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APPENDIX E.2

ADDITIONAL FISH TISSUE COMPARISONS

TABLE E.2-1
COMPARISON OF COPC CONCENTRATIONS IN BROWN BULLHEAD TISSUE 3 TO REFERENCE SAMPLES AND TISSUE RESIDUE BENCHMARKS
REACH 3
WELLS G&H SUPERFUND SITE OU3

	Brown Bullhead - Fillet						Brown Bullhead - Offal													
Chemical of Potential Concern	Study Area Average Conc. mg/kg bw	Reference Average Conc. mg/kg bw	Ratio	Study Area (1) Average Conc. *u* g/g lipid	Reference Average Conc. *u* g/g lipid	Ratio	Study Area Average Conc. mg/kg bw	Reference Average Conc. mg/kg bw	Ratio	Study Area (1) Average Conc. *u* g/g lipid	Reference Average Conc. *u* g/g lipid	Ratio	Tissue Benchmark Conc. mg/kg	Species (2)	Effect	Endpoint	Fraction	Exposure Route	Life-Stage	Effect	ERED Reference ID (3)
SVOCs																					
Benzo(g,h,i)perylene	0.53	0.55	1.0	112	55	2.0	nd	nd		nd	nd		29.56	*Cyprinus carpio* (common carp)	Physiological	NOED	Liver	Injection	na	No significant increase in EROD enzyme and CYP 1A protein content.	URS218
Pesticides																					
4,4'-DDD	0.0056	0.0035	1.6	1.2	0.39	3.2	0.019	0.0069	2.7	1.5	0.45	3.3	0.6	*Pimephales promelas* (fathead minnow)	Reproduction	LOED	Whole Body	Combined	Adult	Sig. different from control	JAW4
4,4'-DDE	0.0077	0.019	0.40	1.7	2.4	0.70	0.023	0.039	0.59	1.9	2.6	0.75	na								
4,4'-DDT	0.0016	0.0016	1.0	0.32	0.20	1.6	0.0027	0.0039	0.71	0.25	0.26	1.0	12.2	*Pimephales promelas* (fathead minnow)	Reproduction	NOED	Whole Body	Ingestion	Adult	Hatchability	JA219
Aldrin	0.00033	0.00082	0.40	0.073	0.10	0.72	0.0014	0.0020	0.70	0.13	0.14	1.0	na								
alpha-Chlordane	0.0056	0.00082	6.8	1.3	0.10	12.3	0.020	0.0020	10	1.6	0.14	12	na								
Aroclor-1248	0.0030	0.0079	0.38	0.67	1.0	0.67	0.013	0.020	0.67	1.2	1.3	0.90	3.7999 [a]	*Ictalurus punctatus* (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104
Aroclor-1254	0.02	0.007	2.29	0.0003	0.0001	3.23	0.06	0.02	3.7	0.0006	0.0001	5.54	4,240	*Brachydanio rerio* (zerba fish)	Growth	NOED	Whole Body	Water	na	Weight	JA41
Aroclor-1260	0.031	0.071	0.43	6.8	8.0	0.85	0.088	0.14	0.65	7.9	8.7	0.90	3.7999 [a]	*Ictalurus punctatus* (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104
beta-BHC	0.00031	0.00082	0.38	0.069	0.10	0.67	0.0013	0.0020	0.66	0.12	0.14	0.89	na								
