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Table 10-1. Summary of Turtle Sample Collections for 2009 and 2010
Tennessee Valley Authority Kingston, Tennessee

Location					Species														
Site Name		Type	Statistical Groupings		2009 Common Musk Turtle			2010 Common Musk Turtle			2009 Snapping Turtle			2010 Snapping Turtle			2010 Eastern Spiny Softshell Turtle		
2009	2010		2009	2010	Blood	Toenail	Carapace	Blood	Toenail	Carapace	Blood	Toenail	Carapace	Blood	Toenail	Carapace	Blood	Toenail	Carapace
Timberlake Pond	Upstream Tennesee River	Reference Site	Reference [2]	Reference	0	NC	NC	20	20	NC	10	NC	NC	21	21	NC	10	11	11
Upstream Clinch River	---	Potentially Unaffected Site [2]			0	NC	NC	---	---	---	3	NC	NC	---	---	---	---	---	---
Ash Spill Area [1] [3]	Emory River	Potentially Affected Sites	Ash Spill Area [1] [3]	Emory River	13	NC	NC	20	29	NC	1	NC	NC	8	8	NC	20	21	21
Emory River[3]	Clinch River[4]		Emory River[3]	Clinch River	5	NC	NC	41	41	NC	6	NC	NC	5	4	NC	16	18	18
Downstream Clinch River[3]	Downstream Tennesee River		Downstream Clinch River[3]	Downstream Tennesee River	6	NC	NC	22	24	NC	2	NC	NC	17	17	NC	18	20	20

Notes:
[1] Location includes East Embayment, West Embayment, and ash pond.
[2] The unaffected site and Timberlake pond were combined for statistical tests and collectively referred to as reference.
[3] The ash spill area, Emory River, and downstream Clinch River were collectively referred to as the impacted area for 2009 snapping turtle data.
[4] The Clinch River was separated by river miles (2.5 and 4.0) for 2010 common musk turtle data.
NC = Not collected.

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Table 10-2. Representative Reptilian Species of Potential Occurrence in Roane County, Tennessee
Tennessee Valley Authority Kingston, Tennessee

Common Name	*Scientific Name*
Lizards	
Green Anole [D]	*Anolis carolinensis*
Six-lined Racerunner[D]	*Aspidoscelis sexlineatus*
Five-lined Skink	*Eumeces fasciatus*
Broad-headed Skink	*Eumeces laticeps*
Eastern Slender Glass Lizzard [S3 G5T5 D]	*Ophisaurus attenuatus longicaudus*
Common Five-lined Skink	*Plestiodon fasciatus*
Broad-headed Skink	*Plestiodon laticeps*
Eastern Fence Lizard	*Sceloporus undulatus*
Little Brown Skink/Ground Skink	*Scincella lateralis*
Snakes	
Copperhead	*Agkistrodon contortrix*
Eastern Wormsnake	*Carphophis amoenus*
Scarlet Snake	*Cemophora coccinea*
North American Racer	*Coluber constrictor*
Timber Rattlesnake	*Crotalus horridus*
Ring-necked Snake	*Diadophis punctatus*
Corn Snake	*Elaphe guttata*
Rat Snake	*Elaphe obsoleta*
Eastern Hognose Snake	*Heterodon platyrhinos*
Yellow-bellied Kingsnake/Mole Snake	*Lampropeltis calligaster*
Common Kingsnake	*Lampropeltis getula*
Milk Snake	*Lampropeltis triangulum*
Common Watersnake	*Nerodia sipedon*
Rough Green Snake	*Opheodrys aestivus*
Red Cornsnake	*Pantherophis guttatus*
Gray Ratsnake	*Pantherophis spiloides*
Northern Pine Snake [S3 G4T4 T]	*Pituophis melanoleucus melanoleucus*
Queen Snake	*Regina septemvittata*
Dekay's Brownsnake	*Storeria dekayi*
Red-bellied Snake	*Storeria occipitomaculata*
Crowned Snake	*Tantilla coronata*
Common Garter Snake	*Thamnophis sirtalis*
Smooth Earth Snake	*Virginia valeriae*

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Table 10-2. Representative Reptilian Species of Potential Occurrence in Roane County, Tennessee
Tennessee Valley Authority Kingston, Tennessee

Common Name	*Scientific Name*
Turtles	
Spiny Softshell	*Apalone spinifera*
Snapping Turtle	*Chelydra serpentina*
Painted Turtle	*Chrysemys picta*
Southern Painted Turtle	*Chrysemys dorsalis*
Northern Map Turtle	*Graptemys geographica*
Ouachita Map Turtle	*Graptemys ouachitensis*
False Map Turtle	*Graptemys pseudogeographica*
River Cooter	*Pseudemys concinna*
Eastern Musk Turtle/Stinkpot	*Sternotherus odoratus*
Loggerhead Musk Turtle/Stripe-neck Musk Turtle	*Sternotherus minor*
Eastern Box Turtle	*Terrapene carolina*
Pond Slider [D]	*Trachemys scripta*
Spiny Softshell Turtle	*Trionyx spiniferus*

Notes: Information compiled from Klein (1989) and Redmond and Scott (2008).
D = Deemed in Need of Management. Species of nongame wildlife which shoud be investigated in order to develop information relating to biological and ecological data to determine management measures necessary for their continued ability to sustain themselves successfully.
G = Global rank.
G4 = Widespread, abundant, and apparently secure globally, but with cause for long-term concern.
G5 = Demonstrably widespread and secure globally.
S = State rank.
S3 = Rare and uncommon in the state, from 21-100 occurances.
T = Threatened. Species is likely to become an endangered species within the forseeable future.

