Appendix H

Additional Analyses for PCBs and Mercury

To perform the screening analysis for the National Sediment Quality Survey using NSI data, EPA selected reasonably conservative screening values, including theoretically and empirically derived risk-based screening levels. The limited number of sediment criteria available for use in this type of evaluation, however, contributed to the possibility of over- and underestimation of potential adverse effects associated with sediment contaminated for some chemicals. Two chemicals where this issue is particularly relevant are PCBs and mercury. EPA conducted further analyses on PCBs and mercury to determine the effect of using different assessment parameters on the number of sampling stations where these chemicals were identified as associated with a probability of adverse effects.

Because of the tendency for PCBs to bind to sediment and because of the relative toxicity of these chemicals to humans, EPA selected a precautionary approach for the analysis of PCBs in the NSI evaluation. The approach was precautionary because (1) it did not require matching sediment chemistry data and tissue residue data for Tier 1 classification and (2) it used the cancer risk level of 10^{-5} for all congener, aroclor, or total PCB measurements to evaluate human health effects related to PCB contamination. EPA applied the cancer slope factor for aroclor 1260, the most potent commercial mixture, to all measures. It should be noted that there were only 542 sampling stations where matching sediment chemistry data and tissue residue data were available for analysis. In the following evaluation, the amount of PCB sediment and fish tissue data exceeding screening values other than those used in the NSI analysis is compared to the number of sampling stations classified as Tier 1 or Tier 2.

Figure H-1 is a cumulative density function graph depicting the maximum PCB concentration at each sediment sampling station where PCBs were detected. The various screening values that could be used to indicate adverse effects levels

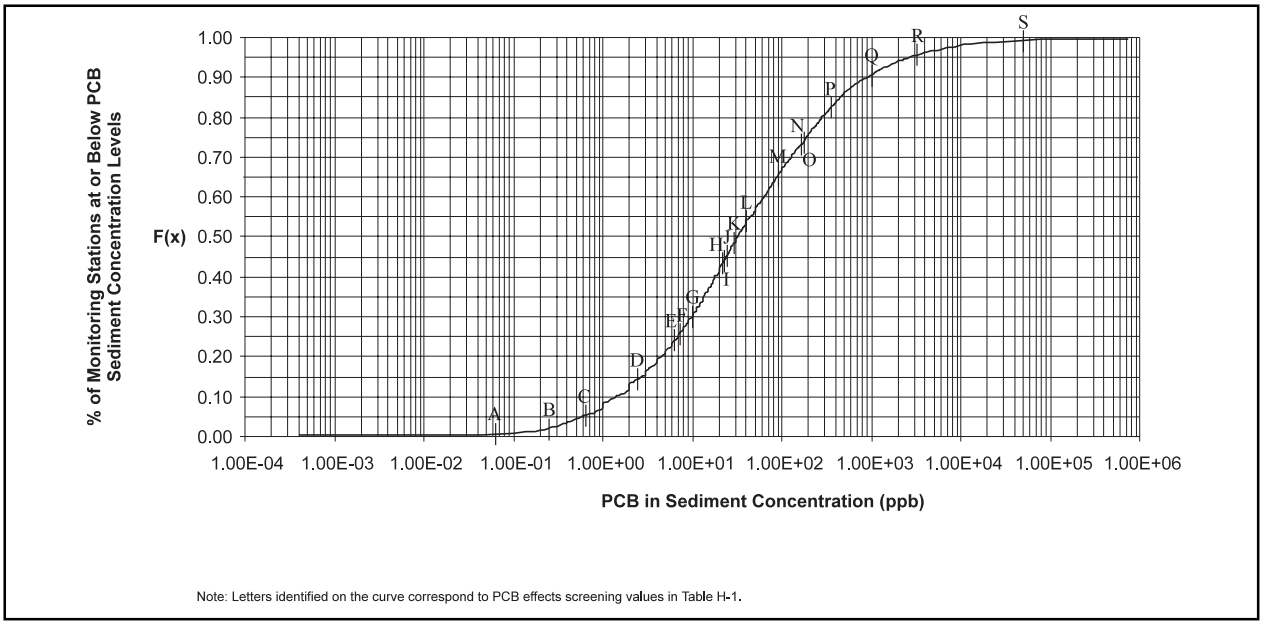

Figure H-1. Cumulative Frequency Distribution of PCB Sediment Concentration Data (All Aroclors and Total PCB).