delta-BHC	0.00045	0.00082	0.55	0.096	0.10	0.93	0.0015	0.0020	0.77	0.14	0.14	1.0	na								
Endosulfan I	0.00030	0.00082	0.37	0.068	0.10	0.66	0.0013	0.0020	0.66	0.12	0.14	0.89	na								
Endosulfan sulfate	0.00060	0.0016	0.38	0.13	0.20	0.67	0.0025	0.0039	0.66	0.23	0.26	0.89	na								
Endrin aldehyde	0.00073	0.0016	0.47	0.16	0.20	0.80	0.0049	0.0039	1.3	0.44	0.26	1.7	0.08	*Lepomis macrochirus* (bluegill)	Growth	NOED	Whole Body	Absorption	na	No increase in mortality	JA23
gamma-Chlordane	0.0035	0.00082	4.3	0.80	0.10	7.8	0.013	0.0020	6.3	0.98	0.14	7.2	na								
Inorganics																					
Aluminum	2.1	1.2	1.8				67	13	5.2				na								
Antimony	0.080	0.044	1.8				0.14	0.049	2.8				na								
Arsenic	0.14	0.042	3.4				**1.2**	0.046	27				0.52	*Lepomis macrochirus* (bluegill)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on mortality	URS10
Barium	0.074	0.085	0.87				5.7	4.2	1.4				na								
Cadmium	0.011	0.0060	1.8				0.080	0.0068	12				0.9	*Cyprinodon variegatus* (sheepshead minnow)	Development	LOED	Whole Body	Absorption	Egg-embryo	Decreased time to hatch	URS198
Chromium	0.092	0.043	2.1				1.4	0.26	5.6				na								
Cobalt	0.029	0.020	1.5				0.15	0.022	6.6				na								
Copper	0.46	0.21	2.2				2.4	0.97	2.5				13	*Lepomis macrochirus* (bluegill)	Growth	LOED	Gill	Combined	Immature	Effect on growth - over 22 month period	JB5
Iron	8.7	18	0.50				306	329	0.93				na								
Lead	0.040	0.060	0.66				**1.7**	**0.67**	2.5				0.451	*Pimephales promelas* (fathead minnow)	Behavior	LOED	Brain	Absorption	Immature	Sig. reduction in feeding rate and ineffetive feeding behaviors	URS230
Manganese	0.12	0.30	0.39				3.4	36	0.10				na								
Mercury	0.037	0.044	0.85	8.9	5.3	1.7	0.038	0.018	2.1	3.8	1.2	3.2	0.135	*Perca flavescens* (yellow perch)	Growth	NOED	Whole Body	Combined	Adult	No effect after 2 years, tissue concentration after one year	URS232
Nickel	0.025	0.020	1.3				0.094	0.022	4.2				na								
Selenium	0.35	0.62	0.57				0.56	0.75	0.75				3	*Micropterus salmoides* (largemouth bass)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on survivorship	URS160
Silver	0.019	0.016	1.2				0.078	0.018	4.4				0.12	*Lepomis macrochirus* (bluegill)	Mortality	NOED	Whole Body	Water	Juvenile	na	JA88
Zinc	5.9	6.2	1.0				31	22	1.4				na								