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Table 10-3. Data Used in Determining Appropriate Statistical Hypothesis Testing for Each COPEC
Tennessee Valley Authority Kingston, Tennessee

Analyte	Number	Number Detected 2009 & 2010	% Detected 2009 & 2010	Mean Reporting Limit in 2009 mg/kg (ww)	Mean Reporting Limit in 2010 mg/kg (ww)
Aluminum [1]	329	6	2%	10	37
Antimony [1]	334	5	1%	0.050	0.13
Arsenic [2]	334	50	15%	0.051	0.36
Barium [2]	334	127	38%	0.070	0.46
Beryllium [1]	334	0	0%	0.041	0.33
Boron [1]	334	2	1%	0.83	3.7
Cadmium [1]	334	26	8%	0.043	0.068
Calcium *	334	253	76%	92	827
Chromium [1]	334	2	1%	0.12	1.4
Cobalt [2]	334	211	63%	0.061	0.13
Copper [2]	334	245	73%	0.47	1.3
Iron [2]	334	266	80%	NA	205
Lead [2]	334	92	28%	0.074	0.25
Magnesium *	334	208	62%	86	427
Manganese [2]	334	206	62%	0.46	1.8
Mercury [2]	334	146	44%	0.018	0.11
Molybdenum [1]	334	1	0%	0.40	0.31
Nickel [1]	334	27	8%	0.079	0.82
Potassium *	334	229	69%	NA	6445
Selenium [2]	334	278	83%	0.2	1.0
Silver [2]	334	48	14%	0.022	0.027
Sodium *	334	330	99%	NA	2794
Strontium [2]	334	274	82%	0.065	0.46
Thallium [1]	334	2	1%	0.048	0.12
Vanadium [1]	334	1	0%	0.11	0.49
Zinc [3]	334	284	85%	NA	24

Notes:

[1] Detection ≤ 10%; excluded from statistical evaluation.

[2] 10% < Detection < 85%; sample reporting limit substituted for non-detects; evaluated using non-parametric comparison methods.

[3] Detection >85%; sample reporting limit substituted for non-detects; evaluated using parametric comparison methods.

* = Essential nutrients. Not included in statistical analyses.

COPEC = Constituent of potential ecological concern.

mg/kg = Milligram per kilogram.

NA = Not available.

ww = Wet weight.

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Table 10-4. Turtle Species Recorded in 2009 from Reference Site, Clinch River, Ash Spill Area, and Emory River

Tennessee Valley Authority **Kingston, Tennessee**

Taxon	Common Name	Location				
		Reference[1] Site	Clinch River (Upstream)[2]	Clinch River (Downstream)	Ash Release Area[3]	Emory River
Class Reptilia						
Order Chelonia						
Apalone spinifera	Spiny Softshell Turtle		X	X	X	X
Chelydra serpentina	Common Snapping Turtle	X	X	X	X	X
Chrysemys picta	Eastern Painted Turtle					X
Deirochelys reticularia	Chicken Turtle					X
Pseudemys concinna	River Cooter				X	
Sternotherus carinatus	Musk/Mud Turtle			X	X	X
Trachemys scripta	Red-eared slider			X	X	X
	Total Species:	1	2	4	5	6

Notes:

[1] Observations of all turtle species not recorded in 2009.

[2] Clinch River (upstream) includes river mile 6.5 and greater.

[3] Location includes East Embayment, West Embayment, and ash pond.

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Table 10-5. Summary of Sampling Effort for Turtle Relative Abundance for 2009, Timberlake Pond, Ash Spill Area, Emory River, and Clinch River

Tennessee Valley Authority **Kingston, Tennessee**

Species Captured	Reference Site	Potentially Affected Site			Potentially Unaffected Site	Totals
	Timberlake Pond[1]	Ash Release Area[2]	Clinch River (Downstream)	Emory River	Clinch River (Upstream)[3]	
	Total # Captured	Total # Captured	Total # Captured	Total # Captured	Total # Captured	
Target Species						
Snapping Turtle	10	1	2	6	3	22
Mud/Musk Turtle	0	15	6	5	0	26
Non-Target Species						
Eastern Spiny Softshell	0	3	3	14	6	26
Slider Turtles	0	104	155	100	148	507
Other	0	4	0	2	0	6
All species	10	127	166	200	157	660

Note: Traps were set out at the above locations for 50 nights. There were approximately 350 traps between all of the above locations.

[1] Observations of all turtle species not recorded in 2009.

