	***1.8***	***51***
2004	***11***	***298***	***2.9***	***82***	***1.2***	***33***	***3.1***	***88***	***2.6***	***73***	***2.1***	***60***	***1.8***	***50***
2005	***9.0***	***252***	***2.7***	***76***	***1.1***	***31***	***3.0***	***85***	***2.5***	***69***	***2.0***	***56***	***1.7***	***46***
2006	***8.0***	***224***	***2.4***	***68***	***1.0***	***28***	***3.2***	***89***	***2.4***	***67***	***1.8***	***52***	***1.5***	***43***
2007	***7.6***	***214***	***2.3***	***64***	*0.9*	***26***	***2.8***	***78***	***2.3***	***64***	***1.8***	***49***	***1.4***	***40***
2008	***8.2***	***230***	***2.2***	***61***	*0.9*	***24***	***2.9***	***82***	***2.4***	***68***	***1.9***	***53***	***1.5***	***43***
2009	***8.5***	***238***	***2.1***	***60***	*0.8*	***23***	***2.8***	***79***	***2.3***	***65***	***1.8***	***51***	***1.5***	***42***
2010	***6.5***	***182***	***1.9***	***54***	*0.7*	***20***	***2.6***	***72***	***2.0***	***56***	***1.6***	***43***	***1.3***	***36***
2011	***6.1***	***170***	***1.7***	***49***	*0.6*	***18***	***2.7***	***76***	***2.1***	***59***	***1.6***	***44***	***1.3***	***36***
2012	***5.6***	***156***	***1.7***	***48***	*0.6*	***16***	***2.6***	***73***	***2.1***	***58***	***1.6***	***44***	***1.3***	***36***
2013	***5.4***	***150***	***1.7***	***48***	*0.5*	***15***	***2.7***	***75***	***2.1***	***58***	***1.6***	***43***	***1.3***	***35***
2014	***5.4***	***151***	***1.6***	***45***	*0.5*	***14***	***2.6***	***73***	***2.0***	***57***	***1.5***	***43***	***1.2***	***35***
2015	***5.2***	***146***	***1.5***	***43***	*0.5*	***13***	***2.4***	***67***	***1.9***	***54***	***1.5***	***41***	***1.2***	***33***
2016	***6.1***	***171***	***1.5***	***43***	*0.5*	***13***	***2.4***	***68***	***2.0***	***56***	***1.6***	***44***	***1.3***	***36***
2017	***6.0***	***167***	***1.5***	***43***	*0.5*	***13***	***2.4***	***67***	***1.9***	***54***	***1.5***	***43***	***1.3***	***35***
2018	***6.1***	***171***	***1.5***	***42***	*0.5*	***13***	***2.2***	***63***	***1.8***	***51***	***1.4***	***39***	***1.2***	***32***

Bold values indicate exceedances

Table 8-24: Ratio of Modeled Dietary Doses to Toxicity Benchmarks for Female Otter on a TEQ Basis for the Period 1993-2018

Year	LOAEL 189 Average	NOAEL 189 Average	LOAEL 168 Average	NOAEL 168 Average	LOAEL 154 Average	NOAEL 154 Average	LOAEL 152 Average	NOAEL 152 Average	LOAEL 113 Average	NOAEL 113 Average	LOAEL 90 Average	NOAEL 90 Average	LOAEL 50 Average	NOAEL 50 Average
1993	107	3003	31	877	12	342	96	2683	64	1796	15	413	14	389
1994	75	2089	28	790	11	318	68	1916	55	1546	13	371	12	343
1995	85	2384	26	725	10	292	59	1650	49	1379	12	342	11	310
1996	54	1514	20	554	8.3	233	71	1983	47	1302	11	316	10	284
1997	53	1485	18	495	8.2	229	63	1770	44	1235	10	284	9.2	258
1998	43	1198	18	495	8.0	224	117	3267	94	2640	22	615	20	555
1999	42	1164	17	476	7.7	215	48	1346	38	1054	9.4	264	8.6	241
2000	34	953	14	380	6.4	180	42	1166	32	886	7.9	221	7.3	204
2001	30	827	12	335	5.9	166	46	1278	31	865	7.2	203	6.6	184
2002	29	806	10	289	5.3	148	44	1232	32	902	7.4	208	6.6	185
2003	26	721	9.8	273	4.9	138	39	1084	29	818	7.0	195	6.2	173
2004	34	945	10	281	4.9	138	33	914	27	758	6.7	189	6.0	169
2005	29	809	8.9	248	4.4	122	31	859	25	689	6.2	172	5.6	155
2006	23	645	7.8	218	3.9	110	34	944	24	663	5.7	159	5.1	142
2007	27	767	7.6	212	3.8	106	31	858	23	640	5.4	151	4.8	134
2008	28	771	7.6	214	3.5	99	32	883	24	682	5.8	162	5.1	142
2009	27	763	7.3	205	3.4	94	28	778	23	632	5.5	155	4.9	137
2010	26	722	6.3	177	2.9	83	26	720	19	532	4.6	130	4.1	115
2011	20	573	5.9	166	2.7	77	30	832	21	584	4.7	133	4.1	115
2012	20	565	6.0	168	2.4	66	27	747	20	572	4.7	132	4.0	113
2013	17	468	5.6	156	2.2	61	29	818	21	593	4.9	136	4.1	116
2014	19	519	5.2	145	2.1	58	27	756	20	571	4.7	131	4.0	111
2015	17	479	5.0	139	2.0	56	25	693	19	540	4.5	126	3.8	107
2016	20	547	5.4	151	2.0	57	25	698	20	554	4.7	132	4.1	115
2017	22	607	5.4	151	2.1	58	23	641	19	521	4.6	128	4.1	113
2018	20	554	5.2	146	2.1	58	21	589	17	466	4.1	114	3.6	101

Bold values indicate exceedances

Table 10-1: Summary of Area and Volume of Sediment Removed and Mass of PCBs Remediated

Alternative	Area Remediated (Acres)	Area Capped (Acres)	Volume Removed (CY)	Estimated PCB Mass Remediated (kg/lbs)	Estimated PCB Mass Removed (kg/lbs)
No Action	-	-	-	-	-
Monitored Natural Attenuation	-	-	-	-	-
CAP 3/10/Select	493	207	1,732,800	70,000/150,000	(1)
REM 3/10/Select	493	-	2,651,700	70,000/150,000	70,000/150,000
REM 0/0/3	964	-	3,823,100	84,000/185,000	84,000/185,000

(1) To be determined by EPA if necessary.

Table 11-1

Remedial Alternatives Comparative Analysis Summary

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
Overall Protection of Human Health and the Environment	Not protective. Human health and ecological risks continue to be above remediation goals and target levels for the entire model forecast period. Assumes no additional source control at Hudson Falls.	Not sufficiently protective. Human health and ecological risks continue to be above target levels for an unacceptably long period of time. Assumes source control at Hudson Falls.	Substantial improvement in protection of human health and the environment through reduced PCB concentrations in fish. Assumes source control at Hudson Falls.	Substantial improvement in protection of human health and the environment through reduced PCB concentrations in fish. Assumes source control at Hudson Falls.	Most protective of human health and the environment due to largest reduction in human health and ecological risks. Assumes source control at Hudson Falls.
Risk-based Remediation Goal (RG) for the protection of human health is 0.05 mg/kg total PCBs in fish fillet. Other target concentrations are 0.2 mg/kg total PCBs in fish fillet, which is protective at a fish consumption rate of one half-pound meal per month, and 0.4 mg/kg total PCBs in fish fillet, which is protective of the average angler who consumes one half-pound meal every two months.	Neither the RG nor other target levels are met within the 70-year model forecast period.	0.05 mg/kg RG is not met during the 70-year model forecast period.	0.05 mg/kg RG is not met within the 70-year model forecast period.	0.05 mg/kg RG is not met within the model forecast period.	0.05 mg/kg RG is not met within the model forecast period.
		0.2 mg/kg target is projected to be met between 2035 and after 2067, and 0.4 mg/kg target is projected to be met between 2024 and after 2067.	0.2 mg/kg target is projected to be met in 2024, and 0.4 mg/kg target is projected to be met in 2013.	0.2 mg/kg target is projected to be met in 2024, and 0.4 mg/kg target is projected to be met in 2012	0.2 mg/kg target is projected to be met in 2018, and 0.4 mg/kg target is projected to be met in 2010.
	Human health cancer risks are between 4.1E-04 and 6.6E-04.	Human health cancer risks are between 2.0E-04 and 5.0E-04.	Human health cancer risk is 1.1E-04.	Human health cancer risk is 9.9E-05.	Human health cancer risk is 7.5E-05.
Times to reach target concentrations in fish (species weighted) are averaged over entire Upper Hudson River.	Non-cancer hazard index is between 27 and 38.	Non-cancer hazard index is between 19 and 32.	Non-cancer hazard index is 8.6.	Non-cancer hazard index is 7.9.	Non-cancer hazard index is 5.3.

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
The risk-based RG for the ecological exposure pathway is a range from 0.3 to 0.03 mg/kg total PCBs in fish (whole body), based on the Lowest Observed Adverse Effect Level and the No Observed Adverse Effect Level for consumption of largemouth bass (whole fish) by the river otter.	RG not met during the entire 70-year model forecast period. 0.7 mg/kg to 0.07 mg/kg target concentration range is met between 2013 and after 2067.	RG is projected to be met between 2044 and after 2067. 0.7 mg/kg to 0.07 mg/kg target concentration range is projected to be met between 2010 and after 2067.	RG is projected to be met in 2035. 0.7 mg/kg to 0.07 mg/kg target concentration range is projected to be met in 2006.	RG is projected to be met in 2035. 0.7 mg/kg to 0.07 mg/kg target concentration range is projected to be met in 2006.	RG is projected to be met in 2025. 0.7 mg/kg to 0.07 mg/kg target concentration range is projected to be met in 2006.
EPA also considered a target concentration of 0.7 mg/kg and 0.07 mg/kg PCBs in spottail shiner (whole body) based on LOAEL and NOAEL, respectively, for mink.	Toxicity Quotients (TQs) for river otter are 6.9 to 9.4 (LOAEL) and 69 to 94 (NOAEL). TQs for mink are 1.0 to 1.3 (LOAEL) and 9.9 to 13 (NOAEL).	TQs for river otter are 3.3 to 5.9 (LOAEL) and 33 to 59 (NOAEL). TQs for mink are 0.4 to 0.7 (LOAEL) and 4.1 to 7.5 (NOAEL).	TQs for river otter are 1.8 (LOAEL) and 18 (NOAEL). TQs for mink are 0.2 (LOAEL) and 2.4 (NOAEL).	TQs for river otter are 1.7 (LOAEL) and 17 (NOAEL). TQs for mink are 0.2 (LOAEL) and 2.3 (NOAEL).	TQs for river otter are 1.2 (LOAEL) and 12 (NOAEL). TQs for mink are 0.2 (LOAEL) and 1.8 (NOAEL).
Times to reach target concentrations in fish are averaged over entire Upper Hudson River.	PCB load over Federal Dam is substantially greater than under alternatives that include active sediment remediation.	PCB load over Federal Dam is substantially greater than under alternatives that include active sediment remediation.	PCB loading to Lower Hudson in 2011 is reduced by 38% as compared to MNA.	PCB loading to Lower Hudson in 2011 is reduced by 42% as compared to MNA.	PCB loading to Lower Hudson in 2011 is reduced by 53% as compared to MNA.
PCB transport at Federal Dam	Cumulative Total PCB load over Federal Dam, 2011 to 2020, is 942 kgs (2070 lbs).	Cumulative Total PCB load over Federal Dam, 2011 to 2020, is 526 kgs (1160 lbs)	Cumulative Total PCB load over Federal Dam, 2011 to 2020, is 390 kgs (860 lbs).	Cumulative Total PCB load over Federal Dam, 2011 to 2020, is 327 kgs (720 lbs).	Cumulative Total PCB load over Federal Dam, 2011 to 2020, is 305 kgs (670 lbs).