ERED - U.S. Army Corps of Engineers and U.S. Environmental Protection Agency Environmental Residue-Effects Database (last update - February 1998)
Conc. - concentration
ID - identification number
na - no test data available in the ERED database
NOED - no observed effect dose
LOED - lowest observed effect dose
nd - not detected in this data set
Ratio = study area average concentration divided by reference average concentration
(1) With exception of mercury, lipid normalized tissue concentrations were not calculated for inorganic COPCs because inorganics are not expected to preferentially concentrate in lipid material
(2) ERED database records of several freshwater fish were queried - members of Ictaluridae, Centrachidae, Cyprinadae, Percidae, and Esocidae.
(3) Citations for primary references are provided in the ERED database
(4) Value for Endrin
a Test involved PCBs, specific congeners not indicated

TABLE E.2-2
COMPARISON OF COPC CONCENTRATIONS IN BROWN BULLHEAD TISSUE TO TISSUE RESIDUE BENCHMARKS
REACH 6
WELLS G&H SUPERFUND SITE OU3

	Brown Bullhead - Fillet						Brown Bullhead - Offal													
Chemical of Potential Concern	Study Area Average Conc. mg/kg bw	Reference Average Conc. mg/kg bw	Ratio	Study Area(1) Average Conc. *u* g/g lipid	Reference Average Conc. *u* g/g lipid	Ratio	Study Area Average Conc. mg/kg bw	Reference Average Conc. mg/kg bw	Ratio	Study Area(1) Average Conc. *u* g/g lipid	Reference Average Conc. *u* g/g lipid	Ratio	Tissue Benchmark Conc. mg/kg	Species (2)	Effect	Endpoint	Fraction	Exposure Route	Life-Stage	Effect	ERED Reference ID (3)
SVOCs																					
Benzo(g,h,i)perylene	0.55	0.55	1.0	110	55	2.0	nd	nd		nd	nd		29.56	*Cyprinus carpio* (common carp)	Physiological	NOED	Liver	Injection	na	No significant increase in EROD enzyme and CYP 1A protein content.	URS218
Pesticides																					
4,4'-DDD	0.0040	0.0035	1.2	0.80	0.39	2.1	0.023	0.0069	3.3	1.2	0.45	2.5	0.6	*Pimephales promelas* (fathead minnow)	Reproduction	LOED	Whole Body	Combined	Adult	Sig. different from control	JAW4
4,4'-DDE	0.0061	0.019	0.32	1.2	2.4	0.51	0.033	0.039	0.86	1.7	2.6	0.64	na								
4,4'-DDT	0.00055	0.0016	0.35	0.11	0.20	0.55	0.0020	0.0039	0.51	0.098	0.26	0.37	12.2	*Pimephales promelas* (fathead minnow)	Reproduction	NOED	Whole Body	Ingestion	Adult	Hatchability	JA219
Aldrin	0.00028	0.00082	0.34	0.055	0.10	0.54	0.0010	0.0020	0.50	0.050	0.14	0.37	na								
alpha-Chlordane	0.0036	0.00082	4.4	0.72	0.10	7.0	0.019	0.0020	9.5	0.95	0.14	7.0	na								
Aroclor-1248	0.0079	0.0079	1.0	1.6	1.0	1.6	0.033	0.020	1.7	1.7	1.3	1.3	3.7999 [a]	*Ictalurus punctatus* (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104