[2] Location includes East Embayment, West Embayment, and ash pond.

[3] Clinch River (upstream) includes river mile 6.5 and greater.

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Table 10-6. Turtle Species Recorded in 2010 from Reference Site, Clinch River, Emory River, and Tennessee River
Tennessee Valley Authority Kingston, Tennessee

Taxon	Common Name	Location			
		Reference Site	Clinch River	Emory River	Tennessee River (Downstream)
Class Reptilia					
Order Chelonia					
Apalone spinifera	Spiny Softshell Turtle	X	X	X	X
Chelydra serpentina	Common Snapping Turtle	X	X	X	X
Chrysemys picta	Eastern Painted Turtle	X	X	X	X
Graptemys geographica	Map Turtle	X	X	X	X
Pseudemys concinna	River Cooter	X	X	X	X
Sternotherus carinatus	Musk/Mud Turtle	X	X	X	X
Trachemys scripta	Common slider	X	X	X	X
	Total Species:	7	7	7	7

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Table 10-7. Summary of Sampling Effort for Turtle Relative Abundance for 2010, Upstream Tennessee River Reference, Clinch River, Emory River, and Downstream Tennessee River
Tennessee Valley Authority Kingston, Tennessee

Species Captured	Reference Site		Potentially Affected Sites						Totals
	Upstream Tennessee River Total # of Traps at Location = 386		Clinch River Total # of Traps at Location = 226		Emory River Total # of Traps at Location = 531		Downstream Tennessee River Total # of Traps at Location = 204		
	Total # Captured	Total # of Turtles per Trap	Total # Captured	Total # of Turtles per Trap	Total # Captured	Total # of Turtles per Trap	Total # Captured	Total # of Turtles per Trap	
Target Species									
Eastern Spiny Softshell	11	0.028	20	0.088	34	0.064	24	0.12	89
Snapping Turtle	28	0.073	4	0.018	8	0.015	17	0.083	57
Mud/Musk Turtle	51	0.13	77	0.34	158	0.30	64	0.31	350
Non-Target Species									
Slider Turtles	843	2.2	647	2.9	974	1.8	760	3.7	3224
Other	29	0.075	9	0.040	29	0.055	19	0.093	86
All species	962	2.5	757	3.3	1203	2.3	884	4.3	3806

Note:
Traps were set out at the above locations for 51 nights. The number of traps at each location are as follows:

Upstream Tennesse:	386
Downstream Tennessee:	204
Emory River:	531
Clinch River:	226

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Table 10-8. Summary of Selenium and Strontium Concentrations from 2009-2010 in Turtle Blood
Tennessee Valley Authority **Kingston, Tennessee**

Common Musk Turtle

	2009 (mg/kg ww)									
	Ash Spill Area [1]		Timberlake Pond		Upstream Clinch River		Downstream Clinch River		Emory River	
	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range
Selenium	0.67 ± 0.24	0.42 - 1.3	NC ± NC	NC - NC	NC ± NC	NC - NC	0.79 ± 0.25	0.56 - 1.2	0.64 ± 0.08	0.52 - 0.73
Strontium	0.16 ± 0.12	0.05 - 0.41	NC ± NC	NC - NC	NC ± NC	NC - NC	0.14 ± 0.11	0.09 - 0.36	0.17 ± 0.09	0.09 - 0.28
	2010 (mg/kg ww)									
	Upstream TR (Ref)		Downstream TR		Clinch River (2.5)		Clinch River (4.0)		Emory River	
	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range
Selenium	0.42 ± 0.12	0.22 - 0.73	0.51 ± 0.10	0.33 - 0.69	0.89 ± 0.21	0.36 - 1.1	0.94 ± 0.36	0.46 - 1.6	0.46 ± 0.17	0.18 - 0.92
Strontium	0.14 ± 0.10	0.08 - 0.44	0.14 ± 0.06	0.09 - 0.32	0.31 ± 0.24	0.09 - 1	0.15 ± 0.13	0.07 - 0.52	0.15 ± 0.12	0.07 - 0.52

Snapping Turtle

	2009 (mg/kg ww)					
	Impacted Area [1]		Timberlake Pond		Upstream Clinch River	
	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range
Selenium	0.91 ± 1.36	0.21 - 4.5	0.254 ± 0.0726	0.2 - 0.4	0.32 ± 0.1253	0.19 - 0.44
Strontium	0.10 ± 0.09	0.015 - 0.29	0.279 ± 0.082	0.18 - 0.43	0.1647 ± 0.11	0.084 - 0.29
	2010 (mg/kg ww)							
	Upstream TR (Ref)		Downstream TR		Clinch River		Emory River	
	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range
Selenium	0.35 ± 0.05	0.24 - 0.44	0.39 ± 0.06	0.27 - 0.5	0.38 ± 0.06	0.29 - 0.45	0.34 ± 0.11	0.15 - 0.45
Strontium	0.23 ± 0.19	0.05 - 0.78	0.09 ± 0.04	0.043 - 0.18	0.13 ± 0.11	0.05 - 0.26	0.17 ± 0.10	0.05 - 0.32