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
Compliance with ARARs	Four chemical-specific ARARs (500 ng/L federal MCL; 90 ng/L NYS Standard for protection of human health and drinking water sources; 14 ng/L criteria continuous concentration (CCC) Federal Water Quality Criterion (FWQC) for PCBs in freshwater; and 30 ng/L CCC FWQC in saltwater) will be met during the model forecast period. Three of the chemical-specific ARARs (1 ng/L federal Ambient Water Quality Criterion; 0.12 ng/L New York State standard for protection of wildlife; and 0.001 ng/L New York State standard for protection of human consumers of fish) are not met within the forecast period.	Four chemical-specific ARARs (500 ng/L federal MCL; 90 ng/L NYS Standard for protection of human health and drinking water sources; 14 ng/L CCC FWQC for PCBs in freshwater; and 30 ng/L CCC FWQC in saltwater) will be met during the model forecast period. Three of the chemical-specific ARARs (1 ng/L federal Ambient Water Quality Criterion; 0.12 ng/L New York State standard for protection of wildlife; and 0.001 ng/L New York State standard for protection of human consumers of fish) are not met within the forecast period.	Four chemical-specific ARARs (500 ng/L federal MCL; 90 ng/L NYS Standard for protection of human health and drinking water sources; 14 ng/L CCC FWQC for PCBs in freshwater; and 30 ng/L CCC FWQC in saltwater) will be met during the model forecast period. Three of the chemical-specific ARARs (1 ng/L federal Ambient Water Quality Criterion; 0.12 ng/L New York State standard for protection of wildlife; and 0.001 ng/L New York State standard for protection of human consumers of fish) are not met within the forecast period.	Four chemical-specific ARARs (500 ng/L federal MCL; 90 ng/L NYS Standard for protection of human health and drinking water sources; 14 ng/L CCC FWQC for PCBs in freshwater; and 30 ng/L CCC FWQC in saltwater) will be met during the model forecast period. Three of the chemical-specific ARARs (1 ng/L federal Ambient Water Quality Criterion; 0.12 ng/L New York State standard for protection of wildlife; and 0.001 ng/L New York State standard for protection of human consumers of fish) are not met within the forecast period.	Four chemical-specific ARARs (500 ng/L federal MCL; 90 ng/L NYS Standard for protection of human health and drinking water sources; 14 ng/L CCC FWQC for PCBs in freshwater; and 30 ng/L CCC FWQC in saltwater) will be met during the model forecast period. Three of the chemical-specific ARARs (1 ng/L federal Ambient Water Quality Criterion; 0.12 ng/L New York State standard for protection of wildlife; and 0.001 ng/L New York State standard for protection of human consumers of fish) are not met within the forecast period.
	Modeled water column PCB concentration is 10 ng/L at Federal Dam in 2067.	Modeled water column PCB concentration is 1.7 ng/L at Federal Dam in 2067.	Modeled water column PCB concentration is 1.7 ng/L at Federal Dam in 2067, although PCB water column concentration is substantially improved over MNA during the first 20 years (between 2005 and 2024) of the forecast period.	Modeled water column PCB concentration is 1.7 ng/L at Federal Dam in 2067, although PCB water column concentration is substantially improved over MNA during the first 20 years (between 2005 and 2024) of the forecast period.	Modeled water column PCB concentration is 1.7 ng/L at Federal Dam in 2067, although PCB water column concentration is substantially improved over MNA during the first 20 years (between 2005 and 2024) of the forecast period.
	Action- and Location-specific ARARs do not apply because there is no active sediment remediation under this alternative.	Action- and Location-specific ARARs do not apply because there is no active sediment remediation under this alternative.	Would comply with substantive action-specific and location-specific ARARs	Would comply with substantive action-specific and location-specific ARARs	Would comply with substantive action-specific and location-specific ARARs

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
Long Term Effectiveness and Permanence *Reduction in residual risk*	Removes no PCBs from the river and effects no active reduction in PCB levels in fish, other than through naturally occurring processes. Results in a continuation of the degraded condition of the sediments and surface water quality of the Upper Hudson River, especially in the Thompson Island Pool, for at least several decades. No active engineering controls on contaminated sediments.	Removes no PCBs from the river and effects no active reduction in PCB levels in fish, other than through naturally occurring processes. Results in a continuation of the degraded condition of the sediments and surface water quality of the Upper Hudson River, especially in the Thompson Island Pool, for at least several decades, regardless of any reduced PCB concentrations in the upstream water quality. No active engineering controls on contaminated sediments, although assumes source control at Hudson Falls. Institutional controls rely largely on voluntary compliance, and people continue to consume fish caught in the Hudson despite the advisories.	Residual risk is reduced through the capping of 207 acres of PCB-contaminated sediments and removal of 1.73 million cubic yards of sediments. Quantity of PCBs remediated is approx. 150,000 lbs (70,000 kg) Total PCBs. Cancer risks through fish consumption are reduced from 76% to 87% compared to No Action and from 54% to 84% compared to MNA. Reduction in non-cancer health hazards ranges from 71% to 81% compared to No Action and from 61% to 78% compared to MNA. Provides for select removal of some PCB-contaminated sediments in target areas and placement of an engineered cap over the remaining target areas. Relies on institutional controls (although perhaps in a modified form) until target levels are met, although this alternative relies less heavily on institutional controls than No Action and MNA because fish PCB target levels are achieved more quickly. Also includes Site use	Residual risk is reduced through removal of 2.65 million cubic yards of sediments containing approximately 150,000 lbs (70,000 kg) Total PCBs over an area of 493 acres. The reduction in cancer risks through fish consumption ranges from 79% to 88% compared to No Action and from 58% to 86% compared to MNA. Reduction in non-cancer health hazards ranges from 75% to 84% compared to No Action alternative and from 67% to 82% compared to MNA. PCBs in target areas are permanently removed from the river environment. Relies on institutional controls (although perhaps in a modified form) until target levels are met, although this alternative relies less heavily on institutional controls than No Action and MNA because fish PCB target levels are achieved more quickly. Unlikely to require additional Site use restrictions after removal activities are completed.	Residual risk is reduced through removal of 3.82 million cubic yards of sediments containing more than 180,000 lbs (84,000 kg) Total PCBs over an area of 964 acres. The reduction in cancer risks through fish consumption ranges from 84% to 91% compared to No Action and from 66% to 89% compared to MNA. The reduction in non-cancer health hazards ranges from 84% to 90% compared to No Action and from 77% to 88% compared to MNA. Permanently removes the greatest amount of PCBs from the river environment and achieves the greatest reduction of the potential scour-driven resuspension of PCB-contaminated sediments south of the confluence with the Hoosic River. Relies on institutional controls (although perhaps in a modified form) until target levels are met, although this alternative relies less heavily on institutional controls than No Action and MNA because fish PCB target levels are achieved more quickly. Unlikely to require additional Site use restrictions after removal activities are completed.

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
			restrictions in capped areas (e.g., prohibition of sediment disturbance activities in waterfront improvements by private residences or commercial/industrial establishments along the shoreline).		
Adequacy of controls	Inadequate for protection of human health and the environment.	Inadequate for protection of the environment.	Less reliable than removal alternatives. Relies on proper design, placement and maintenance of the cap in perpetuity for its effectiveness, continued performance and reliability. Vulnerable to a catastrophic flow event, such as may be seen during a 500-year flood or dam failure.	More reliable than No Action, MNA and CAP-3/10/Select because PCBs are permanently removed from the river environment, the potential for scour-driven resuspension of PCBs south of the confluence with the Hoosic River is reduced, and there is little or no long-term maintenance associated with the remedial work.	Most reliable alternative, as it permanently removes the greatest amount of sediment and achieves the greatest reduction of the potential scour-driven resuspension of PCB-contaminated sediments south of the confluence with the Hoosic River.
Reliability of controls	Least reliable alternative.	Institutional controls are insufficiently reliable to protect human health and do nothing to protect the environment.	Institutional controls will continue to provide some measure of protection of human health until PCB concentrations in fish are reduced to the point where the fish consumption advisories and fishing restrictions can be relaxed or lifted. Relies less on institutional controls than either MNA or No Action.	Institutional controls will continue to provide some measure of protection of human health until PCB concentrations in fish are reduced to the point where the fish consumption advisories and fishing restrictions can be relaxed or lifted. Relies less on institutional controls than either MNA or No Action.	Institutional controls will continue to provide some measure of protection of human health until PCB concentrations in fish are reduced to the point where the fish consumption advisories and fishing restrictions can be relaxed or lifted. Relies least on institutional controls of the five alternatives.

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
Reduction of Toxicity, Mobility, or Volume through Treatment	No reduction through treatment. Some reduction through natural attenuation. Does not involve any containment or removal of contaminants from the Upper Hudson River sediments.	No reduction through treatment. Some reduction through natural attenuation. Assumes Hudson Falls source is reduced from 0.16 to 0.0256 kg/day by Jan. 1, 2005 via separate source control action. Does not involve any containment or removal of contaminants from the Upper Hudson River sediments.	Mobility of PCBs under 207 acres of cap is reduced. Also includes permanent removal of some PCBs. Capping does not satisfy the CERCLA statutory preference for treatment as a principal element of the remedy, although some sediments may be treated if put to beneficial use. In addition, there is no reduction in the toxicity or volume of the PCBs under the cap. After construction of the remedy, natural attenuation processes will provide additional reductions in PCB concentrations in the remaining sediments and surface water. Assumes Hudson Falls source is reduced from 0.16 to 0.0256 kg/day by Jan. 1, 2005 via separate source control action	70,000 kg (150,000 lbs.) of PCBs (in 2.65 million cubic yards of contaminated sediment) removed permanently. Removal does not satisfy preference for treatment as a principal element of the remedy, although some sediments may be treated if put to beneficial use. After construction, natural attenuation processes will provide additional reductions in PCB concentrations in the remaining sediments and surface water. Assumes Hudson Falls source is reduced from 0.16 to 0.0256 kg/day by Jan. 1, 2005 via separate source control action.	84,000 kg (185,000 lbs) of PCBs (in 3.8 million cubic yards of contaminated sediment) removed permanently. Removal does not satisfy preference for treatment as a principal element of the remedy, although some sediments may be treated if put to beneficial use. After construction, natural attenuation processes will provide additional reductions in PCB concentrations in the remaining sediments and surface water. Assumes Hudson Falls source is reduced from 0.16 to 0.0256 kg/day by Jan. 1, 2005 via separate source control action.
Short-Term Effectiveness *Length of Time Needed to Implement*	No active remediation.	No active remediation of contaminated sediments. Assumes separate source control action at Hudson Falls will be completed by January 1, 2005.	6 years for remedial construction. Assumes separate source control action at Hudson Falls will be completed by January 1, 2005.	6 years for remedial construction. Assumes separate source control action at Hudson Falls will be completed by January 1, 2005.	8 years for remedial construction. Assumes separate source control action at Hudson Falls will be completed by January 1, 2005.

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
Potential Risks to Community	Since no construction activities are associated with this alternative, it does not increase or decrease the potential for direct contact with or ingestion and inhalation of PCBs from the surface water, sediments and fish.	Since no construction activities to remediate contaminated sediments are associated with this alternative, it does not increase or decrease the potential for direct contact with or ingestion and inhalation of PCBs from the surface water, sediments and fish.	Remedy would not pose significant risk to nearby communities. Potential risks to the community from sediment processing/transfer facilities will be controlled via restricted access and engineering controls. Remedial design will provide for appropriate control of air emissions, noise and light through the use of appropriate equipment that meets all applicable standards. Compliance with these design provisions will be monitored during construction, operation and demobilization, and a community notification system will be established that will keep the residents informed regarding the data from EPA's air monitoring program. The potential for vehicular traffic accidents is expected to be minimal, in part because the transportation of sediments for disposal and material for backfill and capping is expected to be accomplished by rail and/or barge.	Remedy would not pose significant risk to nearby communities. Potential risks to the community from sediment processing/transfer facilities will be controlled via restricted access and engineering controls. Remedial design will provide for appropriate control of air emissions, noise and light through the use of appropriate equipment that meets all applicable standards. Compliance with these design provisions will be monitored during construction, operation and demobilization, and a community notification system will be established that will keep the residents informed regarding the data from EPA's air monitoring program. The potential for vehicular traffic accidents is expected to be minimal, in part because the transportation of sediments for disposal and material for backfill and capping is expected to be accomplished by rail and/or barge. If a beneficial use of some portion of the dredged material is arranged, then an appropriate transportation method will be determined (rail, truck, or barge).	Remedy would not pose significant risk to nearby communities. Potential risks to the community from sediment processing/transfer facilities will be controlled via restricted access and engineering controls. Remedial design will provide for appropriate control of air emissions, noise and light through the use of appropriate equipment that meets all applicable standards. Compliance with these design provisions will be monitored during construction, operation and demobilization, and a community notification system will be established that will keep the residents informed regarding the data from EPA's air monitoring program. The potential for vehicular traffic accidents is expected to be minimal, in part because the transportation of sediments for disposal and material for backfill and capping is expected to be accomplished by rail and/or barge. If a beneficial use of some portion of the dredged material is arranged, then an appropriate transportation method will be determined (rail, truck, or barge).

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
			Work in the river will also be designed with provisions for control of air emissions, noise and light. Work areas outside the channels will be isolated (access-restricted), with an adequate buffer zone so that pleasure craft and commercial shipping can safely avoid such areas. Environmental dredging in the channels will be conducted at times and in ways to minimize disruption to river traffic.	Work in the river will also be designed with provisions for control of air emissions, noise and light. Work areas outside the channels will be isolated (access-restricted), with an adequate buffer zone so that pleasure craft and commercial shipping can safely avoid such areas. Environmental dredging in the channels will be conducted at times and in ways to minimize disruption to river traffic.	Work in the river will also be designed with provisions for control of air emissions, noise and light. Work areas outside the channels will be isolated (access-restricted), with an adequate buffer zone so that pleasure craft and commercial shipping can safely avoid such areas. Environmental dredging in the channels will be conducted at times and in ways to minimize disruption to river traffic.
Potential Risks to Remedial Workers	Occupational risks associated with monitoring would not change from current levels.	Minimal additional occupational risks associated with monitoring, which would increase from current levels.	Workers will follow site-specific health and safety plan, OSHA health and safety procedures. No unacceptable risks would be posed to workers during implementation.	Workers will follow site-specific health and safety plan, OSHA health and safety procedures. No unacceptable risks would be posed to workers during implementation.	Workers will follow site-specific health and safety plan, OSHA health and safety procedures. No unacceptable risks would be posed to workers during implementation.
Potential Adverse Environmental Impacts During Construction	Sampling activities not expected to have an adverse impact on the environment.	Sampling activities and monitoring not expected to have an adverse impact on the environment.	Operational controls (e.g., control of sediment removal rates, use of environmental dredges and use of sediment barriers) would be used to control the release of PCBs from the contaminated sediments into the surface water during construction (dredging and cap placement). Although precautions to minimize resuspension will be taken, it is likely that there will be a localized temporary increase in suspended PCB concentrations in the water column and possibly in fish PCB body burdens. At the same time, the expected resuspension due to dredging is expected to be well within the variability that normally occurs	Operational controls (e.g., control of sediment removal rates, use of environmental dredges and use of sediment barriers) would be used to control the release of PCBs from the contaminated sediments into the surface water during construction (dredging). Although precautions to minimize resuspension will be taken, it is likely that there will be a localized temporary increase in suspended PCB concentrations in the water column and possibly in fish PCB body burdens. At the same time, the expected resuspension due to dredging is expected to be well within the variability that normally occurs on a yearly	Operational controls (e.g., control of sediment removal rates, use of environmental dredges and use of sediment barriers) would be used to control the release of PCBs from the contaminated sediments into the surface water during construction (dredging). Although precautions to minimize resuspension will be taken, it is likely that there will be a localized temporary increase in suspended PCB concentrations in the water column and possibly in fish PCB body burdens. At the same time, the expected resuspension due to dredging is expected to be well within the variability that normally occurs on a yearly

