

Publication No. 11-03-055-AppD2

This is Appendix D-2 for the report:

Control of Toxic Chemicals in Puget Sound: Assessment of Selected Toxic Chemicals in the Puget Sound Basin, 2007-2011. www.ecy.wa.gov/biblio/1103055.html

Appendix D-2. Hazard Evaluation – Results of Prioritization

Table 1a. Fresh Surface Water Prioritization

Table 1b. Marine Nearshore Surface Water Prioritization

Table 1c. Marine Offshore Surface Water Prioritization

Table 2a. Freshwater Sediment Prioritization

Table 2b. Marine Nearshore Sediment Prioritization

Table 2c. Marine Offshore Sediment Prioritization

Table 3. Tissue Residue Prioritization

Table 4. Wildlife Prioritization

Table 5. Human Health Prioritization

Appendix D-2. Table 1a. Summary of observed freshwater concentrations compared to effect concentrations and water quality standards, prioritization, and data uncertainty.

Freshwater Summary - Aquatic Life							
COC ¹	90 th ile Observed Conc. > 10 th %ile Effects Conc.	90 th ile Observed Conc. Exceeds Acute WQS	90 th ile Observed Conc. Exceeds Chronic WQS	Total N	% FOD	Level of Concern	Data Uncertainty
Arsenic	INS	No	No	4528	85.0	U	High data uncertainty due to low number of effects concentrations for dissolved arsenic (<15; n=1).
Cadmium	No	No	No	4166	7.1	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=78) of effects data.
Copper	Yes	No	Yes	5378	92.2	Priority 1	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=855) of effects data.
Lead	No	No	No	4427	32.9	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=77) of effects data.
Mercury	No	No	Yes	4313	63.3	Priority 1	Low data uncertainty for total mercury due to large number of environmental measurements (>200), large number of effects data for total mercury (>50; n=894); high data uncertainty for dissolved mercury due to low number of effects data for dissolved mercury (n=1) and large number of measured concentrations (>200).
Zinc	No	No	No	4844	87.5	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=217) of effects data.
PCBs - Total Congeners	No	No	No	177	79.9	Priority 2	Moderate data uncertainty due to moderate number of environmental measurements (>50 < 200) and large amount (>50; n=308) of effects data.
PCB Aroclors [®]	No	No	Yes	1248	3.5	Priority 1	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=308) of effects data.
PBDEs	INS	NA	NA	255	59	U	High uncertainty due to lack of effects data.
1,2,3,4,7,8 HxCDD	INS	NA	NA	7	29	U	High data uncertainty due to low number of effects concentrations (<15; n=3) and low number of observed concentrations (<50).
1,2,3,7,8 PeCDD	INS	NA	NA	7	29	U	High data uncertainty due to low number of effects concentrations (<15; n=3) and low number of observed concentrations (<50).
2,3,7,8 TCDD	INS	NA	NA	7	14	U	High data uncertainty due to limited number of environmental measurements (<50) and moderate number of effects data (>15 <50).
DDT and Metabolites	No	Yes	Yes	2179	4.1	Priority 1	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=743) of effects data.
Acenaphthene	No	NA	NA	1540	7.8	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=61) of effects data.
Anthracene	No	NA	NA	1539	5.9	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=168) of effects data.
Benzo(a)anthracene	INS	NA	NA	1447	11.3	U	High uncertainty due to lack of effects data (<15; n=2).
Benzo(a)pyrene	No	NA	NA	1558	11.2	Priority 2	Moderate data uncertainty due to large number of environmental measurements (>200) and moderate number of (>15 <50; n=29) of effects data.
Benzo(g,h,i)perylene	INS	NA	NA	1559	11.3	U	High uncertainty due to lack of effects data.
Benzo(k)fluoranthene	INS	NA	NA	1558	12.5	U	High uncertainty due to lack of effects data (<15; n=2).
Chrysene	INS	NA	NA	1557	15.5	U	High uncertainty due to lack of effects data (<15; n=3).
Dibenzo(a,h)anthracene	INS	NA	NA	1557	4.7	U	High uncertainty due to lack of effects data (<15; n=1).
Fluoranthene	No	NA	NA	1539	21.9	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=135) of effects data.

Appendix D-2. Table 1a. Summary of observed freshwater concentrations compared to effect concentrations and water quality standards, prioritization, and data uncertainty.

Freshwater Summary - Aquatic Life							
COC ¹	90 th %ile Observed Conc. > 10 th %ile Effects Conc.	90 th %ile Observed Conc. Exceeds Acute WQS	90 th %ile Observed Conc. Exceeds Chronic WQS	Total N	% FOD	Level of Concern	Data Uncertainty
Fluorene	No	NA	NA	1539	8.3	Priority 2	Moderate data uncertainty due to large number of environmental measurements (>200) and moderate amount (> 15 < 50; n=32) of effects data.
Naphthalene	No	NA	NA	1577	21.2	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=78) of effects data.
Phenanthrene	No	NA	NA	1538	23.2	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=117) of effects data.
Pyrene	No	NA	NA	1536	24.4	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=52) of effects data.
Bis(2-Ethylhexyl) Phthalate	No	NA	NA	1484	84.1	Priority 2	Moderate data uncertainty due to large number of environmental measurements (>200) and moderate amount (> 15 < 50; n=23) of effects data.
Triclopyr	No	NA	NA	1632	33.2	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=151) of effects data.
Nonylphenol	No	No	No	539	25.6	Priority 2	Low data uncertainty due to large number of environmental measurements (>200) and large amount (>50; n=514) of effects data.
Petroleum - Heavy Fuel Oil	INS	NA	NA	17	100	U	High data uncertainty due to low number of effects concentrations (<15; n=5) and low number of measured concentrations (<50).
Petroleum - Diesel Fuel Oil	INS	NA	NA	295	8.5	U	High data uncertainty due to low number of effects concentrations (<15; n=13) and high number of measured concentrations (>200).
Petroleum - Gasoline	INS	NA	NA	359	26.5	U	High data uncertainty due to low number of effects concentrations (<15; n=6) and moderate number of measured concentrations (>50 <200).
Petroleum - Lube Oil	INS	NA	NA	894	8.3	U	High data uncertainty due to low number of effects concentrations (<15; n=8) and high number of measured concentrations (>200).