Eastern Spiny Softshell Turtle

	2009 (mg/kg ww)							
	Upstream TR (Ref)		Downstream TR		Clinch River		Emory River	
	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range
Selenium	NC ± NC	NC - NC	NC ± NC	NC - NC	NC ± NC	NC - NC	NC ± NC	NC - NC
Strontium	NC ± NC	NC - NC	NC ± NC	NC - NC	NC ± NC	NC - NC	NC ± NC	NC - NC
	2010 (mg/kg ww)							
	Upstream TR (Ref)		Downstream TR		Clinch River		Emory River	
	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range	Mean ± SD[2]	Range
Selenium	0.39 ± 0.24	0.06 - 0.83	0.35 ± 0.20	0.06 - 0.65	0.73 ± 0.47	0.11 - 1.5	0.57 ± 0.46	0.063 - 1.4
Strontium	0.10 ± 0.08	0.05 - 0.28	0.09 ± 0.05	0.041 - 0.25	0.08 ± 0.03	0.06 - 0.17	0.11 ± 0.05	0.05 - 0.27

Notes:

[1] Location includes East Embayment, West Embayment, and ash pond.

[2] Mean calculated using full reporting limits, which were substituted for non-detects.

mg/kg = Milligram per kilogram.

NC = Data not collected.

Ref = Reference site.

SD = Standard deviation.

TR = Tennessee River.

ww = Wet weight.

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Table 10-9. Summary of COPEC Concentrations in Surface Water Compared to Available Aquatic Life Criteria
Tennessee Valley Authority Kingston, Tennessee

Dissolved Metal Concentrations (µg/L)

	Hardness (mg/L)[a]	Aluminum[b]	Arsenic	Cadmium	Chromium[c]	Chromium VI	Copper	Iron[b,d]	Lead	Mercury	Nickel	Selenium[b]	Silver[e]	Zinc
Acute Criteria	--	NA	340	2	NA	16	13	--	65	1.4	470	--	3.2	120
Chronic Criteria	--	NA	150	0.25	NA	11	9	--	2.5	0.77	52	--	--	120
CR_A	136	<50	1.36	**<0.33**	<0.33	2.1	2.65	<25	<0.33	<0.15	0.39	0.7	<0.33	<8.3
CR_B	138	142	1.58	**<0.33**	<0.33	2.1	2.37	129	<0.33	<0.15	0.42	0.37	<0.33	<8.3
CR_R	138	<50	0.52	**<0.33**	<0.33	2	0.69	77.7	<0.33	0.2	0.52	0.36	<0.33	<8.3
ER_A	129	<50	2.28	**<0.33**	<0.33	NA	1.4	<25	<0.33	<0.15	0.48	0.66	<0.33	8.51
ER_B	126	<50	2.32	**<0.33**	<0.33	NA	2.92	30.4	<0.33	<0.15	0.59	0.58	<0.33	<8.3
ER_C	122	<50	1.74	**<0.33**	<0.33	NA	2.12	<25	<0.33	<0.15	0.54	0.4	<0.33	<8.3
ER_R	95.7	<50	1.04	**<0.33**	<0.33	NA	0.41	<25	<0.33	<0.15	0.63	<0.33	<0.33	<8.3
TR_B	74.5	65	0.98	**<0.33**	<0.33	1.6	3.18	83.9	<0.33	<0.15	0.4	0.4	<0.33	<8.3
TR_R	66.2	<50	0.97	**<0.33**	<0.33	1.7	2.05	<25	<0.33	<0.15	0.34	0.39	<0.33	<8.3

Total Recoverable Metal Concentrations (µg/L)

	Hardness (mg/L)[a]	Aluminum	Arsenic[f]	Cadmium	Chromium[c]	Chromium VI [f]	Copper	Iron[d]	Lead	Mercury	Nickel	Selenium	Silver[e]	Zinc
Acute Criteria	--	750	340	2.12	NA	16.29	13.54	--	82.17	1.65	470.94	20	3.76	122.70
Chronic Criteria	--	87	150	0.28	NA	11.43	9.38	1000	3.16	0.91	52.16	5	--	121.70
CR_A	136	**214**	1.53	**<0.33**	0.46	--	1.95	150	0.37	0.229	0.76	0.76	<0.33	<8.3
CR_B	138	**139**	1.95	**<0.33**	0.39	--	2.56	133	<0.33	<0.15	0.59	0.38	<0.33	<8.3
CR_R	138	**107**	0.61	**<0.33**	0.51	--	1.58	126	0.34	<0.15	0.65	0.43	<0.33	<8.3
ER_A	129	**255**	2.52	**<0.33**	2.71	--	2.12	220	0.36	0.189	0.72	0.93	<0.33	13.7
ER_B	126	**319**	2.78	**<0.33**	0.5	--	1.73	251	0.44	0.186	0.86	0.55	<0.33	<8.3
ER_C	122	**339**	2.56	**<0.33**	0.47	--	0.98	316	0.58	<0.15	0.83	<0.33	<0.33	<8.3
ER_R	95.7	<50	1.3	**<0.33**	0.41	--	0.67	133	<0.33	0.166	0.72	0.38	<0.33	<8.3
TR_B	74.5	**263**	1.31	**<0.33**	0.43	--	2.19	236	0.47	<0.15	1.13	<0.33	<0.33	<8.3
TR_R	66.2	**206**	1.17	**<0.33**	0.38	--	1.29	199	<0.33	<0.15	0.6	0.45	<0.33	<8.3