Aroclor-1254	0.02	0.007	2.17	0.0003	0.0001	2.94	0.08	0.02	4.6	0.0004	0.0001	3.92	4,240	*Brachydanio rerio* (zerba fish)	Growth	NOED	Whole Body	Water	na	Weight	JA41
Aroclor-1260	0.025	0.071	0.35	5.0	8.0	0.63	0.14	0.14	1.0	7.0	8.7	0.80	3.7999 [a]	*Ictalurus punctatus* (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104
beta-BHC	0.00028	0.00082	0.34	0.055	0.10	0.54	0.0010	0.0020	0.50	0.050	0.14	0.37	na								
delta-BHC	0.00028	0.00082	0.34	0.055	0.10	0.54	0.0010	0.0020	0.50	0.050	0.14	0.37	na								
Endosulfan I	0.00038	0.00082	0.47	0.076	0.10	0.74	0.0020	0.0020	1.0	0.10	0.14	0.74	na								
Endosulfan sulfate	0.00055	0.0016	0.35	0.11	0.20	0.55	0.0020	0.0039	0.51	0.098	0.26	0.37	na								
Endrin aldehyde	0.00055	0.0016	0.35	0.11	0.20	0.55	0.0020	0.0039	0.51	0.098	0.26	0.37	0.08	*Lepomis macrochirus* (bluegill)	Growth	NOED	Whole Body	Absorption	na	No increase in mortality	JA23
gamma-Chlordane	0.0025	0.00082	3.1	0.50	0.10	4.9	0.014	0.0020	7.0	0.70	0.14	5.2	na								
Inorganics																					
Aluminum	1.3	1.2	1.1				4.9	13	0.4				na								
Antimony	0.050	0.044	1.1				0.049	0.049	1.0				na								
Arsenic	0.17	0.042	4.07				0.096	0.046	2.10				0.52	*Lepomis macrochirus* (bluegill)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on mortality	URS10
Barium	0.080	0.085	0.9				1.2	4.2	0.3				na								
Cadmium	0.023	0.0060	3.8				0.017	0.0068	2.5				0.9	*Cyprinodon variegatus* (sheepshead minnow)	Development	LOED	Whole Body	Absorption	Egg-embryo	Decreased time to hatch	URS198
Chromium	0.097	0.043	2.3				0.38	0.26	1.5				na								
Cobalt	0.054	0.020	2.7				0.023	0.022	1.01				na								
Copper	0.80	0.21	3.9				0.71	0.97	0.74				13	*Lepomis macrochirus* (bluegill)	Growth	LOED	Gill	Combined	Immature	Effect on growth - over 22 month period	JB5
Iron	44	18	2				181	329	0.55				na								
Lead	**2.3**	0.060	38.3				0.26	**0.67**	0.39				0.451	*Pimephales promelas* (fathead minnow)	Behavior	LOED	Brain	Absorption	Immature	Sig. reduction in feeding rate and ineffetive feeding behaviors	URS230
Manganese	1.5	0.30	4.79				6.6	36	0.19				na								
Mercury	0.018	0.044	0.4	3.6	5.3	0.68	0.0092	0.018	0.5	0.46	1.2	0.39	0.135	*Perca flavescens* (yellow perch)	Growth	NOED	Whole Body	Combined	Adult	No effect after 2 years, tissue concentration after one year	URS232
Nickel	0.023	0.020	1.15				0.023	0.022	1.01				na								
Selenium	0.45	0.62	0.7				0.52	0.75	0.7				3	*Micropterus salmoides* (largemouth bass)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on survivorship	URS160
Silver	0.019	0.016	1.2				0.018	0.018	1.0				0.12	*Lepomis macrochirus* (bluegill)	Mortality	NOED	Whole Body	Water	Juvenile	na	JA88
Zinc	6.9	6.2	1.1				22	22	1.0				na								