1 - LPAH and HPAH were evaluated as individual PAHs
WQS - Washington State water quality standard WAC 173-201A
INS - Insufficient data
FOD - Frequency of Detection
U - Unknown or Uncategorized
NA - not available

Appendix D-2. Table 1b. Summary of observed nearshore water concentrations compared to effect concentrations and water quality standards, prioritization, and data uncertainty.

Nearshore Water Summary - Aquatic Life							
COC ¹	90 th ile Observed Conc. > 10 th ile Effects Conc.	90 th ile Observed Conc. Exceeds Acute WQS	90 th ile Observed Conc. Exceeds Chronic WQS	Total N	% FOD	Level of Concern	Data Uncertainty
Arsenic	INS	INS	INS	43	93.0	U	High data uncertainty due to lack of effects data.
Cadmium	INS	INS	INS	32	100	U	High data uncertainty due to low number of environmental measurements (<50) and moderate number of effects data (>15 < 50; n=23).
Copper	Yes	Yes	Yes	107	100	Priority 1	Low data uncertainty due to moderate number of environmental measurements (>50 <200) and moderate number of effects data (>50; n=190).
Lead	INS	INS	INS	44	68.1	U	High data uncertainty due to low number of environmental measurements (<50) and moderate number of effects data (>15 < 50; n=28).
Mercury	INS	INS	INS	7	100	U	High data uncertainty due to low number of environmental measurements (<50) and large number of effects data (>50; n=471).
Zinc	INS	INS	INS	33	100	U	High data uncertainty due to low number of environmental measurements (<50) and high number of effects data (>50; n=73).
PCB Aroclors®	INS	INS	INS	11	0	U	High uncertainty due to lack of detections and limited number of measurements (<50).
DDT and Metabolites	INS	INS	INS	11	0	U	High uncertainty due to lack of detections and limited number of measurements (<50).
LPAHs	NA	NA	NA	NA	0	NA	Evaluated as individual PAHs
HPAH	NA	NA	NA	NA	0	NA	Evaluated as individual PAHs
Acenaphthene	INS	NA	NA	12	58.3	U	High data uncertainty due to low number of environmental measurements (<50) and moderate number of effects data (>15 < 50; n=36).
Anthracene	INS	NA	NA	12	8.3	U	High data uncertainty due to low number of environmental measurements (<50) and low number of effects data (<15; n=10).
Benzo(a)anthracene	INS	NA	NA	11	9.1	U	High data uncertainty due to low number of environmental measurements (<50) and low number of effects data (<15; n=2).
Benzo(a)pyrene	INS	NA	NA	12	8.3	U	High data uncertainty due to low number of environmental measurements (<50) and lack of effects data.
Benzo(k)fluoranthene	INS	NA	NA	12	8.3	U	High data uncertainty due to low number of environmental measurements (<50) and low number of effects data (<15; n=2).
Chrysene	INS	NA	NA	12	8.3	U	High data uncertainty due to low number of environmental measurements (<50) and low number of effects data (<15; n=2).
Fluoranthene	INS	NA	NA	12	75.0	U	High data uncertainty due to low number of environmental measurements (<50) and moderate number of effects data (>50; n=91).
Fluorene	INS	NA	NA	12	16.7	U	High data uncertainty due to low number of environmental measurements (<50) and low number of effects data (<15; n=4).
Naphthalene	INS	NA	NA	12	25.0	U	High data uncertainty due to low number of environmental measurements (<50) and moderate number of effects data (>50; n=78).
Phenanthrene	INS	NA	NA	12	66.7	U	High data uncertainty due to low number of environmental measurements (<50) and low number of effects data (>15 <50; n=19).
Pyrene	INS	NA	NA	12	50.0	U	High data uncertainty due to low number of environmental measurements (<50) and low number of effects data (>15 <50; n=16).
Bis(2-Ethylhexyl) Phthalate	INS	NA	NA	12	91.7	U	High data uncertainty due to low number of environmental measurements (<50) and low number of effects data (<15; n=7).
Nonylphenol	INS	INS	INS	11	27.2	U	High data uncertainty due to low number of environmental measurements (<50) and moderate number of effects data (>50; n=110).

1 - The following COCs were not evaluated in nearshore water due to lack of measured data: petroleum, PCB congeners, PBDEs, dioxins/furans, triclopyr and dibenzo(a,h) anthracene; LPAH and HPAH were evaluated as individual PAHs.