Notes: Hardness-dependent metals criteria was calculated using a hardness value of 100 mg/L.
[a] Lowest hardness value sampled within a reach used for hardness-adjusted criteria calculations.
[b] Criteria only available as total recoverable metal concentrations.
[c] No critera available for combined chromium species.
[d] No acute criteria available.
[e] No chronic criteria available.
[f] Criteria only available as dissolved metal concentrations.
-- = Relevant criteria unavailable.
Bold = Indicates exceedance of chronic criteria.
COPEC = Constituent of potential ecological concern.
CR = Clinch River.
ER = Emory River.
µg/L = Microgram per liter.
mg/L = Milligram per liter.
NA = Data not available.
TR = Tennessee River.

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Table 10-10. Summary of COPEC Concentrations in Submerged Sediment Compared to Screening Values for Clinch River

Tennessee Valley Authority **Kingston, Tennessee**

			Clinch River Reaches											
			CR_A				CR_B				CR_Ref			
Analyte Name	Units	Screening Value	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ
Aluminum	mg/kg	225000	44200	25383	<1	<1	38300	24983	<1	<1	11900	11333	<1	<1
Antimony	mg/kg	12	ND	1.89	<1	NA	1.46	1.83	<1	<1	ND	1.51	<1	NA
Arsenic	mg/kg	7.24	27.8	17.32	2	4	37.8	20	3	5	9.16	6.37	<1	1
Barium	mg/kg	--	320	234	NA	NA	417	225	NA	NA	88	73.77	NA	NA
Beryllium	mg/kg	--	2.73	1.84	NA	NA	3.43	1.83	NA	NA	0.686	0.63	NA	NA
Boron	mg/kg	--	106	38.93	NA	NA	56.3	32.07	NA	NA	15.1	12.57	NA	NA
Cadmium	mg/kg	1	ND	0.19	<1	NA	ND	0.18	<1	NA	ND	0.15	<1	NA
Chromium	mg/kg	52.3	50.8	29.84	<1	<1	56.5	31.88	<1	1	27.9	20.53	<1	<1
Cobalt	mg/kg	50	23.2	17.12	<1	<1	23.7	16.47	<1	<1	11.7	10.30	<1	<1
Copper	mg/kg	18.7	62.4	37	2	3	46.4	28.57	2	2	15.5	11	<1	<1
Hex. Chromium	mg/kg	52.3	ND	0.47	<1	NA	ND	0.39	<1	NA	ND	0.32	<1	NA
Lead	mg/kg	30.2	31	22	<1	1	25.7	19.57	<1	<1	19.2	14.70	<1	<1
Manganese	mg/kg	1100	2180	1190	1	2	1570	871	<1	1	1160	1057	<1	1
Mercury	mg/kg	0.13	1.3	0.58	4	10	1.3	0.43	3	10	5	2.03	16	38
Molybdenum	mg/kg	--	ND	7.58	NA	NA	ND	7.31	NA	NA	ND	6.02	NA	NA
Nickel	mg/kg	15.9	39.3	27.40	2	2	43.1	26.58	2	3	19.4	13.63	<1	1
Selenium*	mg/kg	2	3.01	2.15	1	2	3.5	2.12	1	2	ND	1.51	<1	NA
Silver	mg/kg	2	ND	0.95	<1	NA		0.91	<1	<1	ND	0.75	<1	NA
Strontium	mg/kg	--	160	128	NA	NA	231	100	NA	NA	17.6	13.10	NA	NA
Thallium	mg/kg	--	ND	1.89	NA	NA	ND	1.83	NA	NA	ND	1.51	NA	NA
Vanadium	mg/kg	--	81.2	50.44	NA	NA	89.9	51.40	NA	NA	21.3	17.83	NA	NA
Zinc	mg/kg	124	130	90.38	<1	1	103	74.93	<1	<1	67.9	57.50	<1	<1
Calcium	mg/kg	--	5540	3438	NA	NA	14200	4279	NA	NA	3110	2487	NA	NA
Iron	mg/kg	--	37000	26567	NA	NA	35300	25417	NA	NA	18900	16200	NA	NA
Magnesium	mg/kg	--	4010	2649	NA	NA	4280	2469	NA	NA	1900	1793	NA	NA
Potassium	mg/kg	--	7120	3822	NA	NA	7890	3943	NA	NA	2490	2050	NA	NA
Sodium	mg/kg	--	491	235	NA	NA	480	256	NA	NA	ND	151	NA	NA

Notes: Screening values based off of USEPA (United States Environmental Protection Agency) Region 4 Sediment Screening Value.