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Conc. - concentration
ID - identification number
na - no test data available in the ERED database
NOED - no observed effect dose
LOED - lowest observed effect dose
nd - not detected in this data set
Ratio = study area average concentration divided by reference average concentration
(1) With exception of mercury, lipid normalized tissue concentrations were not calculated for inorganic COPCs because inorganics are not expected to preferentially concentrate in lipid material
(2) ERED database records of several freshwater fish were queried - members of Ictaluridae, Centrachidae, Cyprinadae, Percidae, and Esocidae.
(3) Citations for primary references are provided in the ERED database
(4) Value for Endrin
a Test involved PCBs, specific congeners not indicated

TABLE E.2-3
COMPARISON OF COPC CONCENTRATIONS IN EEL TISSUE TO TISSUE RESIDUE BENCHMARKS
REACH 6
WELLS G&H SUPERFUND SITE OU3

	Eel - Whole Body														
Chemical of Potential Concern	Study Area Average Conc. mg/kg bw	Reference Average Conc. mg/kg bw	Ratio	Study Area (1) Average Conc. *u* g/g lipid	Reference Average Conc. *u* g/g lipid	Ratio	Tissue Benchmark Conc. mg/kg	Species (2)	Effect	Endpoint	Fraction	Exposure Route	Life-Stage	Effect	ERED Reference ID (3)
SVOCs															
Benzo(g,h,i)perylene	1.9	2.2	0.86	35	32	1.1	29.56	*Cyprinus carpio* (common carp)	Physiological	NOED	Liver	Injection	na	No significant increase in EROD enzyme and CYP 1A protein content.	URS218
Pesticides															
4,4'-DDD	0.17	0.012	14	1.9	0.16	12	0.6	*Pimephales promelas* (fathead minnow)	Reproduction	LOED	Whole Body	Combined	Adult	Sig. different from control	JAW4
4,4'-DDE	0.35	0.075	4.6	4.3	1.1	3.9	na								
4,4'-DDT	0.026	0.0043	6.1	0.32	0.059	5.3	12.2	*Pimephales promelas* (fathead minnow)	Reproduction	NOED	Whole Body	Ingestion	Adult	Hatchability	JA219
Aldrin	0.0014	0.0010	1.3	0.016	0.013	1.2	na								
alpha-Chlordane	0.053	0.0023	23	0.64	0.027	23	na								
Aroclor-1248	0.013	0.010	1.3	0.15	0.13	1.2	3.7999 [a]	*Ictalurus punctatus* (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104
Aroclor-1254	0.15	0.01	14.9	0.0002	0.00001	15.6	4,240	*Brachydanio rerio* (zerba fish)	Growth	NOED	Whole Body	Water	na	Weight	JA41
Aroclor-1260	0.53	0.11	4.9	6.7	1.6	4.2	3.7999 [a]	*Ictalurus punctatus* (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104
beta-BHC	0.0014	0.0010	1.4	0.016	0.013	1.3	na								
delta-BHC	0.0013	0.0010	1.2	0.015	0.013	1.2	na								
Endosulfan I	0.0013	0.0010	1.3	0.015	0.013	1.2	na								
Endosulfan sulfate	0.0041	0.0021	2.0	0.046	0.026	1.8	na								
Endrin aldehyde	0.0071	0.0022	3.3	0.084	0.029	2.9	0.08	*Lepomis macrochirus* (bluegill)	Growth	NOED	Whole Body	Absorption	na	No increase in mortality	JA23
gamma-Chlordane	0.017	0.0011	15	0.21	0.014	16	na								
Inorganics															
Aluminum	1.6	3.0	0.53				na								
Antimony	0.051	0.050	1.0				na								
Arsenic	0.047	0.048	1.0				0.52	*Lepomis macrochirus* (bluegill)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on mortality	URS10
Barium	0.21	0.26	0.82				na								
Cadmium	0.021	0.030	0.70				0.9	*Cyprinodon variegatus* (sheepshead minnow)	Development	LOED	Whole Body	Absorption	Egg-embryo	Decreased time to hatch	URS198
Chromium	0.083	0.098	0.9				na								
Cobalt	0.022	0.023	1.0				na								
Copper	0.42	0.40	1.04				13	*Lepomis macrochirus* (bluegill)	Growth	LOED	Gill	Combined	Immature	Effect on growth - over 22 month period	JB5
Iron	24	37	0.6				na								
Lead	0.26	0.082	3.19				0.451	*Pimephales promelas* (fathead minnow)	Behavior	LOED	Brain	Absorption	Immature	Sig. reduction in feeding rate and ineffetive feeding behaviors	URS230
Manganese	2.2	3.0	0.75				na								
Mercury	0.050	**0.23**	0.21	0.69	3.7	0.19	0.135	*Perca flavescens* (yellow perch)	Growth	NOED	Whole Body	Combined	Adult	No effect after 2 years, tissue concentration after one year	URS232
Nickel	0.029	0.034	0.9				na								
Selenium	0.82	0.78	1.0				3	*Micropterus salmoides* (largemouth bass)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on survivorship	URS160
Silver	0.022	0.018	1.2				0.12	*Lepomis macrochirus* (bluegill)	Mortality	NOED	Whole Body	Water	Juvenile	na	JA88
Zinc	28	27	1.0				na								

ERED - U.S. Army Corps of Engineers and U.S. Environmental Protection Agency Environmental Residue-Effects Database (last update - February 1998)
Conc. - concentration
ID - identification number
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nd - not detected in this data set
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(3) Citations for primary references are provided in the ERED database
(4) Value for Endrin
a Test involved PCBs, specific congeners not indicated