WQS - Washington State water quality standard WAC 173-201A

INS - Insufficient data

FOD - Frequency of Detection

Appendix D-2. Table 1c. Summary of observed offshore water concentrations compared to effect concentrations and water quality standards, prioritization, and data uncertainty.

Offshore Water Summary - Aquatic Life							
COC ¹	90 th ile Observed Conc. > 10 th ile Effects Conc.	90 th ile Observed Conc. Exceeds Acute WQS	90 th ile Observed Conc. Exceeds Chronic WQS	Total N	% FOD	Level of Concern	Data Uncertainty
Arsenic	INS	No	No	58	91	U	High data uncertainty due to lack of effects data.
Cadmium	INS	INS	INS	42	100	U	High data uncertainty due to low number of environmental measurements (<50) and moderate number of effects data (>15 < 50; n=23).
Copper	No	No	No	71	100	Priority 2	Moderate data uncertainty due to moderate number of environmental measurements (>50 <200) and large number of effects data (>50; n=190).
Lead	No	No	No	74	88	Priority 2	Moderate data uncertainty due to moderate number of environmental measurements (>50 <200) and moderate number of effects data (>15 < 50; n=28).
Mercury	INS	INS	INS	14	93	U	High data uncertainty due to low number of environmental measurements (<100) and large number of effects data (>50; n=471).
Zinc	Yes	No	No	57	95	Priority 1	Moderate data uncertainty due to moderate number of environmental measurements (>50 <200) and moderate of effects data (>50; n=73).
PCB Aroclors®	NA	INS	INS	42	0	U	High uncertainty due to lack of detections and limited number of measurements (<100).
PCBs -Total Congeners	No	INS	INS	84	100	Priority 2	Moderate uncertainty due to moderate number of measurements (>50) and moderate number of effects data (>50; n=63).
PBDEs	INS	NA	NA	126	20	U	High uncertainty No effects data available.
Acenaphthene	No	NA	NA	84	1.2	Priority 2	Moderate data uncertainty due to moderate number of environmental measurements (>50) and moderate number of effects data (>15 < 50; n=36).
Anthracene	INS	NA	NA	12	0.0	U	High data uncertainty due to low number of environmental measurements (<50) and lack of detections.
Benzo(a)anthracene	INS	NA	NA	84	0.0	U	High data uncertainty due to low number of environmental measurements (<50) and lack of detections.
Benzo(a)pyrene	INS	NA	NA	84	0.0	U	High data uncertainty due to low number of environmental measurements (<50) and lack of detections.
Benzo(k) fluoranthene	INS	NA	NA	84	0.0	U	High data uncertainty due to low number of environmental measurements (<50) and lack of detections.
Chrysene	INS	NA	NA	84	0.0	U	High data uncertainty due to low number of environmental measurements (<50) and lack of detections.
Dibenzo(a,h) anthracene	INS	NA	NA	84	0.0	U	High data uncertainty due to low number of environmental measurements (<50) and lack of detections.
Fluoranthene	No	NA	NA	84	3.6	Priority 2	Moderate data uncertainty due to low number of environmental measurements (>50 <200) and moderate number of effects data (>50; n=91).
Fluorene	INS	NA	NA	84	1.2	U	High data uncertainty due to low number of environmental measurements (<50) and low number of effects data (<15; n=4).

Offshore Water Summary - Aquatic Life							
COC ¹	90 th ile Observed Conc. > 10 th ile Effects Conc.	90 th ile Observed Conc. Exceeds Acute WQS	90 th ile Observed Conc. Exceeds Chronic WQS	Total N	% FOD	Level of Concern	Data Uncertainty
Naphthalene	No	NA	NA	84	2.4	Priority 2	Moderate data uncertainty due to moderate number of environmental measurements (>50) and moderate number of effects data (>50; n=78).
Phenanthrene	No	NA	NA	84	3.6	Priority 2	Moderate data uncertainty due to moderate number of environmental measurements (>50) and low number of effects data (>15 <50; n=19).
Bis(2-Ethylhexyl) Phthalate	INS	NA	NA	84	54	U	Moderate data uncertainty due to moderate number of environmental measurements (>50) and low number of effects data (<15; n=7).
Nonylphenol	No	No	No	84	17	Priority 2	Moderate data uncertainty due to moderate number of environmental measurements (>50 <200) and moderate number of effects data (>50; n=110).

1 - The following COCs were not evaluated in offshore water due to lack of measured data: petroleum, DDTs, dioxins/furans, pyrene and triclopyr; LPAH and HPAH were evaluated as individual PAH

WQS - Washington State water quality standard WAC 173-201A

INS - Insufficient data

FOD - Frequency of Detection

U - Unknown or Uncategorized

NA - not available

Appendix D-2. Table 2a. Summary of observed freshwater sediment concentrations compared to sediment guidelines, prioritization, and data uncertainty.