* = Screening value obtained from Lemley, A.D. 2002. Selenium assessment in aquatic ecosystems. U.S. Forest Service, Blacksburg, VA.

-- = No screening value available.

Maximum detection exceeds the USEPA Region 4 Sediment Screening Value.

Mean with full RL exceeds the USEPA Region 4 Sediment Screening Value.

COPEC = Constituent of potential ecological concern.

CR = Clinch River.

HQ = Hazard quotient.

mg/kg = Milligram per kilogram.

NA = Not available.

ND = All samples were non-detects.

RL = Reporting limit.

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Table 10-11. Summary of COPEC Concentrations in Submerged Sediment Compared to Screening Values for Emory River

Tennessee Valley Authority **Kingston, Tennessee**

			Emory River Reaches															
			ER_A				ER_B				ER_C				ER_Ref			
Analyte Name	Units	Screening Value	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ
Aluminum	mg/kg	225000	25600	15746.67	<1	<1	30600	13791.11	<1	<1	38800	11697	<1	<1	29300	11547.50	<1	<1
Antimony	mg/kg	12	ND	1.81	<1	NA	3.44	1.74	<1	<1	ND	1.62	<1	NA	ND	1.54	<1	NA
Arsenic	mg/kg	7.24	32.2	24.98	3	4	89.5	22.89	3	12	76.9	10.80	1	11	6.33	3.38	<1	<1
Barium	mg/kg	--	291	236.25	NA	NA	398	161.11	NA	NA	305	84.60	NA	NA	273	104.28	NA	NA
Beryllium	mg/kg	--	2.48	1.79	NA	NA	3.84	1.52	NA	NA	2.86	0.91	NA	NA	1.57	0.85	NA	NA
Boron	mg/kg	--	27.9	20.79	NA	NA	52.6	17.16	NA	NA	40.2	12.01	NA	NA	10.5	7.15	NA	NA
Cadmium	mg/kg	1	ND	0.18	<1	NA	ND	0.15	<1	NA	ND	0.16	<1	NA	ND	0.15	<1	NA
Chromium	mg/kg	52.3	33.2	22.36	<1	<1	43	18.39	<1	<1	39.5	13.34	<1	<1	30.2	12.87	<1	<1
Cobalt	mg/kg	50	21.6	15.52	<1	<1	22.7	11.11	<1	<1	21.6	7.89	<1	<1	37.2	13.92	<1	<1
Copper	mg/kg	18.7	36	26.13	1	2	52.3	20.58	1	3	49	10.27	<1	3	13	7.16	<1	<1
Hex. Chromium	mg/kg	52.3	ND	0.79	<1	NA	0.36	0.60	<1	<1	ND	2.50	<1	NA	ND	1	<1	NA
Lead	mg/kg	30.2	23.3	15.28	<1	<1	28.4	13.88	<1	<1	29	9.91	<1	<1	22.2	10.98	<1	<1
Manganese	mg/kg	1100	971	443.83	<1	<1	1260	318.93	<1	1	660	273.38	<1	<1	450	232.50	<1	<1
Mercury	mg/kg	0.13	0.24	0.12	<1	1.85	0.16	0.08	<1	1	0.1	0.06	<1	<1	0.055	0.05	<1	<1
Molybdenum	mg/kg	--	ND	7.25	NA	NA	ND	5.92	NA	NA	ND	6.48	NA	NA	ND	6.17	NA	NA
Nickel	mg/kg	15.9	35.5	25.63	2	2	42.3	19.11	1	3	35	12.64	<1	2	30.8	14.01	<1	2
Selenium*	mg/kg	2	3.34	2.58	1	2	4.59	2.13	1	2	5.16	2.04	1	3	ND	1.54	<1	NA
Silver	mg/kg	2	ND	0.91	<1	NA	ND	0.74	0.37	NA	ND	0.81	<1	NA	ND	0.77	<1	NA
Strontium	mg/kg	--	170	128.48	NA	NA	256	88.08	NA	NA	202	30.82	NA	NA	22.7	10.68	NA	NA
Thallium	mg/kg	--	ND	1.81	NA	NA	2.82	1.56	NA	NA	ND	1.62	NA	NA	ND	1.54	NA	NA
Vanadium	mg/kg	--	63.1	45.14	NA	NA	88.2	36.68	NA	NA	75.8	21.67	NA	NA	41.6	16.73	NA	NA
Zinc	mg/kg	124	86.6	55.98	<1	<1	78.8	45.81	<1	<1	111	39.44	<1	<1	73.3	41.55	<1	<1
Calcium	mg/kg	--	4360	3423.33	NA	NA	5600	1971.17	NA	NA	3820	936.50	NA	NA	1660	720.25	NA	NA
Iron	mg/kg	--	34200	26833.33	NA	NA	30100	16376.67	NA	NA	32200	11925	NA	NA	12700	10020	NA	NA
Magnesium	mg/kg	--	2450	1501.67	NA	NA	2630	1092.11	NA	NA	3460	964.30	NA	NA	2030	944.25	NA	NA
Potassium	mg/kg	--	3280	1851.50	NA	NA	4000	1569.44	NA	NA	6310	1648.50	NA	NA	3870	1457.75	NA	NA
Sodium	mg/kg	--	266	212.50	NA	NA	477	208.61	NA	NA	404	184.90	NA	NA	167	160.75	NA	NA