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
			on a yearly basis. Dredged areas will be restored under a backfill/habitat replacement program. A monitoring program will be established to verify the attainment of the habitat replacement objectives. There is a potential transient impact from temporary exposure of deeper contaminated sediments during the interval between dredging and placement of the cap.	basis. Dredged areas will be restored under a backfill/habitat replacement program. A monitoring program will be established to verify the attainment of the habitat replacement objectives.	basis. Dredged areas will be restored under a backfill/habitat replacement program. A monitoring program will be established to verify the attainment of the habitat replacement objectives.
Time Until Remedial Response Objectives are Achieved	See discussion under "Overall Protection of Human Health and the Environment," above.	See discussion under "Overall Protection of Human Health and the Environment," above.	See discussion under "Overall Protection of Human Health and the Environment," above.	See discussion under "Overall Protection of Human Health and the Environment," above.	See discussion under "Overall Protection of Human Health and the Environment," above.
Implementability *Technical feasibility*	No Action and MNA are the most technically feasible alternatives because neither requires active remedial measures.	No Action and MNA are the most technically feasible alternatives because neither requires active remedial measures (other than the separate source control action associated with MNA).	Technically feasible. The transfer, dewatering and stabilization of dredged material at the sediment processing facilities is considered a readily implementable, commonly engineered activity. Facility locations will be determined after a public process. Environmental sediment dredging is a readily implementable engineering activity. The placement of capping materials also is a readily	Technically feasible. The transfer, dewatering and stabilization of dredged material at the sediment processing facilities is considered a readily implementable, commonly engineered activity. Facility locations will be determined after a public process. Environmental dredging is a readily implementable engineering activity. Dredged materials may be transported in-river to sediment processing/transfer facilities	Technically feasible, The transfer, dewatering and stabilization of dredged material at the sediment processing facilities is considered a readily implementable, commonly engineered activity. Facility locations will be determined after a public process. Environmental dredging is a readily implementable engineering activity. Dredged materials may be transported in-river to sediment processing/transfer facilities

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
			implementable engineering activity. This alternative will require long-term monitoring of the cap, and may require boating restrictions to be placed on certain sections of the river. The implementability and long-term performance of AquaBlok$_{tm}$ have not yet been established. The AquaBlok$_{tm}$ system is currently being evaluated at several remedial sites. Bentonite, the primary component of this material, has been demonstrated to be effective for the long-term encapsulation of contaminants. Dredged materials may be transported in-river to sediment processing/transfer facilities using barges or pipelines. These are considered readily implementable engineering activities. Transportation via pipeline is limited to certain distances as a result of pumping limitations. Consequently, in some areas of the river, pipelines may not be implementable. Off-site transportation of dredged materials to disposal facilities will be by rail and/or barge, which is a routine engineering activity and is technically implementable. CAP-3/10/Select is less technically implementable than both removal alternatives due to the combination of capping and dredging issues associated	using barges or pipelines. These are considered readily implementable engineering activities. Transportation via pipeline is limited to certain distances as a result of pumping limitations. Consequently, in some areas of the river, pipelines may not be implementable. Off-site transportation of dredged materials to disposal facilities will be by rail and/or barge, which is a routine engineering activity and is technically implementable.	using barges or pipelines. These are considered readily implementable engineering activities. Transportation via pipeline is limited to certain distances as a result of pumping limitations. Consequently, in some areas of the river, pipelines may not be implementable. Off-site transportation of dredged materials to disposal facilities will be by rail and/or barge, which is a routine engineering activity and is technically implementable.

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
			with the capping alternative.		
Administrative Feasibility	Administratively Feasible. Alternative does not include active remediation.	Administratively Feasible. Alternative does not include active remediation.	Administratively feasible. Transfer facilities and all dredging activities are considered "on-site" for the purposes of the CERCLA Section 121(e) permit exemption, and no permits would therefore be required for such activities. Sediment processing/transfer facilities and dredging will comply with the substantive requirements of any otherwise necessary Federal or State permits.	Administratively feasible. Transfer facilities and all dredging activities are considered "on-site" for the purposes of the CERCLA Section 121(e) permit exemption, and no permits would therefore be required for such activities. Sediment processing/transfer facilities and dredging will comply with the substantive requirements of any otherwise necessary Federal or State permits.	Administratively feasible. Transfer facilities and all dredging activities are considered "on-site" for the purposes of the CERCLA Section 121(e) permit exemption, and no permits would therefore be required for such activities. Sediment processing/transfer facilities and dredging will comply with the substantive requirements of any otherwise necessary Federal or State permits.
			Habitat replacement/backfilling will be implemented in accordance with substantive Federal and State requirements. Construction activities will also be coordinated with the New York State Canal Corporation, which operates the locks on the Upper Hudson River from May through November and controls navigation in the Champlain Canal. Requirements of any other regulatory programs will be incorporated as necessary on the basis of design information developed during subsequent phases of the project.	Habitat replacement/backfilling will be implemented in accordance with substantive Federal and State requirements. Construction activities will also be coordinated with the New York State Canal Corporation, which operates the locks on the Upper Hudson River from May through November and controls navigation in the Champlain Canal. Requirements of any other regulatory programs will be incorporated as necessary on the basis of design information developed during subsequent phases of the project.	Habitat replacement/backfilling will be implemented in accordance with substantive Federal and State requirements. Construction activities will also be coordinated with the New York State Canal Corporation, which operates the locks on the Upper Hudson River from May through November and controls navigation in the Champlain Canal. Requirements of any other regulatory programs will be incorporated as necessary on the basis of design information developed during subsequent phases of the project s.
Availability of Services and Materials	All services and materials are available.	All services and materials are available.	It is expected that construction contractors will be able to obtain the necessary services and materials required to implement, including	It is expected that construction contractors will be able to obtain the necessary services and materials required to implement. Backfill is readily	It is expected that construction contractors will be able to obtain the necessary services and materials required to implement. Backfill is readily

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
			AquaBlok$_{tm}$. Backfill is readily available from commercial sources.	available from commercial sources.	available from commercial sources.
Cost *(Presented in Year 2000 dollars)*	Capital Cost, Net Present Worth (NPW) Cost: $0 Average Annual O&M Cost: $15,371 Total NPW Cost: (rounded): $140,000	Capital Cost (NPW): $416,648. Average Annual O&M Cost: $3,613,016 Total NPW Cost (rounded): $39,000,000	Capital Cost (NPW): $344,414,122 Average Annual O&M Cost: $3,446,099 Total NPW Cost (rounded): $370,000,000	Capital Cost (NPW): $448,386,006 Average Annual O&M Cost: $3,201,230 Total NPW Cost (rounded): $460,000,000	Capital Cost (NPW): $556,135,092 Average Annual O&M Cost: $3,350,458 Total NPW Cost (rounded): $570,000,000
State Acceptance	The State of New York concurs with EPA's selected remedy for the Site.				

Table 11-1

Criterion	No Action	MNA	CAP-3/10/Select	REM-3/10/Select *(6-year phased implementation and assumed 0.13% PCB resuspension loss)*	REM-0/0/3
Community Acceptance	There are numerous stakeholders involved with the Site with varying positions on active remediation of the Upper Hudson River. EPA received tens of thousands of comments on the Proposed Plan, some in support of dredging the Hudson and some in opposition to dredging. For example, a number of organizations including environmental groups from the Mid- and Lower Hudson region are in favor of remediation. This includes the environmental group Scenic Hudson, Inc., which was a recipient of a Technical Assistance Grant for the Site. Groups in favor of an active remedy argue that there would be continued unacceptable human health risks if no remediation is conducted, continued economic loss of commercial fisheries, continued angler consumption of contaminated fish despite advisories and insignificant breakdown of PCBs through dechlorination processes. They further point to the fact that PCB-contaminated sediments are not being universally buried and that the peer review findings support EPA's technical analyses and conclusions. Many residents of communities immediately adjacent to the areas where dredging would have its greatest construction impacts oppose active remediation, preferring to leave the contamination in place. These groups cite concern over the remedy being "ecologically devastating," that there is ongoing natural cleanup through dechlorination and burial, that EPA's PCB load estimates are flawed, that the models and data do not support materially accelerated reductions of PCBs in fish from dredging (as compared to results under MNA or No Action) and that EPA's conclusions about the toxicity of PCBs are overstated . During the comment period on the Proposed Plan, Upper Hudson communities raised concerns about the location and design features of needed dredge material sediment processing/transfer facilities. As discussed in the ROD and Responsiveness Summary, EPA is not siting these facilities as part of this Record of Decision. Rather, during the remedial design, EPA will provide opportunities for the public to have involvement and meaningful input into the siting and design of such facilities. The Agricultural, Citizen and Governmental Liaison Groups are generally against active remediation, while most members of the Environmental Liaison Group are in favor of it. Many municipalities have formally endorsed EPA's remedy proposal, while many other municipalities have opposed it.				

Table 11-2
Species-Weighted Fish Fillet Average PCB Concentration (mg/kg)

	No Action				Estimated Upper Bound of No Action			
Year	Upper River Average	River Section 1 (RM 189)	River Section 2 (RM 184)	River Section 3 (RM 154)	Upper River Average	River Section 1 (RM 189)	River Section 2 (RM 184)	River Section 3 (RM 154)
1998	3.353	6.774	9.659	1.529	3.368	6.801	9.747	1.529
1999	3.212	6.621	8.877	1.501	3.286	6.796	9.253	1.501
2000	2.791	5.563	8.028	1.292	2.951	5.917	8.870	1.292
2001	2.504	4.924	7.210	1.171	2.753	5.535	8.445	1.171
2002	2.301	4.705	6.571	1.047	2.603	5.447	8.072	1.047
2003	2.129	4.290	6.090	0.980	2.458	5.117	7.708	0.980
2004	2.203	5.025	5.958	0.948	2.545	5.982	7.519	0.948
2005	1.996	4.368	5.647	0.857	2.346	5.364	7.219	0.857
2006	1.776	3.691	5.171	0.778	2.158	4.756	6.914	0.778
2007	1.756	4.023	4.848	0.736	2.163	5.148	6.716	0.736
2008	1.681	3.982	4.596	0.684	2.109	5.214	6.505	0.684
2009	1.605	3.887	4.377	0.637	2.038	5.106	6.344	0.637
2010	1.472	3.613	4.070	0.564	1.930	4.885	6.171	0.564
2011	1.295	2.982	3.690	0.519	1.780	4.330	5.908	0.519
2012	1.202	2.899	3.445	0.451	1.699	4.242	5.767	0.451
2013	1.091	2.574	3.155	0.416	1.586	3.848	5.552	0.416
2014	1.077	2.741	2.976	***0.392***	1.557	3.877	5.415	***0.392***
2015	1.021	2.558	2.833	0.378	1.501	3.701	5.267	0.378
2016	1.060	2.831	2.793	0.382	1.542	4.024	5.175	0.382
2017	1.069	2.970	2.683	0.384	1.558	4.161	5.128	0.384
2018	1.012	2.757	2.495	0.382	1.510	3.938	5.027	0.382
2019	1.045	3.071	2.395	0.377	1.544	4.222	4.977	0.377
2020	0.957	2.699	2.253	0.361	1.459	3.836	4.867	0.361
2021	0.871	2.274	2.120	0.355	1.378	3.451	4.729	0.355
2022	0.889	2.397	2.089	0.359	1.392	3.582	4.653	0.359
2023	0.908	2.559	2.037	0.360	1.409	3.723	4.609	0.360
2024	0.819	2.230	1.930	0.325	1.322	3.387	4.529	0.325
2025	0.762	2.022	1.788	0.315	1.268	3.191	4.399	0.315
2026	0.727	1.829	1.736	0.316	1.233	3.006	4.336	0.316
2027	0.837	2.503	1.765	0.321	1.329	3.609	4.332	0.321
2028	0.838	2.617	1.726	0.303	1.326	3.710	4.290	0.303
2029	0.753	2.185	1.613	0.298	1.238	3.269	4.155	0.298
2030	0.679	1.743	1.541	0.302	1.172	2.877	4.090	0.302
2031	0.725	2.132	1.503	0.289	1.217	3.245	4.071	0.289
2032	0.680	1.933	1.412	0.285	1.171	3.043	3.972	0.285
2033	0.657	1.845	1.373	0.279	1.143	2.935	3.919	0.279
2034	0.655	1.921	1.318	0.270	1.139	2.987	3.877	0.270
2035	0.586	1.497	1.242	0.277	1.072	2.605	3.766	0.277
2036	0.643	1.899	1.234	0.272	1.123	2.981	3.744	0.272
2037	0.574	1.543	1.170	0.263	1.052	2.637	3.652	0.263
2038	0.613	1.843	1.134	0.260	1.082	2.888	3.599	0.260
2039	0.559	1.505	1.104	0.262	1.031	2.587	3.550	0.262
2040	0.543	1.410	1.096	0.261	1.009	2.488	3.499	0.261
2041	0.648	1.991	1.155	0.273	1.099	2.998	3.521	0.273
2042	0.661	2.130	1.152	0.263	1.109	3.139	3.488	0.263
2043	0.578	1.675	1.099	0.253	1.024	2.678	3.429	0.253
2044	0.504	1.328	1.023	0.238	0.952	2.359	3.335	0.238
2045	0.533	1.536	1.013	0.236	0.974	2.542	3.301	0.236
2046	0.517	1.454	1.006	0.232	0.947	2.412	3.267	0.232
2047	0.569	1.764	0.998	0.239	0.976	2.603	3.223	0.239
2048	0.623	2.063	1.032	0.244	0.995	2.704	3.222	0.244
2049	0.612	1.993	1.034	0.244	0.987	2.673	3.195	0.244
2050	0.567	1.750	1.013	0.237	0.945	2.467	3.153	0.237
2051	0.536	1.635	0.991	0.222	0.916	2.382	3.110	0.222
2052	0.511	1.465	0.990	0.225	0.889	2.236	3.061	0.225
2053	0.625	2.090	1.051	0.239	0.996	2.836	3.097	0.239
2054	0.573	1.779	1.023	0.237	0.943	2.547	3.039	0.237
2055	0.547	1.621	1.018	0.236	0.915	2.393	3.008	0.236
2056	0.587	1.835	1.049	0.241	0.951	2.621	2.986	0.241
2057	0.584	1.804	1.055	0.242	0.942	2.573	2.974	0.242
2058	0.530	1.469	1.041	0.241	0.879	2.207	2.917	0.241
2059	0.609	1.991	1.065	0.235	0.955	2.717	2.936	0.235
2060	0.511	1.480	0.985	0.222	0.859	2.239	2.836	0.222
2061	0.489	1.372	0.952	0.220	0.838	2.148	2.790	0.220
2062	0.514	1.505	0.956	0.226	0.858	2.268	2.766	0.226
2063	0.516	1.501	0.962	0.228	0.855	2.255	2.743	0.228
2064	0.534	1.575	0.981	0.234	0.867	2.321	2.725	0.234
2065	0.527	1.474	1.001	0.243	0.852	2.194	2.715	0.243
2066	0.613	2.057	1.018	0.234	0.931	2.741	2.717	0.234
2067	0.546	1.616	0.973	0.243	0.856	2.331	2.577	0.243

BOLD-ITALICIZED - First occurrence of PCB concentration below human-health based Remediation Goal of 0.05 mg/kg PCBs in species-weighted fish fillet and other risk-based concentrations (0.2 mg/kg and 0.4 mg/kg).