COC ¹	Freshwater Sediment				
	90 th ile Observed Conc. > FP-SQS	Total N	% FOD	Level of Concern	Data Uncertainty
Arsenic	Yes	623	81.5	Priority 1	Low data uncertainty due to the large number (>500) of environmental measurements.
Cadmium	Yes	764	67.3	Priority 1	Low data uncertainty due to the large number (>500) of environmental measurements.
Copper	Yes	826	99.6	Priority 1	Low data uncertainty due to the large number (>500) of environmental measurements.
Lead	No	838	95.7	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Mercury	Yes	803	65.9	Priority 1	Low data uncertainty due to the large number (>500) of environmental measurements.
Zinc	Yes	822	99.5	Priority 1	Low data uncertainty due to the large number (>500) of environmental measurements.
PCB Congeners	INS	26	84.6	U	High data uncertainty due to the small number (<100) of environmental measurements.
PCB Aroclors®	Yes	506	43.3	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
PBDEs	INS	77	97.4	U	High data uncertainty due to lack of FP-SQS.
PCDD/Fs (as TEQs)	INS	36	88.8	U	High data uncertainty due to the small number (<100) of environmental measurements and lack of FP-SQS.
DDTs	INS	365	29.6	U	High data uncertainty due to lack of FP-SQS.
LPAHs	Yes	746	77.2	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
HPAHs	Yes	746	90.2	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Acenaphthene	Yes	597	36.3	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Acenaphthylene	Yes	598	25.6	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Anthracene	Yes	595	51.5	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Benzo(a)anthracene	No	284	76.1	Priority 2	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Benzo(a)pyrene	Yes	602	69.1	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Benzo(ghi)perylene	Yes	594	63.1	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Total Benzo fluoranthenes (b, k, j)	Yes	1182	71.8	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Chrysene	Yes	600	77.7	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Dibenzo(a,h)anthracene	Yes	594	39.7	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Fluoranthene	Yes	596	81.9	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Fluorene	Yes	591	41.5	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).

Appendix D-2. Table 2a. Summary of observed freshwater sediment concentrations compared to sediment guidelines, prioritization, and data uncertainty.

COC ¹	Freshwater Sediment				
	90 th ile Observed Conc. > FP-SQS	Total N	% FOD	Level of Concern	Data Uncertainty
Indeno(1,2,3-cd)pyrene	Yes	602	60.8	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Naphthalene	Yes	595	34.3	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Phenanthrene	Yes	593	74.4	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Pyrene	Yes	593	86	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Bis(2-Ethylhexyl) Phthalate	Yes	548	86.7	Priority 1	Low data uncertainty due to the large number of environmental measurements (>500).
Total nonylphenol	INS	251	11.6	U	High data uncertainty due to lack of FP-SQS and moderate number of environmental measurements.

1 - Triclopyr and petroleum were not evaluated due to lack of environmental data

N = number of dry-weight based measurements. N for organic carbon normalized data used for comparison to some SMS thresholds and may be lower due to availability of OC data.

SQS = Sediment Quality Standard

INS = Insufficient data for comparison

FOD = Frequency of detection

U = Unknown or uncategorized

Appendix D-2. Table 2b. Summary of observed nearshore sediment concentrations compared to sediment guidelines, prioritization, and data uncertainty.

Marine Sediment Nearshore					
COC	90 th ile Observed Conc. > SQS	N	% FOD	Level of Concern	Data Uncertainty
Arsenic	No	399	69.8	Priority 2	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Cadmium	No	462	62.3	Priority 2	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Copper	No	519	99.6	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Lead	No	472	95.3	Priority 2	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Mercury	Yes	459	70.4	Priority 1	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Zinc	No	513	100	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
PCB Total Aroclors®	No	612	63.8	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
PCB Total Congeners	INS	28	3.6	U	High data uncertainty due to the small number of environmental measurements (<100) .
PBDEs	INS	1	100	U	High data uncertainty due to lack of SQS.
Dioxins and Furans (as TEQs)	INS	219	99.5	U	High data uncertainty due to lack of SQS.
DDTs	INS	350	41.1	U	High data uncertainty due to lack of SQS.
LPAHs	No	752	89.2	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
HPAHs	No	752	94.9	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Acenaphthene	No	554	48.2	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Acenaphthylene	No	557	44.0	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Anthracene	No	554	73.1	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Benzo(a) anthracene	No	196	82.1	Priority 2	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Benzo(a) pyrene	No	555	83.6	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Benzo(ghi) perylene	No	550	74.9	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Total Benzo fluoranthenes	No	1051	86.4	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Chrysene	No	559	87.8	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Dibenzo(a,h) anthracene	No	565	51.9	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Fluoranthene	No	557	89.9	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Fluorene	No	555	59.6	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Indeno (1,2,3-cd)pyrene	No	545	74.1	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Naphthalene	No	558	47.8	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Phenanthrene	No	555	86.7	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.

Appendix D-2. Table 2b. Summary of observed nearshore sediment concentrations compared to sediment guidelines, prioritization, and data uncertainty.

Marine Sediment Nearshore					
COC	90 th ile Observed Conc. > SQS	N	% FOD	Level of Concern	Data Uncertainty
Pyrene	No	556	91.4	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Bis(2-Ethylhexyl) Phthalate	Yes	513	74.3	Priority 1	Low data uncertainty due to the large number (>500) of environmental measurements.
4-Nonylphenol	INS	67	14.9	U	High data uncertainty due to low number of environmental measurements and lack of SQS value.

1 - Triclopyr and petroleum were not evaluated due to lack of environmental data

N = number of dry-weight based measurements. N for organic carbon normalized data used for comparison to some SMS thresholds and may be lower due to availability of OC data.