of PCBs in sediment are plotted as A through S in the figure and described in Table H-1. The top two sections of Table H-1 present the screening values of PCBs in sediment that are protective of human or wildlife consumers. The levels shown were derived using the theoretical bioaccumulative potential (TBP) analysis with the default lipid content (3 percent), default organic carbon content (1 percent), and BSAFs with and without the safety factor of 4. (See Appendices B and C for further explanation.) Depending on the screening value, the number of sediment chemistry sampling stations with detectable PCBs exhibiting potential human health or aquatic life effects varies from under 1 percent to over 99 percent. The screening values selected for the NSI evaluation classify approximately 85 percent of sediment chemistry sampling stations in Tier 2 for human health effects (Point D). For aquatic life effects, the selected screening values classify 25 percent of sampling stations as Tier 1 (Point O) and 57 percent of sampling stations as Tier 2 (Point H).

Table H-1. Sediment Sampling Stations with Detectable Levels of PCBs That Exceed Various Screening Values[a,b]

Type of Screening Value	Associated Level (ppb)	Level Plotted in Figure H-1 Corresponds to Letter	Number of Stations with Detected PCBs Exceeding Level	Percentage of Stations with Detected PCBs Exceeding Level
Protection of Consumers				
Cancer Risk Level				
10^{-6}	0.25	B	3,772	98.2
10^{-5}[d]	2.5	D	3,290	85.6
10^{-4}	25	J	2,076	54.0
Noncancer Hazard Quotient of 1	40	L	1,761	45.8
FDA Tolerance Level	360	P	652	17.0
Wildlife Criteria	29	K	1,977	51.5
Protection of Consumers Using BSAF with Safety Factor[c]				
Cancer Risk Level				
10^{-6}	0.063	A	3,828	99.6
10^{-5}	0.63	C	3,648	95.0
10^{-4}	6.3	E	2,921	76.0
Noncancer Hazard Quotient of 1	9.9	G	2,699	70.2
FDA Tolerance Level	90	M	1,330	34.6
Wildlife Criteria	7.2	F	2,849	74.2
Protection of Aquatic Life				
ER-L	22.7	I	2,150	56.0
ER-M	180	N	976	25.4
AET-L	1,000	Q	353	9.2
AET-H	3,100	R	165	4.3
TEL[e]	21.6	H	2,182	56.8
PEL[f]	189	O	962	25.0
Other Protection Levels				
TSCA[g] Level	50,000	S	21	0.55

[a]Maximum total or aroclor-specific value at a given station was used.
[b]PCBs were detected at 3,842 (41%) of the 9,401 stations where collected samples were analyzed for them.
[c]For this presentation, measured levels were compared to risk levels using a default organic carbon content (1%) and default organism lipid content (3%). Use of site-specific organic carbon would yield slightly different results.
[d]Levels used in the current National Sediment Quality Survey evaluation for human health.
[e]Levels used in the current National Sediment Quality Survey evaluation for aquatic life (Tier 2).
[f]Levels used in the current National Sediment Quality Survey evaluation for aquatic life (Tier 1).
[g]Toxic Substances Control Act. 40 CFR Part 761, Subpart B, § 761.20.

Figure H-2 and Table H-2 present the comparison of different screening values and the corresponding number of fish tissue sampling stations with detected levels of PCBs exceeding the screening values. The 10^{-5} cancer risk level (Point B) was one of the most conservative thresholds: concentrations exceeded this level at approximately 95 percent of tissue residue sampling stations where PCBs were detected. These sampling stations were clssified as Tier 1 for potential human health risk.