Upper Hudson River average is weighted by river section length. River Section 1: 6.3 miles = 15.4%; River Section 2: 5.1 miles = 12.5%; and River Section 3: 29.5 miles = 72.1%.

Table 11-2
Species-Weighted Fish Fillet Average PCB Concentration (mg/kg)

Year	MNA				Estimated Upper Bound of MNA			
	Upper River Average	River Section 1 (RM 189)	River Section 2 (RM 184)	River Section 3 (RM 154)	Upper River Average	River Section 1 (RM 189)	River Section 2 (RM 184)	River Section 3 (RM 154)
1998	3.353	6.774	9.659	1.529	3.368	6.801	9.747	1.529
1999	3.212	6.621	8.877	1.501	3.286	6.796	9.253	1.501
2000	2.791	5.563	8.028	1.292	2.951	5.917	8.870	1.292
2001	2.504	4.924	7.210	1.171	2.753	5.535	8.445	1.171
2002	2.301	4.705	6.571	1.047	2.603	5.447	8.072	1.047
2003	2.129	4.290	6.090	0.980	2.458	5.117	7.708	0.980
2004	2.204	5.084	5.934	0.942	2.548	6.030	7.520	0.942
2005	1.852	3.739	5.523	0.812	2.219	4.763	7.200	0.812
2006	1.574	2.890	4.904	0.716	1.979	3.971	6.814	0.716
2007	1.474	2.862	4.489	0.654	1.925	4.083	6.599	0.654
2008	1.371	2.774	4.168	0.586	1.851	4.090	6.390	0.586
2009	1.262	2.616	3.877	0.519	1.761	3.958	6.218	0.519
2010	1.116	2.321	3.533	0.440	1.645	3.722	6.033	0.440
2011	0.971	1.921	3.164	***0.388***	1.530	3.399	5.810	***0.388***
2012	0.878	1.851	2.879	0.324	1.449	3.308	5.651	0.324
2013	0.791	1.682	2.601	0.287	1.363	3.068	5.467	0.287
2014	0.742	1.666	2.396	0.258	1.307	2.968	5.314	0.258
2015	0.686	1.535	2.229	0.237	1.254	2.837	5.171	0.237
2016	0.680	1.610	2.126	0.231	1.256	2.963	5.067	0.231
2017	0.649	1.573	1.978	0.221	1.235	2.928	4.995	0.221
2018	0.593	1.437	1.765	0.210	1.197	2.813	4.903	0.210
2019	0.577	1.497	1.619	0.200	1.188	2.861	4.824	0.200
2020	0.512	1.270	1.480	***0.182***	1.126	2.611	4.736	***0.182***
2021	0.460	1.080	1.365	0.171	1.082	2.470	4.624	0.171
2022	0.450	1.093	1.296	0.166	1.067	2.469	4.539	0.166
2023	0.435	1.088	1.225	0.158	1.051	2.452	4.477	0.158
2024	***0.385***	0.939	1.123	0.139	1.006	2.316	4.397	0.139
2025	0.350	0.842	1.019	0.129	0.974	2.227	4.307	0.129
2026	0.325	0.757	0.952	0.124	0.947	2.135	4.231	0.124
2027	0.339	0.888	0.920	0.121	0.957	2.247	4.188	0.121
2028	0.322	0.863	0.875	0.111	0.936	2.205	4.133	0.111
2029	0.287	0.720	0.801	0.105	0.899	2.062	4.050	0.105
2030	0.261	0.620	0.735	0.103	0.877	1.982	3.982	0.103
2031	0.257	0.679	0.675	0.095	0.869	2.012	3.929	0.095
2032	0.234	0.602	0.610	0.091	0.845	1.929	3.856	0.091
2033	0.219	0.560	0.564	0.086	0.826	1.880	3.798	0.086
2034	0.208	0.545	0.521	0.082	0.812	1.858	3.735	0.082
2035	***0.191***	0.443	0.475	0.089	0.792	1.754	3.664	0.089
2036	0.209	0.504	0.446	0.104	0.805	1.804	3.614	0.104
2037	0.190	0.427	0.410	0.101	0.784	1.732	3.556	0.101
2038	0.189	0.456	***0.386***	0.098	0.774	1.725	3.500	0.098
2039	0.173	***0.382***	0.363	0.096	0.756	1.663	3.446	0.096
2040	0.164	0.352	0.346	0.092	0.741	1.627	3.398	0.092
2041	0.180	0.461	0.347	0.092	0.749	1.696	3.377	0.092
2042	0.178	0.486	0.337	0.084	0.745	1.727	3.347	0.084
2043	0.155	0.386	0.316	0.078	0.716	1.607	3.298	0.078
2044	0.136	0.301	0.289	0.074	0.693	1.525	3.237	0.074
2045	0.137	0.329	0.278	0.071	0.688	1.539	3.197	0.071
2046	0.131	0.319	0.269	0.067	0.677	1.521	3.154	0.067
2047	0.153	0.474	0.261	0.066	0.689	1.632	3.117	0.066
2048	0.175	0.612	0.263	0.066	0.668	1.515	3.094	0.066
2049	0.166	0.574	0.259	0.063	0.661	1.505	3.068	0.063
2050	0.151	0.498	0.251	0.060	0.646	1.454	3.034	0.060
2051	0.140	0.457	0.242	0.055	0.633	1.426	2.995	0.055
2052	0.130	0.402	0.236	0.054	0.622	1.387	2.960	0.054
2053	0.146	0.494	0.244	0.055	0.635	1.479	2.946	0.055
2054	0.134	0.430	0.235	0.053	0.622	1.424	2.916	0.053
2055	0.125	0.383	0.231	0.052	0.611	1.380	2.887	0.052
2056	0.129	0.407	0.233	0.051	0.613	1.418	2.861	0.051
2057	0.126	0.397	0.231	0.050	0.604	1.383	2.838	0.050
2058	0.116	0.337	0.226	0.050	0.590	1.321	2.804	0.050
2059	0.127	0.422	0.228	***0.047***	0.596	1.389	2.783	***0.047***
2060	0.106	0.316	0.209	0.044	0.574	1.305	2.731	0.044
2061	0.100	0.286	0.200	0.043	0.564	1.273	2.693	0.043
2062	0.102	0.297	***0.197***	0.043	0.561	1.277	2.663	0.043
2063	0.101	0.296	0.196	0.043	0.556	1.267	2.639	0.043
2064	0.103	0.306	0.196	0.044	0.554	1.271	2.613	0.044
2065	0.100	0.283	0.195	0.045	0.548	1.244	2.595	0.045
2066	0.113	0.377	0.195	0.043	0.554	1.304	2.575	0.043
2067	0.101	0.301	0.183	0.044	0.531	1.245	2.461	0.044

Table 11-2
Species-Weighted Fish Fillet Average PCB Concentration (mg/kg)

	CAP-3/10/Select				REM-3/10/Select (6-yr 0.13% resuspension)			
Year	Upper River Average	River Section 1 (RM 189)	River Section 2 (RM 184)	River Section 3 (RM 154)	Upper River Average	River Section 1 (RM 189)	River Section 2 (RM 184)	River Section 3 (RM 154)
1998	3.353	6.774	9.659	1.529	3.353	6.774	9.659	1.529
1999	3.212	6.621	8.877	1.501	3.212	6.621	8.877	1.501
2000	2.791	5.563	8.028	1.292	2.791	5.563	8.028	1.292
2001	2.504	4.924	7.210	1.171	2.504	4.924	7.210	1.171
2002	2.301	4.705	6.571	1.047	2.301	4.705	6.571	1.047
2003	2.128	4.290	6.088	0.980	2.128	4.290	6.088	0.980
2004	2.190	5.023	5.922	0.937	2.201	5.074	5.930	0.941
2005	1.786	3.439	5.459	0.796	1.826	3.619	5.502	0.806
2006	1.273	1.782	4.032	0.686	1.469	2.412	4.745	0.700
2007	0.862	1.009	2.153	0.607	1.122	1.547	3.394	0.638
2008	0.704	0.946	1.415	0.529	0.786	0.956	1.760	0.581
2009	0.624	0.926	1.267	0.447	0.624	0.896	1.026	0.496
2010	0.541	0.853	1.168	***0.365***	0.522	0.825	0.913	***0.389***
2011	0.456	0.665	1.047	0.309	0.438	0.642	0.821	0.327
2012	0.405	0.674	0.966	0.250	***0.386***	0.653	0.765	0.263
2013	***0.350***	0.554	0.874	0.215	0.332	0.537	0.695	0.225
2014	0.325	0.570	0.813	***0.188***	0.307	0.555	0.650	***0.195***
2015	0.298	0.520	0.762	0.170	0.281	0.507	0.612	0.175
2016	0.302	0.599	0.740	0.163	0.286	0.585	0.600	0.168
2017	0.298	0.639	0.703	0.155	0.282	0.626	0.577	0.158
2018	0.275	0.587	0.649	0.144	0.262	0.574	0.542	0.146
2019	0.277	0.664	0.615	0.136	0.265	0.651	0.524	0.138
2020	0.247	0.562	0.573	0.123	0.236	0.552	0.491	0.124
2021	0.220	0.461	0.530	0.115	0.210	0.453	0.454	0.115
2022	0.218	0.480	0.511	0.112	0.208	0.473	0.439	0.112
2023	0.217	0.517	0.490	0.106	0.208	0.509	0.423	0.106
2024	***0.193***	0.445	0.458	0.093	***0.184***	0.439	***0.398***	0.093
2025	0.177	0.402	0.420	0.087	0.169	***0.397***	0.367	0.086
2026	0.164	***0.349***	0.401	0.084	0.157	0.345	0.352	0.083
2027	0.184	0.484	0.400	0.082	0.177	0.479	0.355	0.082
2028	0.180	0.501	***0.387***	0.076	0.174	0.497	0.344	0.075
2029	0.159	0.404	0.358	0.073	0.153	0.400	0.320	0.072
2030	0.143	0.322	0.337	0.072	0.138	0.319	0.303	0.071
2031	0.151	0.408	0.322	0.067	0.147	0.405	0.293	0.066
2032	0.139	0.357	0.298	0.065	0.135	0.354	0.273	0.064
2033	0.132	0.335	0.285	0.062	0.128	0.333	0.263	0.061
2034	0.131	0.349	0.271	0.061	0.128	0.347	0.251	0.060
2035	0.123	0.270	0.252	0.069	0.120	0.268	0.235	0.069
2036	0.146	0.340	0.246	0.087	0.143	0.339	0.231	0.087
2037	0.134	0.285	0.230	0.086	0.132	0.284	0.217	0.085
2038	0.138	0.327	0.221	0.084	0.136	0.326	0.208	0.083
2039	0.127	0.264	0.212	0.083	0.125	0.263	0.201	0.082
2040	0.121	0.247	0.208	0.080	0.119	0.246	***0.198***	0.079
2041	0.141	0.356	0.216	0.083	0.138	0.355	0.207	0.079
2042	0.144	0.387	0.214	0.079	0.138	0.385	0.205	0.073
2043	0.124	0.300	0.203	0.073	0.119	0.299	0.195	0.068
2044	0.106	0.230	***0.188***	0.065	0.103	0.229	0.181	0.063
2045	0.109	0.264	0.184	0.063	0.107	0.264	0.178	0.061
2046	0.103	0.250	0.182	0.058	0.102	0.249	0.176	0.058
2047	0.107	0.285	0.179	0.057	0.107	0.284	0.173	0.058
2048	0.113	0.322	0.183	0.056	0.113	0.321	0.178	0.057
2049	0.111	0.318	0.182	0.054	0.111	0.316	0.177	0.055
2050	0.102	0.281	0.178	0.051	0.102	0.280	0.173	0.052
2051	0.096	0.265	0.173	***0.046***	0.096	0.263	0.169	***0.047***
2052	0.090	0.234	0.172	0.046	0.091	0.233	0.168	0.047
2053	0.110	0.347	0.181	0.047	0.110	0.346	0.178	0.048
2054	0.100	0.292	0.176	0.046	0.100	0.292	0.172	0.047
2055	0.095	0.266	0.175	0.045	0.095	0.265	0.171	0.046
2056	0.102	0.304	0.179	0.045	0.102	0.303	0.176	0.046
2057	0.101	0.299	0.180	0.045	0.101	0.298	0.177	0.045
2058	0.091	0.237	0.177	0.044	0.090	0.236	0.174	0.045
2059	0.105	0.338	0.180	0.043	0.105	0.337	0.177	0.043
2060	0.087	0.245	0.166	0.040	0.087	0.244	0.164	0.040
2061	0.083	0.224	0.160	0.040	0.083	0.227	0.158	0.040
2062	0.087	0.249	0.160	0.040	0.090	0.270	0.158	0.040
2063	0.088	0.250	0.161	0.040	0.092	0.276	0.159	0.040
2064	0.090	0.262	0.164	0.041	0.094	0.288	0.162	0.041
2065	0.089	0.242	0.166	0.042	0.092	0.266	0.165	0.043
2066	0.103	0.343	0.169	0.041	0.106	0.362	0.168	0.041
2067	0.092	0.266	0.161	0.042	0.095	0.287	0.160	0.042