Notes: Screening values based off of USEPA (United States Environmental Protection Agency) Region 4 Sediment Screening Value.
* = Screening value obtained from Lemley, A.D. 2002. Selenium assessment in aquatic ecosystems. U.S. Forest Service, Blacksburg, VA.
-- = No screening value available.
Maximum detection exceeds the USEPA Region 4 Sediment Screening Value.
Mean with full RL exceeds the USEPA Region 4 Sediment Screening Value.
COPEC = Constituent of potential ecological concern.
ER = Emory River.
HQ = Hazard quotient.
mg/kg = Milligram per kilogram.
NA = Not available.
ND = All samples were non-detects.
RL = Reporting limit.

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Table 10-12. Summary of COPEC Concentrations in Submerged Sediment Compared to Screening Values for Tennessee River
Tennessee Valley Authority Kingston, Tennessee

			Tennessee River Reaches											
			TR_A				TR_B				TR_Ref			
Analyte Name	Units	Screening Value	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ
Aluminum	mg/kg	225000	59500	42740	<1	<1	44000	32625	<1	<1	56100	32433	<1	<1
Antimony	mg/kg	12	ND	2.27	<1	NA	1.5	1.91	<1	<1	ND	1.48	<1	NA
Arsenic	mg/kg	7.24	16.2	12.14	2	2	20.2	15	2	3	10.9	6.46	<1	2
Barium	mg/kg	--	328	252	NA	NA	373	272	NA	NA	466	247.00	NA	NA
Beryllium	mg/kg	--	2.19	1.62	NA	NA	2.16	1.90	NA	NA	1.59	0.95	NA	NA
Boron	mg/kg	--	42.2	28.65	NA	NA	25.5	21.05	NA	NA	27.3	15.42	NA	NA
Cadmium	mg/kg	1	ND	0.23	0.23	NA	ND	0.19	<1	NA	ND	0.15	<1	NA
Chromium	mg/kg	52.3	51	39.38	0.75	0.98	37.7	33.38	<1	<1	51.1	29.87	<1	<1
Cobalt	mg/kg	50	25.2	19.04	0.38	0.50	19.5	17.10	<1	<1	19.7	13.39	<1	<1
Copper	mg/kg	18.7	43.6	33	2	2	38	28.63	2	2	13.5	11	<1	<1
Hex. Chromium	mg/kg	52.3	ND	0.58	<1	NA	ND	0.38	<1	NA	ND	0.32	<1	NA
Lead	mg/kg	30.2	43.9	33	1	1	30.6	24.30	<1	1	28.4	19.47	<1	<1
Manganese	mg/kg	1100	2430	2013	2	2	1990	1187	1	2	3660	1876	2	3
Mercury	mg/kg	0.13	0.55	0.39	3	4	0.54	0.32	2	4	0.066	0.06	<1	<1
Molybdenum	mg/kg	--	ND	9.11	NA	NA	ND	7.44	NA	NA	ND	5.90	NA	NA
Nickel	mg/kg	15.9	34.8	26.75	2	2	28.8	25.73	2	2	18.1	13.03	<1	1
Selenium*	mg/kg	2	ND	2.27	1	NA	2.16	2.13	1	1	ND	1.48	<1	NA
Silver	mg/kg	2	ND	1.14	<1	NA	ND	0.93	<1	NA	ND	0.74	<1	NA
Strontium	mg/kg	--	ND		NA	NA	ND		NA	NA	ND		NA	NA
Thallium	mg/kg	--	ND	2.27	NA	NA	ND	1.86	NA	NA	ND	1.48	NA	NA
Vanadium	mg/kg	--	81.6	61.25	NA	NA	61.9	56.70	NA	NA	75.9	44.00	NA	NA
Zinc	mg/kg	124	207	160.15	1	2	144	101.43	<1	1	110	88.73	<1	<1
Calcium	mg/kg	--	3830	2808	NA	NA	3320	3080	NA	NA	2200	2100	NA	NA
Iron	mg/kg	--	46700	34950	NA	NA	35600	28600	NA	NA	45800	28933	NA	NA
Magnesium	mg/kg	--	4960	3770	NA	NA	5490	3388	NA	NA	3690	3043	NA	NA
Potassium	mg/kg	--	8610	6060	NA	NA	6290	4620	NA	NA	7420	4400	NA	NA
Sodium	mg/kg	--	425	328	NA	NA	320	288	NA	NA	518	275	NA	NA

Notes: Screening values based off of USEPA (United States Environmental Protection Agency) Region 4 Sediment Screening Value.
* Screening value obtained from Lemley, A.D. 2002. Selenium assessment in aquatic ecosystems. U.S. Forest Service, Blacksburg, VA.
-- = No screening value available.
Maximum detection exceeds the USEPA Region 4 Sediment Screening Value.
Mean with full RL exceeds the USEPA Region 4 Sediment Screening Value.
COPEC = Constituent of potential ecological concern.
HQ = Hazard quotient.
mg/kg = Milligram per kilogram.
NA = Not available.
ND = All samples were non-detects.
RL = Reporting limit.
TR = Tennessee River.