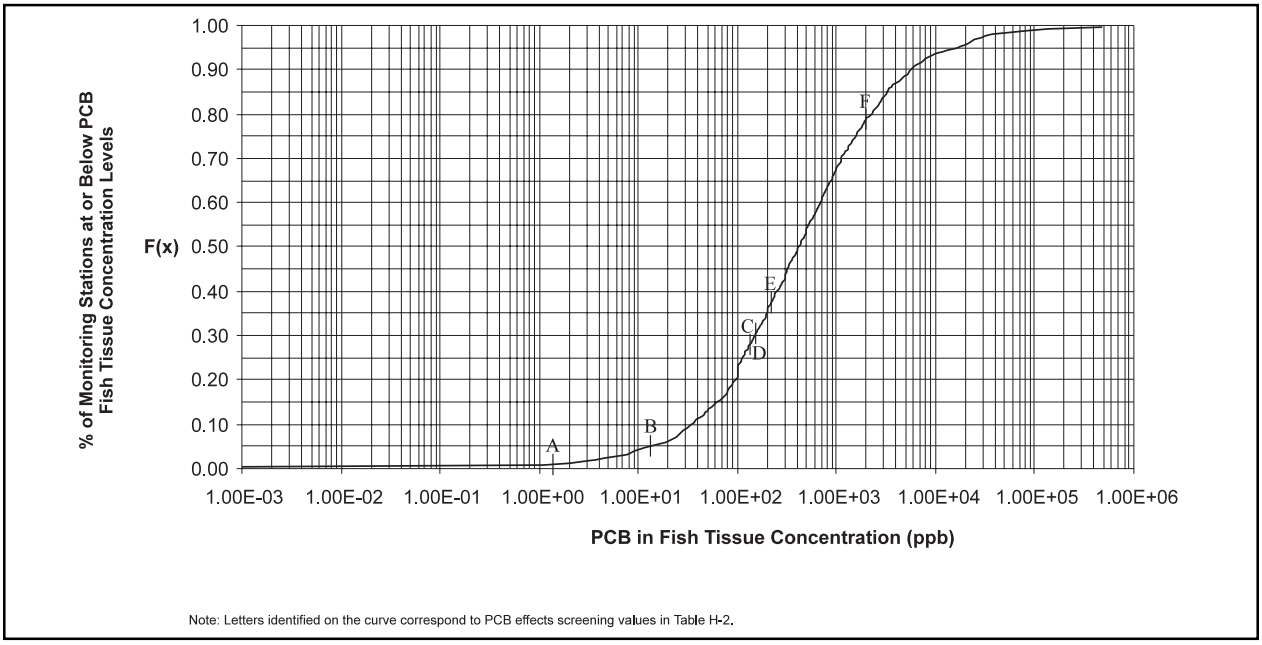

Figure H-2. Cumulative Frequency Distribution of PCB Fish Tissue Concentration Data (All Aroclors and Total PCB).

Table H-2. Fish Tissue Sampling Stations with Detectable Levels of PCBs in Demersal, Resident, Edible Fish That Exceed Various Screening Values[a,b]

Type of Screening Value	Associated Level (ppb)	Level Plotted in Figure H-2 Corresponds to Letter	Number of Stations with Detected PCBs Exceeding Level	Percentage of Stations with Detected PCBs Exceeding Level
Protection of Consumers				
Cancer Risk Level				
10-6	1.4	A	2,354	99.3
10-5[c]	14	B	2,256	95.2
10-4	140	C	1,686	71.1
Noncancer Hazard Quotient of 1	220	E	1,473	62.2
FDA Tolerance Level	2,000	F	489	20.6
Wildlife Criteria	160	D	1,620	68.4

[a]Maximum total or aroclor-specific value at a given station was used.
[b]PCBs were detected at 2,370 (73%) of the 3,234 stations where collected samples were analyzed for them.
[c]Levels used in the current National Sediment Quality Survey evaluation for human health.

In contrast to the PCB evaluation, the evaluation of mercury detected in fish tissue residue in the NSI analysis was substantially less conservative than that which would result from use of different screening values. To determine the possible outcomes of different data evaluations, EPA performed additional analyses of mercury fish tissue data included in the NSI. Figure H-3 and Table H-3 present six screening values that could be applied for the protection of consumers ingesting mercury-contaminated fish. As shown in these displays, both EPA's current noncancer reference dose recommended for general use (Point E) and the FDA action level (Point D), the screening value used in the current NSI analysis, result in only about 4 percent of sampling stations with detectable levels classified as posing potential risk to human health.