Table 11-2
Species-Weighted Fish Fillet Average PCB Concentration (mg/kg)

Year	REM-0/0/3 (Scenario R16)			
	Upper River Average	River Section 1 (RM 189)	River Section 2 (RM 184)	River Section 3 (RM 154)
1998	3.353	6.774	9.659	1.529
1999	3.212	6.621	8.877	1.501
2000	2.791	5.563	8.028	1.292
2001	2.504	4.924	7.210	1.171
2002	2.301	4.705	6.571	1.047
2003	2.128	4.290	6.088	0.980
2004	2.188	5.014	5.921	0.937
2005	1.787	3.475	5.445	0.792
2006	1.379	1.923	4.765	0.676
2007	1.105	1.014	4.165	0.595
2008	0.823	0.581	2.881	0.518
2009	0.551	0.552	1.236	0.432
2010	***0.399***	0.510	0.585	***0.343***
2011	0.331	0.400	0.517	0.283
2012	0.286	0.412	0.480	0.226
2013	0.245	***0.344***	0.435	***0.191***
2014	0.226	0.371	0.407	0.164
2015	0.206	0.345	***0.384***	0.146
2016	0.210	0.406	0.378	0.139
2017	0.207	0.441	0.367	0.129
2018	***0.192***	0.405	0.352	0.119
2019	0.197	0.474	0.346	0.112
2020	0.175	0.407	0.326	0.100
2021	0.157	0.336	0.304	0.093
2022	0.157	0.357	0.296	0.090
2023	0.158	0.390	0.289	0.085
2024	0.140	0.339	0.275	0.074
2025	0.130	0.309	0.254	0.070
2026	0.121	0.270	0.248	0.067
2027	0.139	0.386	0.254	0.066
2028	0.139	0.413	0.248	0.061
2029	0.123	0.332	0.232	0.059
2030	0.110	0.261	0.224	0.059
2031	0.119	0.340	0.220	0.055
2032	0.111	0.300	0.208	0.053
2033	0.106	0.284	0.204	0.052
2034	0.108	0.302	***0.196***	0.051
2035	0.102	0.231	0.186	0.060
2036	0.125	0.300	0.185	0.078
2037	0.116	0.249	0.176	0.077
2038	0.121	0.293	0.171	0.076
2039	0.111	0.234	0.167	0.075
2040	0.107	0.221	0.166	0.072
2041	0.124	0.322	0.176	0.072
2042	0.125	0.356	0.176	0.067
2043	0.108	0.275	0.168	0.062
2044	0.094	0.210	0.156	0.059
2045	0.098	0.245	0.155	0.057
2046	0.094	0.232	0.154	0.055
2047	0.099	0.264	0.154	0.055
2048	0.105	0.299	0.159	0.054
2049	0.103	0.298	0.160	0.052
2050	0.096	0.263	0.156	***0.049***
2051	0.090	0.248	0.153	0.045
2052	0.085	0.220	0.153	0.044
2053	0.105	0.332	0.163	0.046
2054	0.095	0.279	0.159	0.045
2055	0.091	0.254	0.159	0.044
2056	0.097	0.292	0.164	0.044
2057	0.096	0.288	0.165	0.044
2058	0.086	0.227	0.163	0.043
2059	0.101	0.328	0.167	0.042
2060	0.084	0.237	0.154	0.039
2061	0.080	0.220	0.149	0.038
2062	0.087	0.260	0.150	0.039
2063	0.088	0.266	0.151	0.039
2064	0.091	0.278	0.154	0.040
2065	0.089	0.257	0.158	0.042
2066	0.103	0.353	0.161	0.040
2067	0.092	0.279	0.154	0.041

Table 11-3
Upper Hudson River Largemouth Bass
River Length-Weighted Whole Body Average PCB Concentration (in mg/kg)

Year	No Action	Estimated Upper Bound of No Action	MNA	Estimated Upper Bound of MNA	CAP-3/10/Select	REM-3/10/Select (5-yr 0% resuspension)	REM-3/10/Select (5-yr 0.13% resuspension)	REM-3/10/Select (6-yr 0.13% resuspension)	REM-3/10/Select (6-yr 2.5% resuspension)	REM-0/0/3
1998	7.18	7.19	7.18	7.19	7.18	7.18	7.18	7.18	7.18	7.18
1999	6.76	6.81	6.76	6.81	6.76	6.76	6.76	6.76	6.76	6.76
2000	5.74	5.91	5.74	5.91	5.74	5.74	5.74	5.74	5.74	5.74
2001	5.13	5.44	5.13	5.44	5.13	5.13	5.13	5.13	5.13	5.13
2002	4.76	5.16	4.76	5.16	4.76	4.76	4.76	4.76	4.76	4.76
2003	4.33	4.80	4.33	4.80	4.33	4.33	4.33	4.33	4.33	4.33
2004	4.85	5.35	4.87	5.37	4.83	4.82	4.85	4.87	5.02	4.82
2005	4.33	4.81	3.85	4.34	3.68	3.67	3.71	3.78	4.99	3.66
2006	3.71	4.24	3.06	3.60	2.56	2.48	2.54	2.84	3.98	2.57
2007	3.90	4.45	2.95	3.59	1.91	1.80	1.96	2.34	3.42	2.16
2008	3.77	4.38	2.78	3.46	1.60	1.48	1.60	1.80	2.62	1.71
2009	3.68	4.28	2.60	3.31	1.43	1.31	1.35	1.45	1.84	1.21
2010	3.42	4.06	2.31	3.05	1.26	1.15	1.18	1.19	1.26	0.89
2011	2.90	3.59	1.95	2.75	1.03	0.94	0.96	0.97	1.02	0.72
2012	2.74	3.43	1.78	2.58	0.94	0.86	0.88	0.88	0.92	0.64
2013	2.38	3.10	1.55	2.38	0.78	0.71	0.73	0.73	0.76	0.54
2014	2.43	3.11	1.46	2.27	0.74	0.68	0.69	0.69	0.71	0.51
2015	2.27	2.96	1.33	2.15	0.67	0.61	0.62	0.62	0.64	0.46
2016	2.44	3.14	1.36	2.21	0.71	0.65	0.66	0.66	0.68	0.49
2017	2.60	3.29	1.38	2.21	0.74	0.68	0.69	0.69	0.71	0.51
2018	2.44	3.15	1.24	2.12	0.66	0.61	0.62	0.62	0.64	0.46
2019	2.61	3.32	1.25	2.13	0.70	0.66	0.66	0.66	0.68	0.50
2020	2.34	3.05	1.08	1.95	0.61	0.57	0.57	0.57	0.58	0.43
2021	2.06	2.79	0.93	1.84	0.52	0.48	0.49	0.49	0.50	0.37
2022	2.11	2.85	0.92	1.83	0.52	0.49	0.49	0.49	0.50	0.38
2023	2.28	3.00	0.94	1.83	0.55	0.52	0.52	0.52	0.53	0.40
2024	2.02	2.74	0.82	1.71	0.48	0.45	0.45	0.45	0.46	0.35
2025	1.84	2.57	0.73	1.64	0.43	0.40	0.41	0.41	0.41	0.32
2026	1.71	2.45	0.66	1.58	0.39	0.36	0.37	0.37	0.37	***0.29***
2027	2.17	2.88	0.75	1.65	0.47	0.45	0.45	0.45	0.45	0.36
2028	2.22	2.92	0.73	1.61	0.47	0.45	0.45	0.45	0.46	0.37
2029	1.90	2.60	0.62	1.50	0.40	0.38	0.38	0.38	0.38	0.31
2030	1.65	2.37	0.55	1.46	0.35	0.33	0.33	0.33	0.33	0.27
2031	1.92	2.63	0.59	1.47	0.40	0.39	0.39	0.39	0.39	0.32
2032	1.75	2.47	0.53	1.41	0.35	0.34	0.34	0.34	0.34	0.29
2033	1.69	2.39	0.49	1.38	0.34	0.32	0.33	0.33	0.33	0.28
2034	1.72	2.43	0.48	1.35	0.34	0.33	0.33	0.33	0.33	0.28
2035	1.46	2.17	0.41	1.29	***0.30***	***0.29***	***0.29***	***0.29***	***0.29***	0.25
2036	1.76	2.45	0.51	1.38	0.40	0.39	0.39	0.39	0.39	0.35
2037	1.49	2.18	0.45	1.32	0.35	0.34	0.34	0.34	0.34	0.30
2038	1.63	2.31	0.45	1.29	0.36	0.35	0.35	0.35	0.35	0.32
2039	1.47	2.16	0.41	1.26	0.32	0.32	0.32	0.32	0.32	0.29
2040	1.39	2.07	0.38	1.23	0.30	0.30	0.30	0.30	0.30	0.27
2041	1.79	2.44	0.45	1.27	0.38	0.37	0.37	0.37	0.37	0.34
2042	1.87	2.51	0.46	1.28	0.40	0.39	0.39	0.38	0.38	0.35
2043	1.59	2.23	0.39	1.20	0.33	0.33	0.33	0.32	0.32	0.29
2044	1.31	1.96	0.32	1.14	0.27	0.26	0.26	0.26	0.26	0.24
2045	1.45	2.08	0.34	1.15	0.29	0.28	0.28	0.28	0.28	0.26
2046	1.36	1.99	0.32	1.10	0.27	0.26	0.26	0.26	0.26	0.25
2047	1.49	2.10	0.35	1.13	0.28	0.27	0.27	0.28	0.28	0.26
2048	1.65	2.21	0.39	1.11	0.30	0.30	0.30	0.30	0.30	0.28
2049	1.64	2.20	0.38	1.11	0.30	0.29	0.29	0.30	0.30	0.28
2050	1.50	2.05	0.34	1.08	0.27	0.27	0.27	0.27	0.27	0.26
2051	1.40	1.96	0.32	1.05	0.25	0.25	0.25	0.25	0.25	0.24
2052	1.29	1.85	***0.29***	1.02	0.23	0.23	0.23	0.23	0.23	0.22
2053	1.75	2.30	0.37	1.08	0.31	0.31	0.31	0.31	0.31	0.30
2054	1.56	2.10	0.32	1.04	0.27	0.27	0.27	0.27	0.27	0.26
2055	1.46	2.00	0.30	1.02	0.26	0.25	0.25	0.25	0.25	0.24
2056	1.58	2.12	0.32	1.03	0.27	0.27	0.27	0.27	0.27	0.26
2057	1.61	2.13	0.32	1.02	0.28	0.28	0.28	0.28	0.28	0.27
2058	1.37	1.87	0.27	0.97	0.23	0.23	0.23	0.23	0.23	0.23
2059	1.72	2.23	0.33	1.01	0.30	0.30	0.30	0.30	0.30	0.29
2060	1.36	1.86	0.26	0.95	0.23	0.23	0.23	0.23	0.23	0.23
2061	1.28	1.79	0.25	0.93	0.22	0.22	0.22	0.22	0.22	0.21
2062	1.38	1.87	0.26	0.93	0.23	0.23	0.23	0.24	0.24	0.23
2063	1.38	1.87	0.26	0.92	0.23	0.23	0.23	0.24	0.24	0.23
2064	1.44	1.92	0.27	0.92	0.25	0.24	0.24	0.25	0.25	0.24
2065	1.40	1.87	0.25	0.91	0.24	0.23	0.23	0.24	0.24	0.23
2066	1.73	2.20	0.31	0.94	0.29	0.29	0.29	0.30	0.30	0.29
2067	1.49	1.95	0.27	0.91	0.25	0.25	0.25	0.25	0.25	0.25

BOLD-ITALICIZED - First occurrence of PCB concentration in largemouth bass (whole body) below the ecological goal of 0.03 to 0.3 ppm (based on the NOAEL and LOAEL for the river otter,
For river length-weighted averaging- River Section 1: 6.3 miles = 15.4%; River Section 2: 5.1 miles = 12.5%; and River Section 3: 29.5 miles = 72.1%.