SQS = Sediment Quality Standard

INS = Insufficient data for comparison

FOD = Frequency of detection

U = Unknown or uncategorized

NA - not available

Appendix D-2. Table 2c. Summary of observed offshore sediment concentrations compared to sediment guidelines, prioritization, and data uncertainty.

COC ¹	Marine Sediment - Offshore				
	90 th ile Observed Conc. > SQS	N ⁴	% FOD	Level of Concern	Data Uncertainty
Arsenic	No	372	84.0	Priority 2	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Cadmium	No	471	70.1	Priority 2	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Copper	No	560	98.0	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Lead	No	478	99.2	Priority 2	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Mercury	Yes	367	79.3	Priority 1	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Zinc	No	513	100	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Total PCB Aroclors®	Yes	387	47.3	Priority 1	Moderate data uncertainty due to the number (>500) of environmental measurements.
PCB Congeners	No	101	71.3	Priority 2	Moderate data uncertainty due to the number of environmental measurements (<100) .
PBDEs	INS	45	97.8	U	High data uncertainty due to lack of SQS.
PCDD/Fs (as TEQs)	INS	106	99.1	U	High data uncertainty due to lack of SQS.
DDTs	INS	457	25.4	U	High data uncertainty due to lack of SQS.
LPAHs	No	634	87.3	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
HPAH	No	634	91.4	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Acenaphthene	No	508	40.2	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Acenaphthylene	No	507	34.5	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Anthracene	No	507	61.7	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Benzo(a) anthracene	No	217	91.2	Priority 2	Moderate data uncertainty due to the low number of environmental measurement (>100 <500).
Total Benzo flouranthenes	No	906	79.9	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Benzo(a)pyrene	No	507	71.9	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Benzo(ghi) perylene	No	507	63.5	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Chrysene	No	507	81.1	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Dibenzo(a,h) anthracene	No	533	43.9	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Fluoranthene	No	507	86.4	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Fluorene	No	507	46.9	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Indeno(1,2,3-cd) pyrene	No	507	61.7	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Naphthalene	No	507	45.0	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.

Appendix D-2. Table 2c. Summary of observed offshore sediment concentrations compared to sediment guidelines, prioritization, and data uncertainty.

COC ¹	Marine Sediment - Offshore				
	90 th ile Observed Conc. > SQS	N ⁴	% FOD	Level of Concern	Data Uncertainty
Phenanthrene	No	507	82.8	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Pyrene	No	506	87.4	Priority 2	Low data uncertainty due to the large number (>500) of environmental measurements.
Bis(2-Ethylhexyl) Phthalate	Yes	474	66.9	Priority 1	Moderate data uncertainty due to the number (>100 <500) of environmental measurements.
Triclopyr	INS	0	NA	U	High data uncertainty; no available environmental data.
4-nonyphenol	INS	91	28.6	U	High data uncertainty due to low number of environmental measurements and lack of SQS value.
Petroleum	INS	*	*	U	Unknown; no available sediment guidelines;

1 - Triclopyr and petroleum were not evaluated due to lack of environmental data

N = number of dry-weight based measurements. N for organic carbon normalized data used for comparison to some SMS thresholds and may be lower due to availability of OC data.

SQS = Sediment Quality Standard

INS = Insufficient data for comparison

FOD = Frequency of detection

U = Unknown or uncategorized

NA - not available

Appendix D-2. Table 3. Summary of observed tissue concentrations compared to effect concentrations, prioritization and data uncertainty.

Water	Chemical	Organism	Tissue Type	90 th ile Observed Concentrations > 10 th %ile Effects Concentrations	Total N	detects	% FOD	Level of Concern	Data Uncertainty
Freshwater	Mercury	Non-Decapod Invertebrates	Whole Body	INS	16	16	100%	U	Observed and effects data were lacking for freshwater decapods. Uncertainty is high for non-decapod invertebrates due to the lack of tissue residue effects concentrations and <100 observed measurements. Data uncertainty is also high for fish due to <100 observed measurements.
		Fish	Whole Body	INS	11	11	100%	U	
	PCBs - Aroclors	Non-Decapod Invertebrates	Whole Body	Y	142	125	88%	Priority 1	Observed and effects data were lacking for freshwater decapods. Data uncertainty for non-decapod invertebrates is moderate due to >100 and <200 observed concentrations and between 5 and 10 tissue residue effects values. Data uncertainty is high for fish due to <100 observed measurements.
		Fish	Whole Body	INS	11	1	9%	U	
	PCBs - Total Congeners	Non-Decapod Invertebrates	Whole Body	Y	123	123	100%	Priority 1	Observed and effects data were lacking for freshwater decapods. Data uncertainty for non-decapod invertebrates is moderate due to >100 and <200 observed concentrations and between 5 and 10 tissue residue effects values. Data uncertainty is high for fish due to <100 observed measurements.
		Fish	Whole Body	INS	12	12	100%	U	
	PCDD/Fs	Non-Decapod Invertebrates	Whole Body	INS	175	100	57%	U	There were effects values only for freshwater decapods.
	DDTs + metabolites	Non-Decapod Invertebrates	Whole Body	N	139	130	94%	Priority 2	Observed and effects data were lacking for freshwater decapods. Uncertainty is moderate for non-decapod invertebrates due to the moderate number of observed measurements and tissue residue effects values. Data uncertainty for fish is low due to >100 and <200 observed fish tissue concentrations and >10 available tissue residue effect levels.
		Fish	Whole Body	N	83	76	92%	Priority 2	

COCs not assessed include arsenic, cadmium, copper, lead, zinc, individual PAHs, LPAHs, HPAHs, bis(2-ethylhexyl)phthalate, triclopyr, nonylphenol, and petroleum. The exclusion of these COCs does not mean they do not adversely impact fish. See text for details.