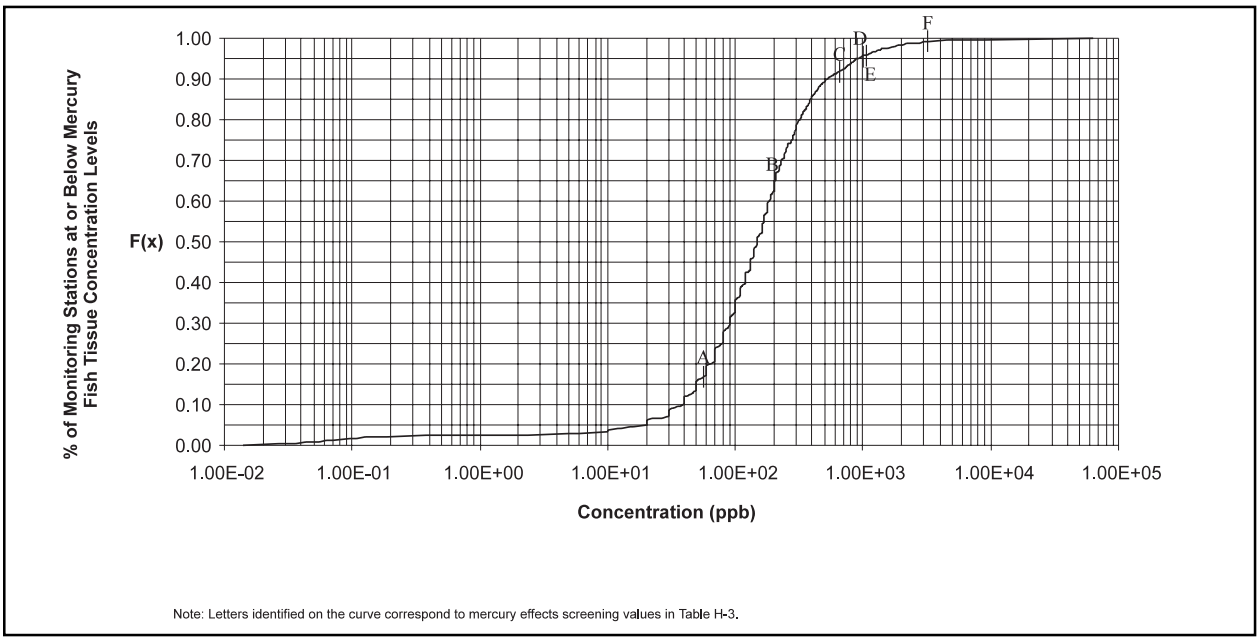

Figure H-3. Cumulative Frequency Distribution of Mercury Fish Tissue Data for Demersal, Resident, and Edible Species.

Table H-3. Fish Tissue Sampling Stations with Detectable Levels of Mercury in Demersal, Resident, Edible Fish Species That Exceed Various Screening Values[a,b]

Type of Screening Value	Associated Level (ppb)	Level Plotted in Figure H-3 Corresponds to Letter	Number of Stations with Detected Mercury Exceeding Level	Percentage of Stations with Detected Mercury Exceeding Level
Protection of Consumers				
Canadian Guideline[b]	200	B	908	35.1
Noncancer Hazard Quotient of 1 (1995)[c]	1,100	E	91	3.5
Noncancer Hazard Quotient of 1 (pre-1995)[d]	3,231	F	15	0.6
Noncancer Hazard Quotient of 1 (pre-1995 for infants)[e]	646	C	204	7.9
FDA Action Level[f]	1,000	D	103	4.0
Wildlife Criteria[g]	57.3	A	2,150	83.0

[a]Mercury was detected at 2,589 (90%) of the 2,861 stations where collected samples were analyzed for mercury.
[b]Canadian guideline limit for mercury in fish that are part of a subsistence diet (Health and Welfare Canada, 1979).
[c]Methyl mercury reference dose that was available in IRIS in 1995 ($1x10^{-4}$ mg/kg-day).
[d]Corresponds to mercury reference dose available in IRIS prior to 1995 ($3x10^{-4}$ mg/kg-day).
[e]Corresponds to mercury reference dose available in IRIS prior to 1995 divided by a factor of 5 to protect against developmental effects among infants ($6x10^{-5}$ mg/kg-day). This value was formerly used by the EPA Office of Water.
[f]Level used in the current National Sediment Quality Survey evaluation for human health.
[g]The results of the wildlife analysis shown in Table 3-5 are slightly different because the data set used for that analysis included demersal, resident species (could be considered edible or not).

The NSI evaluation restricted the data analyzed to demersal, resident, and edible species. Figure H-4 and Table H-4 present the same six mercury screening values with the data for all fish species considered edible by humans with detectable levels of mercury in the NSI. If all edible fish species were analyzed using selected screening values, 9 percent of sampling stations would be classified as Tier 2 because of mercury contamination (Point D). However, the proportion of sampling stations with detectable levels of mercury that exceed some other human health levels ranges from 20 percent to over 55 percent of sampling stations.