Table 11-4
Tri+ PCB Load Over Federal Dam

	Step-down Upstream Boundary Tri+ PCB Load Assumption (0.16 kg/day to 0.0256 kg/day)											
	P3NAS2 (MNA)		CAP-3/10/Select		REM-0/0/3		R14S2 (REM-3/10/Select - No resuspension) - 5 yr dredge		R14RS (REM 3/10/Select - w/ 0.13% resuspension) - 5 yr dredge		R20RS (REM 3/10/Select - w/ 0.13% resuspension) - 6 yr dredge	
Year	Annual Load	Cumulative Load	Annual Load	Cumulative Load	Annual Load	Cumulative Load	Annual Load	Cumulative Load	Annual Load	Cumulative Load	Annual Load	Cumulative Load
1998	330.3	330.3	330.3	330.3	330.3	330.3	330.3	330.3	330.3	330.3	330.3	330.3
1999	157.7	488.0	157.7	488.0	157.7	488.0	157.7	488.0	157.7	488.0	157.7	488.0
2000	205.5	693.5	205.5	693.5	205.5	693.5	205.5	693.5	205.5	693.5	205.5	693.5
2001	236.7	930.2	236.7	930.2	236.7	930.2	236.7	930.2	236.7	930.2	236.7	930.2
2002	137.8	1068.0	137.8	1068.0	137.8	1068.0	137.8	1068.0	137.8	1068.0	137.8	1068.0
2003	130.5	1198.5	130.5	1198.5	130.5	1198.5	130.5	1198.5	130.5	1198.5	130.5	1198.5
2004	95.7	1294.2	94.6	1293.1	94.6	1293.1	94.6	1293.2	95.2	1293.8	95.5	1294.1
2005	92.3	1386.5	87.3	1380.4	86.1	1379.2	87.1	1380.3	88.4	1382.2	90.6	1384.7
2006	105.0	1491.6	92.7	1473.1	88.2	1467.4	92.4	1472.7	93.9	1476.1	96.7	1481.3
2007	103.8	1595.3	82.2	1555.4	78.5	1545.9	81.4	1554.1	91.4	1567.5	91.9	1573.2
2008	50.6	1645.9	39.1	1594.5	37.6	1583.5	38.6	1592.7	46.8	1614.3	48.6	1621.9
2009	46.9	1692.8	33.5	1628.0	32.0	1615.6	32.9	1625.6	34.4	1648.7	40.2	1662.1
2010	93.7	1786.5	59.9	1687.9	49.7	1665.2	58.2	1683.7	60.5	1709.2	61.4	1723.5
2011	71.8	1858.3	43.2	1731.1	33.9	1699.2	41.7	1725.4	43.1	1752.3	43.7	1767.2
2012	65.7	1924.0	40.6	1771.7	32.1	1731.3	39.4	1764.8	40.6	1792.9	41.1	1808.3
2013	67.4	1991.4	40.9	1812.6	31.9	1763.2	39.6	1804.4	40.5	1833.4	41.0	1849.2
2014	49.2	2040.6	31.0	1843.6	24.4	1787.6	30.1	1834.5	30.8	1864.1	31.1	1880.3
2015	45.1	2085.7	28.1	1871.7	21.9	1809.5	27.3	1861.8	27.8	1891.9	28.1	1908.4
2016	26.7	2112.4	17.4	1889.2	13.9	1823.4	17.0	1878.8	17.3	1909.2	17.4	1925.8
2017	24.6	2137.1	16.4	1905.5	13.1	1836.5	16.0	1894.8	16.2	1925.4	16.3	1942.2
2018	33.5	2170.5	19.1	1924.7	14.2	1850.7	18.4	1913.2	18.6	1944.1	18.8	1960.9
2019	22.2	2192.7	14.2	1938.9	11.2	1861.9	13.9	1927.1	14.0	1958.1	14.1	1975.0
2020	28.5	2221.3	17.9	1956.9	13.7	1875.7	17.5	1944.6	17.6	1975.7	17.7	1992.8
2021	26.1	2247.3	16.3	1973.1	12.5	1888.1	15.8	1960.4	16.0	1991.7	16.0	2008.8
2022	18.3	2265.6	12.2	1985.3	9.7	1897.8	11.9	1972.3	12.0	2003.7	12.1	2020.9
2023	16.7	2282.3	11.3	1996.7	9.1	1906.9	11.1	1983.4	11.2	2014.9	11.2	2032.1
2024	29.4	2311.7	18.3	2015.0	14.0	1920.9	17.8	2001.2	17.9	2032.8	18.0	2050.1
2025	19.6	2331.3	12.8	2027.8	10.1	1931.0	12.5	2013.7	12.6	2045.4	12.7	2062.7
2026	19.4	2350.6	12.6	2040.4	9.9	1941.0	12.3	2026.1	12.4	2057.8	12.4	2075.2
2027	15.0	2365.6	10.4	2050.8	8.4	1949.4	10.2	2036.3	10.2	2068.0	10.3	2085.4
2028	17.8	2383.4	12.1	2062.9	9.7	1959.1	11.8	2048.1	11.9	2079.9	11.9	2097.3
2029	17.2	2400.6	11.9	2074.8	9.7	1968.8	11.7	2059.8	11.7	2091.6	11.7	2109.1
2030	15.9	2416.5	11.3	2086.1	9.3	1978.1	11.1	2070.9	11.1	2102.7	11.2	2120.2
2031	18.6	2435.1	12.4	2098.4	10.0	1988.1	12.1	2083.0	12.1	2114.9	12.2	2132.4
2032	15.3	2450.4	10.7	2109.1	8.9	1996.9	10.5	2093.5	10.5	2125.4	10.5	2142.9
2033	13.3	2463.7	9.6	2118.7	8.1	2005.0	9.5	2103.0	9.5	2134.9	9.5	2152.4
2034	15.4	2479.1	11.5	2130.2	9.8	2014.7	11.3	2114.3	11.3	2146.2	11.3	2163.8
2035	23.5	2502.6	19.8	2149.9	17.6	2032.3	19.6	2133.9	19.6	2165.8	19.6	2183.4
2036	33.3	2535.8	29.0	2178.9	26.3	2058.6	28.8	2162.7	28.8	2194.6	28.8	2212.2
2037	29.5	2565.3	25.3	2204.2	22.9	2081.5	25.1	2187.8	25.1	2219.7	25.1	2237.3
2038	20.7	2586.0	18.1	2222.3	16.5	2098.0	18.0	2205.7	18.0	2237.7	18.0	2255.3
2039	27.1	2613.1	22.7	2245.0	20.6	2118.6	22.5	2228.3	22.6	2260.3	22.6	2277.9
2040	16.4	2629.5	14.0	2259.0	12.8	2131.4	13.9	2242.2	13.9	2274.2	13.9	2291.8
2041	15.0	2644.5	14.1	2273.0	12.0	2143.4	14.0	2256.2	14.0	2288.2	13.1	2304.9
2042	10.4	2654.9	10.7	2283.8	8.6	2152.0	10.7	2266.9	10.7	2298.9	9.3	2314.1
2043	19.4	2674.4	18.2	2302.0	14.9	2167.0	18.1	2285.0	18.1	2317.0	16.3	2330.4
2044	19.8	2694.2	15.9	2317.9	15.2	2182.1	15.8	2300.8	15.8	2332.8	16.2	2346.6
2045	15.6	2709.8	12.4	2330.3	12.2	2194.3	12.3	2313.1	12.3	2345.2	13.0	2359.7
2046	14.2	2724.0	11.8	2342.1	11.7	2206.1	11.8	2324.9	11.8	2356.9	12.4	2372.1
2047	12.0	2736.0	9.9	2352.0	9.7	2215.8	9.8	2334.7	9.8	2366.8	10.3	2382.4
2048	12.2	2748.2	9.6	2361.6	9.4	2225.2	9.5	2344.2	9.5	2376.3	9.9	2392.4
2049	10.4	2758.6	8.3	2369.9	8.2	2233.4	8.3	2352.5	8.3	2384.6	8.6	2400.9
2050	12.8	2771.4	10.0	2380.0	9.7	2243.1	10.0	2362.5	10.0	2394.6	10.3	2411.2
2051	13.4	2784.9	10.7	2390.7	10.4	2253.5	10.7	2373.2	10.7	2405.3	11.0	2422.2
2052	9.2	2794.1	7.7	2398.4	7.5	2261.0	7.6	2380.8	7.7	2412.9	7.8	2430.0
2053	8.5	2802.6	7.2	2405.6	7.0	2268.0	7.2	2388.0	7.2	2420.1	7.3	2437.3
2054	8.6	2811.2	7.4	2413.0	7.2	2275.1	7.3	2395.4	7.4	2427.4	7.5	2444.8
2055	10.7	2821.9	9.0	2422.0	8.7	2283.8	9.0	2404.4	9.0	2436.4	9.1	2453.9
2056	6.7	2828.6	6.1	2428.1	6.0	2289.8	6.1	2410.5	6.1	2442.5	6.2	2460.0
2057	9.0	2837.6	8.1	2436.2	7.9	2297.7	8.1	2418.6	8.1	2450.6	8.2	2468.2
2058	8.2	2845.7	7.4	2443.7	7.2	2305.0	7.4	2426.0	7.4	2458.1	7.5	2475.7
2059	8.1	2853.9	7.4	2451.1	7.2	2312.2	7.4	2433.4	7.4	2465.5	7.4	2483.1
2060	10.6	2864.5	9.6	2460.7	9.3	2321.5	9.6	2443.0	9.6	2475.0	9.6	2492.7
2061	11.4	2875.9	10.3	2471.0	10.0	2331.5	10.3	2453.3	10.3	2485.3	10.3	2503.1
2062	7.5	2883.4	7.0	2478.0	6.8	2338.3	6.9	2460.2	6.9	2492.3	7.0	2510.0
2063	7.3	2890.7	6.8	2484.8	6.7	2345.0	6.8	2467.0	6.8	2499.1	6.9	2516.9
2064	7.3	2898.0	6.9	2491.7	6.8	2351.8	6.9	2473.9	6.9	2506.0	6.9	2523.9
2065	7.6	2905.5	7.2	2498.9	7.1	2358.8	7.2	2481.1	7.2	2513.2	7.2	2531.1
2066	7.6	2913.1	7.3	2506.1	7.1	2366.0	7.2	2488.3	7.2	2520.4	7.3	2538.4
2067	6.7	2919.9	6.4	2512.6	6.3	2372.3	6.4	2494.8	6.4	2526.8	6.5	2544.9
Total Loads	2919.9		2512.6		2372.3		2494.8		2526.8		2544.9	

Table 11-4
Tri+ PCB Load Over Federal Dam

			Constant Upstream Boundary Tri+ PCB Load Assumption (0.16 kg/day)		Step-down Upstream Boundary Tri+ PCB Load Assumption (0.16 kg/day to ZERO)			
	R20RX (REM 3/10/Select - w/ 2.5% resuspension) - 6 yr dredge		P3NACW (No Action)		P3NAS0 (MNA)		R14S0 (REM-3/10/Select - No resuspension) - 5 yr dredge	
Year	Annual Load	Cumulative Load	Annual Load	Cumulative Load	Annual Load	Cumulative Load	Annual Load	Cumulative Load
1998	330.3	330.3	330.3	330.3	330.3	330.3	330.3	330.3
1999	157.7	488.0	157.7	488.0	157.7	488.0	157.7	488.0
2000	205.5	693.5	205.5	693.5	205.5	693.5	205.5	693.5
2001	236.7	930.2	236.7	930.2	236.7	930.2	236.7	930.2
2002	137.8	1068.0	137.8	1068.0	137.8	1068.0	137.8	1068.0
2003	130.5	1198.5	130.5	1198.5	130.5	1198.5	130.5	1198.5
2004	104.0	1302.5	95.7	1294.2	95.7	1294.2	94.6	1293.1
2005	126.0	1428.6	111.4	1405.6	88.7	1382.9	83.5	1376.6
2006	139.7	1568.3	129.0	1534.6	100.5	1483.4	87.8	1464.4
2007	154.2	1722.4	128.9	1663.5	99.0	1582.4	76.6	1541.1
2008	107.5	1830.0	71.3	1734.8	46.6	1629.0	34.7	1575.8
2009	85.5	1915.5	67.6	1802.4	42.9	1671.9	29.0	1604.8
2010	84.8	2000.2	131.0	1933.4	86.6	1758.5	51.2	1656.0
2011	58.2	2058.5	103.8	2037.2	65.6	1824.2	35.7	1691.7
2012	53.6	2112.0	101.0	2138.2	59.0	1883.1	32.7	1724.5
2013	50.7	2162.7	104.6	2242.8	60.4	1943.5	32.6	1757.1
2014	37.7	2200.4	83.8	2326.6	42.6	1986.2	23.6	1780.7
2015	33.4	2233.8	80.3	2406.9	38.4	2024.5	20.7	1801.4
2016	20.6	2254.3	52.6	2459.5	21.8	2046.3	12.1	1813.5
2017	19.0	2273.3	51.7	2511.1	19.5	2065.8	10.8	1824.3
2018	21.3	2294.6	64.0	2575.2	27.7	2093.5	12.6	1837.0
2019	16.0	2310.6	48.7	2623.9	17.1	2110.6	8.8	1845.8
2020	19.7	2330.3	63.3	2687.2	21.9	2132.5	10.9	1856.6
2021	17.6	2347.9	60.0	2747.2	19.6	2152.1	9.4	1866.0
2022	13.2	2361.1	47.0	2794.2	12.8	2164.9	6.4	1872.5
2023	12.2	2373.2	45.2	2839.4	11.2	2176.1	5.7	1878.2
2024	19.3	2392.5	72.8	2912.2	21.2	2197.3	9.6	1887.7
2025	13.5	2406.0	53.4	2965.6	13.1	2210.4	6.1	1893.8
2026	13.1	2419.1	53.6	3019.3	12.8	2223.3	5.8	1899.6
2027	10.8	2429.9	45.3	3064.6	9.2	2232.5	4.4	1904.0
2028	12.5	2442.4	53.6	3118.2	10.9	2243.4	5.0	1909.1
2029	12.2	2454.6	53.9	3172.1	10.3	2253.7	4.7	1913.8
2030	11.6	2466.1	52.1	3224.2	9.0	2262.7	4.2	1918.0
2031	12.5	2478.7	58.2	3282.4	11.0	2273.7	4.6	1922.6
2032	10.8	2489.5	51.5	3333.9	8.4	2282.1	3.6	1926.2
2033	9.7	2499.2	47.0	3380.9	6.9	2289.0	3.1	1929.2
2034	11.6	2510.8	56.7	3437.6	7.5	2296.5	3.4	1932.7
2035	19.8	2530.6	62.6	3500.2	16.1	2312.6	12.2	1944.8
2036	29.0	2559.6	74.6	3574.8	25.4	2338.0	20.9	1965.8
2037	25.3	2584.9	69.9	3644.7	21.8	2359.8	17.4	1983.2
2038	18.1	2603.0	54.5	3699.2	14.3	2374.0	11.6	1994.7
2039	22.7	2625.7	72.7	3771.9	18.4	2392.4	13.9	2008.6
2040	14.0	2639.7	49.6	3821.4	10.1	2402.5	7.6	2016.2
2041	13.1	2652.9	49.0	3870.5	8.5	2411.0	7.5	2023.7
2042	9.3	2662.2	37.5	3908.0	5.3	2416.3	5.5	2029.3
2043	16.3	2678.5	67.3	3975.3	10.3	2426.6	9.0	2038.3
2044	16.3	2694.8	64.2	4039.5	11.4	2438.0	7.3	2045.6
2045	13.1	2707.9	52.7	4092.2	8.5	2446.6	5.3	2050.9
2046	12.5	2720.4	52.1	4144.3	7.0	2453.5	4.5	2055.4
2047	10.3	2730.8	46.0	4190.3	5.5	2459.0	3.4	2058.8
2048	9.9	2740.7	46.6	4236.9	5.7	2464.7	3.0	2061.7
2049	8.6	2749.3	41.9	4278.8	4.4	2469.1	2.3	2064.0
2050	10.3	2759.6	51.7	4330.4	5.4	2474.5	2.6	2066.6
2051	11.0	2770.6	55.9	4386.3	5.3	2479.8	2.6	2069.2
2052	7.8	2778.5	41.1	4427.4	3.2	2483.0	1.6	2070.8
2053	7.3	2785.8	39.3	4466.8	2.6	2485.6	1.3	2072.1
2054	7.5	2793.2	40.7	4507.5	2.5	2488.1	1.2	2073.3
2055	9.1	2802.4	50.3	4557.7	3.2	2491.3	1.5	2074.8
2056	6.2	2808.5	34.2	4592.0	1.5	2492.7	0.9	2075.6
2057	8.2	2816.7	45.8	4637.8	2.0	2494.7	1.1	2076.7
2058	7.5	2824.2	41.9	4679.7	1.7	2496.5	1.0	2077.7
2059	7.4	2831.7	42.3	4722.0	1.6	2498.1	0.9	2078.6
2060	9.6	2841.3	54.6	4776.5	2.3	2500.4	1.2	2079.8
2061	10.4	2851.6	59.2	4835.7	2.3	2502.7	1.2	2081.0
2062	7.0	2858.6	40.2	4875.9	1.2	2503.9	0.7	2081.7
2063	6.9	2865.5	39.5	4915.5	1.1	2505.0	0.7	2082.4
2064	7.0	2872.4	40.1	4955.6	1.1	2506.1	0.6	2083.0
2065	7.2	2879.7	41.8	4997.4	1.0	2507.1	0.7	2083.7
2066	7.3	2887.0	42.2	5039.6	1.0	2508.1	0.7	2084.4
2067	6.5	2893.5	37.7	5077.3	0.9	2509.0	0.5	2084.9
Total Loads	2893.5		5077.3		2509.0		2084.9	