FOD - Frequency of Detection

U = Unknown and/or Uncategorized

INS = Insufficient data for comparison

Appendix D-2. Table 3. Summary of observed tissue concentrations compared to effect concentrations, prioritization and data uncertainty.

Water	Chemical	Organism	Tissue Type	90 th ile Observed Concentrations > 10 th %ile Effects Concentrations	Total N	detects	% FOD	Level of Concern	Data Uncertainty
Marine Nearshore	Mercury	Decapods	Whole Body	INS	42	40	95%	U	Data uncertainty is high for all tissue types due to <5 tissue residue effects concentrations. No effects concentrations were available for non-decapod invertebrates or fish.
		Non-Decapod Invertebrates	Whole Body	INS	169	162	96%	U	
		Fish	Whole Body	INS	104	104	100%	U	
	PCBs - Aroclors	Decapods	Whole Body	N	27	19	70%	Priority 2	Data uncertainty is high for decapods due the limited number of observed measurements. Data uncertainty for non-decapod invertebrates is moderate due to >100 and <200 observed measurements and tissue residue effects concentrations. Data uncertainty for fish is high due to <5 tissue residue effects concentrations.
		Non-Decapod Invertebrates	Whole Body	N	99	33	33%	Priority 2	
		Fish	Whole Body	INS	96	96	100%	U	
	PCBs - Total Congeners	Decapods	Whole Body	N	28	28	100%	Priority 2	Data uncertainty is high for decapods due to <100 observed measurements. Data uncertainty for non-decapod invertebrates is high due to <100 observed measurements. Data uncertainty for fish is also high due <5 tissue residue effects concentrations.
		Non-Decapod Invertebrates	Whole Body	N	57	57	100%	Priority 2	
		Fish	Whole Body	INS	70	22	31%	U	
	PCDD/Fs	Decapods	Whole Body	INS	13	13	100%	U	There were no marine effects values.
		Non-Decapod Invertebrates	Whole Body	INS	76	74	97%	U	
		Fish	Whole Body	INS	1	0	0%	U	
	DDTs + metabolites	Decapods	Whole Body	INS	20	20	100%	U	Data uncertainty is high for all tissue types due to <5 tissue residue effects values There were no marine fish effects values.
		Non-Decapod Invertebrates	Whole Body	INS	84	26	31%	U	
		Fish	Whole Body	INS	131	128	98%	U	

COCs not assessed include arsenic, cadmium, copper, lead, zinc, individual PAHs, LPAHs, HPAHs, bis(2-ethylhexyl)phthalate, triclopyr, nonylphenol, and petroleum. The exclusion of these COCs does not mean they do not adversely impact fish. See text for details.

FOD - Frequency of Detection

U = Unknown and/or Uncategorized

INS = Insufficient data for comparison

Appendix D-2. Table 3. Summary of observed tissue concentrations compared to effect concentrations, prioritization and data uncertainty.

Water	Chemical	Organism	Tissue Type	90 th ile Observed Concentrations > 10 th %ile Effects Concentrations	Total N	detects	% FOD	Level of Concern	Data Uncertainty
Marine Offshore	Mercury	Decapods	Whole Body	INS	5	5	100%	U	Data uncertainty is high for all tissue types due to <5 available tissue residue effects concentrations. No effects concentrations were available for non-decapod invertebrates or fish.
		Non-Decapod Invertebrates	Whole Body	INS	48	48	100%	U	
		Fish	Whole Body	INS	190	190	100%	U	
	PCBs - Aroclors	Decapods	Whole Body	INS	5	2	40%	U	Data uncertainty is high for decapods and non-decapod invertebrates due to <100 observed measurements. Data uncertainty for fish is also high due to <5 tissue residue effects concentrations.
		Non-Decapod Invertebrates	Whole Body	N	32	17	53%	Priority 2	
		Fish	Whole Body	INS	26	22	85%	U	
	PCBs - Total Congeners	Decapods	Whole Body	INS	1	1	100%	U	Data uncertainty is high for decapods due to only one observed measurement. Data uncertainty for non-decapod invertebrates is high due to <100 observed measurements. Data uncertainty for fish is also high due to <5 tissue residue effects concentrations.
		Non-Decapod Invertebrates	Whole Body	INS	11	11	100%	U	
		Fish	Whole Body	INS	324	321	99%	U	
	PCDD/Fs	Decapods	Whole Body	INS	9	9	100	U	There were no marine effects values.
		Non-Decapod Invertebrates	Whole Body	INS	28	24	86%	U	
		Fish	Whole Body	INS	10	9	90%	U	
	DDTs + metabolites	Decapods	Whole Body	INS	5	2	40%	U	Data uncertainty is high for all tissue types due to the limited number of tissue residue effects data. There were no marine fish effects values.
		Non-Decapod Invertebrates	Whole Body	INS	33	6	18%	U	
		Fish	Whole Body	INS	543	542	100%	U	

COCs not assessed include arsenic, cadmium, copper, lead, zinc, individual PAHs, LPAHs, HPAHs, bis(2-ethylhexyl)phthalate, triclopyr, nonylphenol, and petroleum. The exclusion of these COCs does not mean they do not adversely impact fish. See text for details.