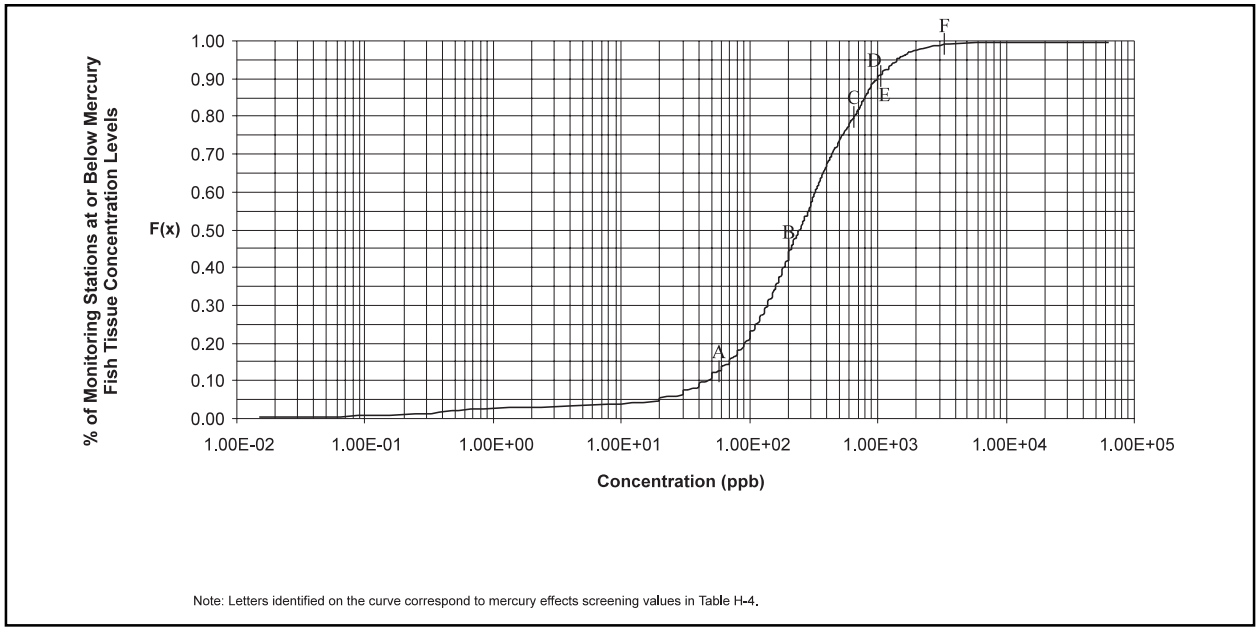

Figure H-4. Cumulative Frequency Distribution of Mercury Fish Tissue Data for All Edible Species.

Table H-4. Fish Tissue Sampling Stations with Detectable Levels of Mercury in Edible Fish Species That Exceed Various Screening Values[a,b]

Type of Screening Value	Associated Level (ppb)	Level Plotted in Figure H-4 Corresponds to Letter	Number of Stations with Detected Mercury Exceeding Level	Percentage of Stations with Detected Mercury Exceeding Level
Protection of Consumers				
Canadian Guideline[b]	200	B	2,308	55.8
Noncancer Hazard Quotient of 1 (1995)[c]	1,100	E	353	7.8
Noncancer Hazard Quotient of 1 (pre-1995)[d]	3,231	F	37	0.9
Noncancer Hazard Quotient of 1 (pre-1995 for infants)[e]	646	C	821	19.9
FDA Action Level[f]	1,000	D	374	9.0
Wildlife Criteria[g]	57.3	A	3,623	87.6

[a]Mercury was detected at 4,135 (93%) of the 4,426 stations where collected samples were analyzed for mercury.
[b]Canadian guideline limit for mercury in fish that are part of a subsistence diet (Health and Welfare Canada, 1979).
[c]Methyl mercury reference dose that was available in IRIS in 1995 ($1x10^{-4}$ mg/kg-day).
[d]Corresponds to mercury reference dose available in IRIS prior to 1995 ($3x10^{-4}$ mg/kg-day).
[e]Corresponds to mercury reference dose available in IRIS prior to 1995 divided by a factor of 5 to protect against developmental effects among infants ($6x10^{-5}$ mg/kg-day). This value was formerly used by the EPA Office of Water.
[f]Level used in the current National Sediment Quality Survey evaluation for human health.
[g]The results of the wildlife analysis shown in Table 3-5 are slightly different because the data set used for that analysis included demersal, resident species (could be considered edible or not).