Table 11-5: Comparison of Present-Worth Costs

Alternative	Area Remediated (Acres)	Area Capped (Acres)	Volume Removed (CY)	Estimated PCB Mass Remediated (kg/lbs)	Present-Worth Cost ($ Millions)
No Action	-	-	-	-	**.14**
Monitored Natural Attenuation	-	-	-	-	**39**
CAP 3/10/Select	493	207	1,732,800	70,000/150,000	**370**
REM 3/10/Select	493	-	2,651,700	70,000/150,000	**460**
REM 0/0/3	964	-	3,823,100	84,000/185,000	**570**

Table 13-1: Areas of Sediments, and Mass of PCBs Remediated for REM 3/10/Select

River Section/Parameter	Target Criteria	Contaminant Removal	Channel Dredging	Total
<u>River Section 1</u>				
Area Remediated (Acres)	3 g/m^2	266	15	282
Volume Sediments Removed (CY)	3 g/m^2	1,495,300	66,100	1,561,400
PCB Mass Removed (kg)	3 g/m^2	36,000 (1)	(2)	36,000 (1)
<u>River Section 2</u>				
Area Remediated (Acres)	10 g/m^2	74	2	76
Volume Sediments Removed (CY)	10 g/m^2	564,000	15,400	580,100
PCB Mass Removed (kg)	10 g/m^2	23,600	700	24,300
<u>River Section 3</u>				
Area Remediated (Acres)	Hot Spot 36, 37, Part of 39	92	43	135
Volume Sediments Removed (CY)		392,900	117,300	510,200
PCB Mass Removed (kg)	Hot Spot 36, 37, Part of 39	6,700	2,800	9,500
<u>Total for Alternative</u>	Hot Spot 36, 37, Part of 39			
Area Remediated (Acres)		432	61	493
Volume Sediments Removed (CY)		2,452,900	198,800	2,651,700
PCB Mass Removed (kg)		66,300	3,500	69,800 (1)(3)

(1) Includes Channel Dredging PCB Mass Removed.
(2) Included in Contaminant Removal PCB Mass Removed (kg).
(3) Rounded to 70,000 kg in Record of Decision text.

Table 13-2: Cost Analysis - Alternative REM-3/10/Select [1]

Cost Item	Quantity	Unit Cost ($)	Unit	Cost ($)
Capital Costs				
Pre-Construction Studies and Designs				
Design Support Testing	1	14,857,830	LS	14,857,830
Design (includes Treatability Study and Model Development)	1	11,007,500	LS	11,007,500
Construction				
Contractor Work Plans	1	363,674	LS	363,674
Health and Safety	1	3,350,454	LS	3,350,454
Construction Management	1	9,321,669	LS	9,321,669
Mobilization/Demobilization	1	3,788,167	LS	3,788,167
Site Preparation and Facility Construction - North	1	15,087,919	LS	15,087,919
Site Preparation and Facility Construction - South	1	9,234,334	LS	9,234,334
Dredging	2,651,730	20.67	CY	54,822,487
Testing and Monitoring during Remediation	1	13,191,268	LS	13,191,268
Barging	2,651,730	21.49	CY	56,987,426
Stabilization	2,651,730	25.90	CY	68,679,950
Transport/Landfill Fee				
Load RR Car	2,863,868	2.44	CY	6,990,528
Transportation/Disposal >33 ppm - Texas	1,682,659	119.20	tons	200,571,817
Transportation/Disposal <33 ppm - Northeast	813,002	55.16	tons	44,842,345
Transportation/Disposal <33 ppm - Southeast	1,513,754	55.16	tons	83,493,373
Sediment Sample and Analysis	4,099,416	0.41	tons	1,681,305
Water Treatment	1	1,107,907	LS	1,107,907
Backfilling	851,634	57.24	CY	48,750,306
Habitat and Vegetation Replacement	1	3,734,322	LS	3,734,322
River Bank Stabilization	1	1,150.693	LS	1,150,693
Construction Monitoring	1	5,364,654	LS	5,364,654
Total Capital Costs				658,379,928
Operations & Maintenance Costs				
Post Construction Sediment Monitoring - Conducted in Years 2010, 2013, 2018				
Sediment Monitoring	3	662,588	Event	1,987,764
Geophysical Survey(includes Multibeam Survery and Bathymetry)	3	376,155	Event	1,128,465
Post Construction O&M - Annual (for 10 years after construction is complete)				
Water Monitoring	10	1,907,912	Year	19,079,120
Fish Monitoring	10	893,378	Year	8,933,780
Annual Reporting	10	45,045	Year	450,450
Post Construction - Every 5 Years (for 10 years after construction is complete)				
Modeling	2	139,504	Event	279,008
Five-Year Review	2	76,856	Event	153,712
Total O&M Costs				32,012,299
Annual O&M Costs (for 10 years over O&M period 2010 through 2019)				3,201,230
Present Worth of Costs				
Pre-Construction Studies and Design				
Design Support Testing (Year 2003)				13,027,002
Design (includes Treatability Study and Model Development - Year 2004)				9,036,959
Construction (Years 2005 to 2009)				426,322,045
Post Construction Sediment Monitoring - Conducted in Years 2010, 2013 and 2018				
Sediment Monitoring				884,323
Geophysical Survey (includes Multibeam Survey and Bathymetry)				502,035
Post Construction O&M - Annual (Years 2010 to 2018)				
Water Monitoring				7,994,229
Fish Monitoring				3,743,290
Annual Reporting				188,740
Post Construction - Every 5 Years (2010 to 2019)				
Modeling				102,058
Five-Year Review				56,226
Total Present Worth Costs for Alternative				**461,856,907**
Round To				**460,000,000**

(1) Cost estimates will not change substantially going from a construction period of five years to six years. Among other things, certain costs such as the quantity of cubic yards and unit costs for dredging have not changed.

Key: LS= Lump Sum, CY = Cubic Yards

Table 14-1: Chemical Specific ARARs

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
RIVER WATER			
Safe Drinking Water Act, *42 U.S.C. §§ 300f - 300j-26*	40 CFR § 141.61	ARAR	The Maximum Contaminant Level (MCL) for PCBs in finished drinking water supplied to consumers of public water supplies is 0.0005 ppm (0.5 µg/L).
Clean Water Act [Federal Water Pollution Control Act, as amended], *33 U.S.C. §§ 1251-1387*	40 CFR § 129.105(a)(4)	ARAR	The ambient water quality criterion for navigable waters is 0.001 µg/L total PCBs.
Clean Water Act [Federal Water Pollution Control Act] Section 304(a), *33 U.S.C. § 1314(a).*	63 Fed. Reg. 68354 (December 10, 1998)	ARAR	Criteria continuous concentration (chronic) for PCBs is 0.014 µg/L in freshwater and 0.03 µg/L in saltwater.
New York State Environmental Conservation Law (ECL) Article 15, Title 3 and Article 17, Titles 3 and 8	6 NYCRR § 703.5	ARAR	Establishes New York Water Quality Standards for almost 200 contaminants. For PCBs in surface water the values are (a) $1x10^{-6}$ µg/L (ppb) for protection of health of human consumers of fish; (b) 0.09 µg/L for protection of human health and drinking water sources; and (c) 1.2 x 10^{-4} µg/L for protection of wildlife.
AIR			
No promulgated chemical-specific ARARs identified for air.			
SEDIMENT			
No promulgated chemical-specific ARARs identified for sediment			

Note: The tolerance level of 2 ppm PCBs in fish and shellfish (edible portion) shipped in interstate commerce (21 CFR § 109.30(a)(7)) is not an ARAR for this site because the Federal Food, Drug and Cosmetic Act, 21 U.S.C. § 301-393, the statute under which the tolerance level is promulgated, is not a Federal environmental law or a State environmental law or facility siting law.

Table 14-2: Location-Specific ARARs

MEDIUM/ AUTHORITY	CITATION	STATUS	*REQUIREMENT SYNOPSIS*
Statement of Procedures on Floodplain Management and Wetlands Protection	40 CFR Part 6, Appendix A	ARAR	Sets forth EPA policy and guidance for carrying out Executive Orders 11990 and 11988. Executive Order 11988: Floodplain Management requires federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain. Federal agencies are required to avoid adverse impacts or minimize them if no practicable alternative Executive Order 11990: Protection of Wetlands requires federal agencies conducting certain activities to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands if a practicable alternative exists. Federal agencies are required to avoid adverse impacts or minimize them if no practicable alternative exists. Preliminary Floodplain and Wetlands assessments have been performed for the selected remedy and are included as Appendices to the Responsiveness Summary.
Endangered Species Act of 1973, as amended, *16 U.S.C. §§ 1531- 1544*	50 CFR Part 17, Subpart I; 50 CFR Part 402	ARAR	Federal agencies are required to verify that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of a critical habitat of such species, unless such agency has been granted an appropriate exemption by the Endangered Species Committee (16 U.S.C. § 1536).
Fish and Wildlife Coordination Act, *16 U.S.C. § 662*	N/A	ARAR	Whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose, by any department or agency of the United States, such department or agency first shall consult with the United States Fish and Wildlife Service, Department of the Interior, and with the head of the agency exercising administration over the wildlife resources of the particular State in which the impoundment, diversion, or other control facility is to be constructed, with a view to the conservation of wildlife resources by preventing loss of and damage to such resources.
Farmland Protection Policy Act of 1981, *7 U.S.C. § 4201*	7 CFR Part 658	ARAR	Regulates the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses.
National Historic Preservation Act, *16 U.S.C. § 470 et seq.*	36 CFR Part 800	ARAR	Remedial actions must take into account effect on properties in or eligible for inclusion in the National Registry of Historic Places. A Stage 1A Cultural Resources Survey is included as an Appendix to the Responsiveness Summary.
New York State Freshwater Wetlands Law, Environmental Conservation Law (ECL) Article 24, Title 7	6 NYCRR Parts 662- 665	ARAR	Defines procedural requirements for undertaking different activities in and adjacent to freshwater wetlands, and establishes standards governing the issuance of permits to alter or fill freshwater wetlands. In accordance with CERCLA Section 121 (e), a permit is not required for on-site CERCLA response actions, although the selected remedy will comply with substantive provisions of these regulations.
New York State ECL Article 3, Title 3; Article 27, Titles 7 and 9	6 NYCRR § 373-2.2	ARAR	Establishes construction requirements for hazardous waste facilities in 100-year floodplain.