FOD - Frequency of Detection

U = Unknown and/or Uncategorized

INS = Insufficient data for comparison

Appendix D-2. Table 4. Summary of wildlife effects prioritization for bioaccumulative COCs.

Effects on Birds						
Chemical	Great Blue Heron - Freshwater	Osprey - Marine	Count of Effect Doses	Level of Concern		Data Uncertainty
	Daily Dose > Lowest Effect Dose/10	Daily Dose > Lowest Effect Dose/10		Great Blue Heron	Osprey	
Mercury	Yes	Yes	14	Priority 1	Priority 1	Data uncertainty is low for mercury in birds due to a high number of observed freshwater and marine concentrations in fish and sediments and high number of lowest effects doses (>10).
PCBs	Yes	Yes	15	Priority 1	Priority 1	Data uncertainty is low for PCBs in birds due to a high number of observed freshwater and marine concentrations in fish and sediments and high number of lowest effects doses (>10).
Dioxins/Furans	INS	INS	2	U	U	Data uncertainty is high for dioxins/furans in birds due to low number of lowest effects doses (<5) and observed freshwater and marine whole body fish concentrations.
DDT+metabolites	Yes	Yes	22	Priority 1	Priority 1	Data uncertainty is low for DDT+metabolites in birds due to a high number of observed freshwater and marine fish and sediments concentrations and high number of lowest effects doses (>10).
Effects on Mammals						
Chemical	River Otter - Freshwater	Harbor Seal - Marine	Count of Effect Doses	Level of Concern		Data Uncertainty
	Daily Dose > Lowest Effect Dose/10	Daily Dose > Lowest Effect Dose/10		River Otter	Harbor Seal	
Mercury	Yes	Yes	13	Priority 1	Priority 1	Data uncertainty is low for mercury in mammals due to a high number of observed freshwater and marine concentrations in fish and sediments and high number of lowest effects doses (>10).
PCBs	Yes	Yes	18	Priority 1	Priority 1	Data uncertainty is low for PCBs in mammals due to a high number of observed freshwater and marine concentrations in fish and sediments and very high number of lowest effects doses (>10).
Dioxins/Furans	Yes	No	12	Priority 1	Priority 2	Data uncertainty is moderate for dioxins/furans in mammals due to low number of observed freshwater and marine whole body fish concentrations, but relatively high number of lowest effects doses (>10).
DDT+metabolites	No	No	11	Priority 2	Priority 2	Data uncertainty is low for DDT+metabolites in mammals due to a high number of observed freshwater and marine fish and sediments concentrations and high number of lowest effects doses (>10).

The following COCs were not evaluated for wildlife: arsenic, cadmium, copper, lead, zinc, PAHs, PBDEs, bis(2-ethylhexyl)phthalate, triclopyr, nonylphenol, and petroleum. The exclusion of these COCs does not mean they do not adversely impact wildlife. See text for details.

INS - The number of lowest effects doses is insufficient to make comparison

Appendix D-2. Table 5. Summary of Human Health prioritization from seafood consumption.