Table 14-3: Action-Specific ARARs

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
Clean Air Act, *42 U.S.C. §§ 7401-7671q*	40 CFR Parts 50, 51 and 52 National Primary and Secondary Ambient Air Quality Standards *(NAAQs)*	ARAR	Identifies emissions requirements for "major" sources of lead, NO_x, CO, PM_{10}, and SO_2 in attainment and non-attainment areas. The sediment processing/transfer facilities will not be "major" sources for purposes of the NAAQs, although the NAAQs are relevant and appropriate to the selected remedy.
Toxic Substances Control Act (TSCA), Title I, *15 U.S.C. § 2605*	40 CFR § 761.50	ARAR	Identifies disposal requirements for various PCB waste types.
TSCA, *15 U.S.C. § 2605*	40 CFR § 761.61 PCB Remediation Waste	ARAR	Cleanup and disposal options for PCB remediation waste, which includes PCB-contaminated sediments and dredged materials. Disposal options for PCB remediation waste include disposal in a high-temperature incinerator, an approved chemical waste landfill, or a facility with a coordinated approval under 40 CFR § 761.77. PCB remediation waste containing PCBs at concentrations less than 50 ppm may be disposed of off-site in an approved land disposal facility for the management of municipal solid waste, or in a disposal facility approved under 40 CFR part 761. 40 CFR § 761.61(c) allows an EPA Regional Administrator to approve a risk-based disposal method that will not pose an unreasonable risk of injury to human health or the environment.
TSCA, *15 U.S.C. § 2605*	40 CFR § 761.65	ARAR	Storage requirements: Establishes technical requirements for temporary storage of PCB wastes prior to treatment or disposal.
TSCA, *15 U.S.C. § 2605*	40 CFR § 761.79	ARAR	Decontamination standards and procedures for removing PCBs that are regulated for disposal from water, organic liquids, and other materials.
Solid Waste Disposal Act, as amended, *42 U.S.C. §§ 6901-6992k.*	40 CFR Part 261 Identification and Listing of Hazardous Waste	ARAR	Lists and establishes criteria for identifying hazardous waste. Provisions of this Part, or equivalent authorized New York State regulations, may be applicable to determine whether sediments removed from the Hudson River contain hazardous waste(s)
Solid Waste Disposal Act, as amended, *42 U.S.C. §§ 6901-6992k.*	40 CFR Part 262 Standards Applicable to Generators of Hazardous Waste	ARAR	Includes manifest, record keeping and other requirements applicable to generators of hazardous waste. If it is determined that sediments removed from the Hudson River via the selected remedy contain hazardous waste(s), provisions of this Part, or equivalent authorized New York State regulations, may apply.
Solid Waste Disposal Act, as amended, *42 U.S.C. §§ 6901-6992k.*	40 CFR Part 263 Standards Applicable to Transporters of Hazardous Waste	ARAR	Sets forth standards for transporters of hazardous wastes, including the receipt of an EPA identification number and manifesting requirements. If it is determined that sediments removed from the Hudson River via the selected remedy contain hazardous waste(s), provisions of this Part, or equivalent authorized New York State regulations, may apply.
Solid Waste Disposal Act, as amended, *42 U.S.C. §§ 6901-6992k.*	40 CFR Parts 264 and 265 Standards for Owners and Operators of Hazardous Waste, Treatment and Storage Facilities	ARAR	Includes management standards including record keeping, requirements for particular units such as tanks or containers, and other requirements applicable to owners and operators of hazardous waste treatment, storage and disposal facilities. If it is determined that sediments removed from the Hudson River via the selected remedy contain hazardous waste(s), provisions of this Part, or equivalent authorized New York State regulations, may apply to the sediment processing/transfer facilities.

Table 14-3: Action-Specific ARARs

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
Solid Waste Disposal Act, as amended, *42 U.S.C. §§ 6901-6992k.*	40 CFR Part 268 Land Disposal Restrictions	ARAR	Places land disposal restrictions, including treatment standards and related testing, tracking and record keeping requirements, on hazardous waste(s). If it is determined that sediments removed from the Hudson River via the selected remedy contain hazardous waste(s), provisions of this Part, or equivalent authorized New York State regulations, may apply.
Section 404(b) of the Clean Water Act, *33 U.S.C. § 1344(b)*	40 CFR Part 230	ARAR	Guidelines for Specification of Disposal Sites for Dredged or Fill Material. Except as otherwise provided under Clean Water Act Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. If there is no other practical alternative, impacts must be minimized. Includes criteria for evaluating whether a particular discharge site may be specified.
Section 404(c) of the Clean Water Act, *33 U.S.C. § 1344(c)*	40 CFR Part 231, 33 CFR Parts 320-329	ARAR	These regulations apply to all existing, proposed, or potential disposal sites for discharges of dredged or fill materials into U.S. waters, which include wetlands. Includes special policies, practices, and procedures to be followed by the U.S. Army Corps of Engineers in connection with the review of applications for permits to authorize the discharge of dredged or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act. In accordance with CERCLA Section 121(e), a permit is not required for on-site CERCLA response actions, although the selected remedy will comply with substantive requirements of these regulations.
Section 10, Rivers and Harbors Act, *33 U.S.C. § 403*	33 CFR Parts 320, 321 and 322	ARAR	U.S. Army Corps of Engineers approval is generally required to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of the channel of any navigable water of the United States. The selected remedy is exempt from permit requirements pursuant to CERCLA Section 121(e), although the selected remedy will comply with substantive requirements of these regulations, and will be coordinated with the U.S. Army Corps. of Engineers.
Hazardous Materials Transportation Act, as amended , *49 U.S.C. §§ 5101 - 5127*	49 CFR Part 171	ARAR	Department of Transportation Rules for Transportation of Hazardous Materials, including procedures for the packaging, labeling, manifesting and transporting of hazardous materials.
New York State ECL Article 27, Title 7	6 NYCRR Part 360 Solid Waste Management Facilities	ARAR	New York State regulations for design, construction, operation, and closure requirements for solid waste management facilities.
New York State ECL Article 27, Title 3	6 NYCRR Part 364 Standards for Waste Transportation	ARAR	Regulations governing the collection, transport and delivery of regulated wastes, including hazardous wastes.
New York State ECL Article 27, Title 9	6 NYCRR Parts 370 and 371, Standards for Hazardous Waste Management	ARAR	New York State regulations for activities associated with hazardous waste management. All dredged materials and other solid wastes containing 50 ppm by weight (on a dry weight basis for other than liquid wastes) or greater of PCBs are listed hazardous wastes, excluding small capacitors and PCB articles drained in accordance with applicable NY State regulations.
New York State ECL Article 3, Title 3; Article 27, Titles 7 and 9	6 NYCRR Part 372 Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities	ARAR	Includes Hazardous Waste Manifest System requirements for generators, transporters, and treatment, storage or disposal facilities, and other requirements applicable to generators and transporters of hazardous waste.

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
New York State ECL Article 3, Title 3; Article 27, Titles 7 and 9	6 NYCRR Part 373 Hazardous Waste Management Facilities	ARAR	These regulations establish requirements for treatment, storage, and disposal of hazardous waste; permit requirements (from which the selected remedy is exempt for on-site actions); and construction and operation standards for hazardous waste management facilities.
New York State ECL Article 27, Title 9	6 NYCRR Part 376	ARAR	Land Disposal Restrictions. PCB wastes including dredge spoils containing PCBs greater than 50 ppm must be disposed of in accordance with federal regulations at 40 CFR Part 761.
New York State ECL, Article 19, Title 3 - Air Pollution Control Law. Promulgated pursuant to the Federal Clean Air Act, *42 U.S.C. § 7401*	6 NYCRR Parts 200, 202, 211, 212, and 257. Air Pollution Control Regulations	ARAR	The emission of air contaminants to the outside atmosphere that jeopardize human, plant, or animal life, or are ruinous to property, or which unreasonably interfere with the comfortable enjoyment of life or property, is prohibited (6 NYCRR 211.2). New York State Air Quality Standards are promulgated at 6 NYCRR Part 257.
New York State ECL Article 15, Title 5, and Article 17, Title 3	6 NYCRR Part 608 Use and Protection of Waters	ARAR	A permit is required to change, modify, or disturb any protected stream, its bed or banks, or remove from its bed or banks sand or gravel or any other material; or to excavate or place fill in any of the navigable waters of the state. Any applicant for a federal license or permit to conduct any activity which may result in any discharge into navigable waters must obtain a State Water Quality Certification under Section 401 of the Federal Water Pollution Control Act, 33 USC § 1341. In accordance with CERCLA Sections 121(d)(2) and 121(e), neither a permit nor a water quality certification is required for on-site CERCLA response actions, although such actions will comply with substantive requirements of 6 NYCRR Part 608.
New York State ECL Article 17, Title 8	6 NYCRR Parts 750 - 758 New York State Pollutant Discharge Elimination System (SPDES) Requirements	ARAR	Standards for Storm Water Runoff, Surface Water, and Groundwater Discharges. In general, no person shall discharge or cause a discharge to NY State waters of any pollutant without a permit under the New York State Pollutant Discharge Elimination System (SPDES) program. In accordance with CERCLA Section 121(e), a permit is not required for on-site CERCLA response actions, although the selected remedy will comply with substantive requirements of 6 NYCRR Parts 750 - 758.
New York State ECL Article 17, Title 5	ECL § 17-0301, 6 NYCRR Parts 701, 703	ARAR	It shall be unlawful for any person, directly or indirectly, to throw, drain, run or otherwise discharge into such waters organic or inorganic matter that shall cause or contribute to a condition in contravention of applicable standards adopted by NYSDEC pursuant to ECL 17-0301.
New York State ECL Article 11, Title 5	NY ECL § 11-0503	ARAR	Fish & Wildlife Law against water pollution. No deleterious or poisonous substances shall be thrown or allowed to run into any public or private waters in quantities injurious to fish life, protected wildlife or waterfowl inhabiting those waters, or injurious to the propagation of fish, protected wildlife or waterfowl therein.

Table 14-4
Location-Specific Criteria, Advisories and Guidance to be Considered (TBCs) [1]

MEDIUM/ AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS
EPA Office of Solid Waste and Emergency Response	Policy on Floodplains and Wetland Assessments for CERCLA Actions, August 1985	To Be Considered	Superfund actions must meet the substantive requirements of the Floodplain Management Executive Order (E.O. 11988) and the Protection of Wetlands Executive Order (E.O. 11990). This memorandum discusses situations that require preparation of a floodplains or wetlands assessment, and the factors that should be considered in preparing an assessment, for response actions taken pursuant to Section 104 or 106 of CERCLA. For remedial actions, a floodplain/ wetlands assessment must be incorporated into the analysis conducted during the planning of the remedial action. USACE, the federal natural resource trustees, and NYSDEC will be consulted during remedial design and remedial action in order to develop measures to mitigate or avoid impacts to floodplains or wetlands from implementation of the selected remedy.
No Other Location-Specific To-Be-Considered Criteria Identified.			

[1] No Chemical-Specific TBCs have been identified

Table 14-5
Action-Specific Criteria, Advisories, and Guidance to be Considered (TBCs)

MEDIUM/ AUTHORITY	CITATION	STATUS	REQUIREMENT SYNOPSIS
USEPA	Remedial Design/Remedial Action Handbook (OSWER Directive No. 9355.0-04B, June 1995)	To Be Considered	General reference manual that provides Remedial Project Managers with an overview of the remedial design and remedial action processes. The management principles outlined apply to Federal-lead sites where the Superfund is used to finance the remedial design or remedial action, as well as to non-Federal lead sites. Will be consulted during remedial design and remedial action for the selected remedy.
USEPA	Superfund Remedial Design and Remedial Action Guidance (OSWER Directive No. 9355.0-4A, June 1986)	To Be Considered	Guidance document developed to assist agencies and parties who plan, administer, and manage remedial design and remedial action at Superfund sites (e.g., EPA Remedial Project Managers, State project officers, USACE personnel, and responsible parties). Will be consulted during remedial design and remedial action for the selected remedy.
USEPA	Comprehensive Five-Year Review Guidance (OSWER No. 9355.7-03B-P, June 2001)	To Be Considered	Provides guidance on conducting Five-Year Reviews for sites at which hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unrestricted use and unlimited exposure. The purpose of the Five-Year Review is to evaluate whether the selected response action continues to be protective of public health and the environment and is functioning as designed. The guidance will be consulted for the Five-Year Reviews required for the selected remedy pursuant to CERCLA Section 121(c).
NYSDEC	Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants, 2000.	To Be Considered	Provides Guidance for the control of toxic ambient air contaminants in New York State. Current annual guideline concentrations (AGCs) for PCBs are 0.01 $\mu g/m^3$ for inhalation of evaporative congeners (Aroclor 1242 and below) and 0.002 $\mu g/m^3$ for inhalation of 3 persistent highly chlorinated congeners (Aroclor 1248 and above) in the form of dust or aerosols. Will be consulted during remedial design and remedial construction in connection with potential emission of air contaminants from implementation of the selected remedy.
NYSDEC	Technical and Operational Guidance Series (TOGS) 1.2.1 Drafting Strategy for Surface Waters	To Be Considered	Provides guidance for writing permits for discharges of wastewater from industrial SPDES permit facilities and for writing requirements equivalent to SPDES permits for discharges from remediation sites. Will be consulted with respect to treatment of wastewater during implementation of the selected remedy.

Table 14-5 (Continued) Action-Specific Criteria, Advisories, and Guidance to be Considered (TBCs)			
NYSDEC	Technical and Operational Guidance Series (TOGS) 1.3.1 Waste Assimilative Capacity Analysis & Allocation for Setting Water Quality Based Effluent Limits	To Be Considered	Provides guidance to water quality controlengineers in determining whether discharges to water bodies have a reasonable potential to violate water quality standards and guidance values. Will be consulted in connection with wastewater treatment component of the selected remedy.
NYSDEC	Technical and Operational Guidance Series (TOGS) 1.3.2 Toxicity Testing in the SPDES Permit Program	To Be Considered	Describes the criteria for deciding when toxicity testing will be required in a permit and the procedures which should be followed when including toxicity testing requirements in a permit. Will be consulted in connection with wastewater treatment component of the selected remedy.
NYSDEC	Technical and Operational Guidance Series (TOGS) 1.3.7 Analytical Detectability & Quantitation Guidelines for Selected Environmental Parameters	To Be Considered	Provides method detection limits and practical quantitation limits for pollutants in distilled water. Will be consulted in connection with wastewater treatment component of the selected remedy.
NYSDEC	Technical and Administrative Guidance Memorandum (TAGM) 4031 Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites	To Be Considered	Provides guidance on fugitive dust suppression and particulate monitoring for inactive hazardous waste sites. Will be consulted with respect to potential emissions of dust and particulate matter during implementation of the selected remedy.
NYSDEC	Interim Guidance on Freshwater Navigational Dredging, October 1994	To Be Considered	Provides guidance for navigational dredging activities in freshwater areas, including guidance on navigational dredging of sediments which contain PCBs. Will be consulted, as appropriate, in connection with navigational dredging necessary as part of the selected remedy.