Human Health Assessment																									
Chemical	Freshwater Seafood								Marine Tissues												Data Uncertainty				
	90th%ile Observed Conc. > NTR	Bivalve		Fish		Invertebrate		Level of Concern	90th%ile Observed Conc. > NTR	Nearshore				Level of Concern	90th%ile Observed Conc. > NTR	Offshore				Level of Concern					
		N	FOD	N	FOD	N	FOD			N	FOD	N	FOD			N	FOD	N	FOD			N	FOD		
Arsenic	INS	0	NA	8	0.0%	0	NA	U	INS	11	100%	0	NA	2	100%	U	INS	2	100%	0	NA	0	NA	U	High data uncertainty due to low number of observed concentrations.
Mercury	No	69	100%	776	99.8%	34	100%	Priority 2	No	153	92.8%	197	100%	107	98.1%	Priority 2	No	37	100%	346	100%	154	100%	Priority 2	Moderate uncertainty due to variable numbers of observed concentrations across tissue types and habitats.
PCB Aroclors®	Yes	91	85.7%	864	92.9%	51	92.1%	Priority 1	Yes	99	33.3%	335	97.9%	68	69.1%	Priority 1	Yes	10	100%	477	97.4%	45	66.6%	Priority 1	Low uncertainty due to high number of observed concentrations for all categories except offshore invertebrates.
PCB Congeners	Yes	155	92.2%	918	77.0%	93	87.0%	Priority 1	Yes	161	100%	344	100%	225	100%	Priority 1	Yes	155	92.2%	727	98.2%	12	100%	Priority 1	Moderate uncertainty due to moderate number of observed concentrations with exception of high uncertainty for nearshore fish due to the low number of observed concentrations.
2,4,7,8 TCDD (dioxin)	Yes	64	25.0%	72	62.5%	35	74.2%	Priority 1	Yes	129	18.6%	8	0.0%	82	62.1%	Priority 1	Yes	40	5.0%	53	32.0%	32	46.8%	Priority 1	Low uncertainty for fish and bivalve consumption due to high number of observed concentrations. Moderate uncertainty for invertebrates due to moderate number of observed concentrations.
4,4' DDD	Yes	104	79.8%	620	79.8%	56	91.0%	Priority 1	No	120	40.8%	437	62.4%	50	20.0%	Priority 2	No	33	0.0%	1036	74.8%	76	22.3%	Priority 2	Low uncertainty for fish and bivalve consumption due to high number of observed concentrations. Moderate uncertainty for invertebrates due to moderate number of observed concentrations.
4,4' DDE	Yes	104	86.5%	634	94.4%	56	100%	Priority 1	No	120	38.3%	491	94%	59	86.4%	Priority 2	No	33	6.0%	1209	97.6%	77	42.8%	Priority 2	Low uncertainty for fish and bivalve consumption due to high number of observed concentrations. Moderate uncertainty for invertebrates due to moderate number of observed concentrations.
4,4' DDT	No	104	79.8%	440	68.1%	56	76.7%	Priority 2	Yes	120	50.0%	360	65.0%	48	81.3%	Priority 1	No	33	18.2%	885	72.4%	76	40.7%	Priority 2	Low uncertainty for fish and bivalve consumption due to high number of observed concentrations. Moderate uncertainty for invertebrates due to moderate number of observed concentrations.
Anthracene	No	102	85.2%	17	0%	56	100%	Priority 2	No	111	33.3%	81	64.1%	51	76.4%	Priority 2	No	29	31.0%	27	33.3%	47	2.1%	Priority 2	Low uncertainty for bivalve consumption due to high number of observed concentrations. Moderate uncertainty for fish and invertebrates due to moderate number of observed concentrations.
Fluorene	No	102	81.3%	17	0%	56	100%	Priority 2	No	111	33.3%	81	71.6%	51	82.8%	Priority 2	No	29	24.1%	27	33.3%	47	21.2%	Priority 2	Low uncertainty for bivalve consumption due to high number of observed concentrations. Moderate uncertainty for fish and invertebrates due to moderate number of observed concentrations.
Benzo(a)pyrene	Yes	102	72.5%	17	0%	56	100%	Priority 1	Yes	117	50.4%	81	41.9%	53	32.1%	Priority 1	INS	33	21.2%	27	22.7%	47	6.3%	U	Low uncertainty for bivalve consumption due to high number of observed concentrations. Moderate uncertainty for fish and invertebrates due to moderate number of observed concentrations.
Benzo(b) fluoranthene	Yes	102	70.5%	17	0%	56	100%	Priority 1	Yes	117	38.4%	81	54.3%	53	43.3%	Priority 1	INS	21	42.8%	27	18.5%	23	21.7%	U	Low uncertainty for bivalve consumption due to high number of observed concentrations. Moderate uncertainty for fish and invertebrates due to moderate number of observed concentrations.
Benzo(k) fluoranthene	Yes	102	63.7%	17	0%	56	100%	Priority 1	Yes	106	33.0%	81	53.0%	53	39.6%	Priority 1	INS	14	7.1%	21	23.8%	23	21.7%	U	Low uncertainty for bivalve consumption due to high number of observed concentrations. Moderate uncertainty for fish and invertebrates due to moderate number of observed concentrations.
Dibenzo(a,h)-anthracene	Yes	102	21.5%	17	0%	56	83.9%	Priority 1	Yes	117	20.5%	81	88.6%	53	26.4%	Priority 1	INS	33	9.0%	27	11.1%	47	88.5%	U	Low uncertainty for bivalve consumption due to high number of observed concentrations. Moderate uncertainty for fish and invertebrates due to moderate number of observed concentrations.
Fluoranthene	No	102	86.2%	17	0%	56	100%	Priority 2	No	114	51.7%	81	62.9%	51	78.4%	Priority 2	No	43	34.8%	27	44.4%	74	28.3%	Priority 2	Low uncertainty for bivalve consumption due to high number of observed concentrations. Moderate uncertainty for fish and invertebrates due to moderate number of observed concentrations.
Indeno(1,2,3-cd)pyrene	Yes	102	42.0%	17	0%	56	100%	Priority 1	Yes	117	28.2%	81	34.5%	53	37.7%	Priority 1	INS	33	15.1%	27	14.8%	47	10.6%	U	Low uncertainty for bivalve consumption due to high number of observed concentrations. Moderate uncertainty for fish and invertebrates due to moderate number of observed concentrations.
Pyrene	No	102	83.3%	17	0%	56	100%	Priority 2	No	114	46.4%	81	61.7%	50	78.0%	Priority 2	No	43	25.5%	27	18.5%	74	28.3%	Priority 2	Low uncertainty for bivalve consumption due to high number of observed concentrations. Moderate uncertainty for fish and invertebrates due to moderate number of observed concentrations.
Bis(2-ethylhexyl) phthalate	Yes	99	57.5%	9	0%	46	60.8%	Priority 1	INS	73	32.8%	79	10.1%	42	9.5%	U	INS	16	25.4%	16	0.0%	33	24.2%	U	High uncertainty for all tissues in marine habitats and freshwater fish due to low number of observed concentrations. Low uncertainty for remaining tissue in freshwater due to moderate to high numbers of observed concentrations.

The following COCs were not assessed because they are not in the National Toxics Rule: cadmium, copper, lead, zinc, PBDEs, acenaphthene, benzo(a)anthracene, chrysene, phenanthrene, triclopyr, nonylphenol, and petroleum.

NTR - National Toxics Rule

FOD - Frequency of detection