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Table 10-13. Summary of COPEC Concentrations in Seasonally-Exposed Sediment Compared to Screening Values for Clinch River

Tennessee Valley Authority **Kingston, Tennessee**

			Clinch River Reaches							
			CR_A				CR_B			
Analyte Name	**Units**	**Screening Value**	**Maximum Detection**	**Mean with Full RL**	**Mean HQ**	**Maximum HQ**	**Maximum Detection**	**Mean with Full RL**	**Mean HQ**	**Maximum HQ**
Aluminum	mg/kg	225000	143000	44081	<1	<1	59400	27144	<1	<1
Antimony	mg/kg	12	2.52	1.47	<1	<1	1.73	1.48	<1	<1
Arsenic	mg/kg	7.24	63.4	19.24	3	9	82.6	18	2	11
Barium	mg/kg	--	190	110	NA	NA	216	113	NA	NA
Beryllium	mg/kg	--	4.39	1.18	NA	NA	1.7	0.84	NA	NA
Boron	mg/kg	--	60.5	42.69	NA	NA	45.7	19.17	NA	NA
Cadmium	mg/kg	1	ND	0.14	<1	NA	ND	0.14	<1	NA
Chromium	mg/kg	52.3	125	50.15	<1	2	71.3	39.66	<1	1
Cobalt	mg/kg	50	18.0	10.95	<1	<1	23.8	14.66	<1	<1
Copper	mg/kg	18.7	90.4	24	1	5	46.8	16.40	<1	3
Hex. Chromium	mg/kg	52.3	0.83	0.46	<1	<1	0.84	0.44	<1	<1
Lead	mg/kg	30.2	102	33	1	3	86.7	28.52	<1	3
Manganese	mg/kg	1100	1700	666	<1	2	3540	1183	1	3
Mercury	mg/kg	0.13	0.39	0.15	1	3	1	0.27	2	8
Molybdenum	mg/kg	--	ND	5.54	NA	NA	ND	5.75	NA	NA
Nickel	mg/kg	15.9	135	26.78	2	8	36.9	15.28	<1	2
Selenium*	mg/kg	2	ND	1.39	<1	NA	1.77	1.47	<1	<1
Silver	mg/kg	2	ND	0.69	<1	NA	ND	0.72	<1	NA
Strontium	mg/kg	--	43.6	22	NA	NA	42.1	17	NA	NA
Thallium	mg/kg	--	ND	1.39	NA	NA	3.11	1.62	NA	NA
Vanadium	mg/kg	--	193	60.53	NA	NA	63.5	42.75	NA	NA
Zinc	mg/kg	124	460	122.52	<1	4	194	66.75	<1	2
Calcium	mg/kg	--	3430	1669	NA	NA	4140	1570	NA	NA
Iron	mg/kg	--	93800	39600	NA	NA	49200	28877	NA	NA
Magnesium	mg/kg	--	5780	2746	NA	NA	7150	2284	NA	NA
Potassium	mg/kg	--	8880	5066	NA	NA	18100	4377	NA	NA
Sodium	mg/kg	--	284	178	NA	NA	219	157	NA	NA

Notes: Screening values based off of USEPA (United States Environmental Protection Agency) Region 4 Sediment Screening Value.
* = Screening value obtained from Lemley, A.D. 2002. Selenium assessment in aquatic ecosystems. U.S. Forest Service, Blacksburg, VA.
-- = No screening value available.
Maximum detection exceeds the USEPA Region 4 Sediment Screening Value.
Mean with full RL exceeds the USEPA Region 4 Sediment Screening Value.
COPEC = Constituent of potential ecological concern.
CR = Clinch River.
HQ = Hazard quotient.
mg/kg = Milligram per kilogram.
NA = Not available.
ND = All samples were non-detects.
RL = Reporting limit.

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Table 10-14. Summary of COPEC Concentrations in Seasonally-Exposed Sediment Compared to Screening Values for Emory River

Tennessee Valley Authority **Kingston, Tennessee**

			Emory River Reaches															
			ER_A				ER_B				ER_C				ER_Ref			
Analyte Name	Units	Screening Value	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ	Maximum Detection	Mean with Full RL	Mean HQ	Maximum HQ
Aluminum	mg/kg	225000	76500	29850.00	<1	<1	39400	17585.56	<1	<1	27100	9164	<1	<1	14800	8594.00	<1	<1
Antimony	mg/kg	12	1.8	1.52	<1	<1	2.26	1.44	<1	<1	ND	1.38	<1	NA	ND	1.39	<1	NA
Arsenic	mg/kg	7.24	32.3	14.34	2	4	62.4	15.18	2	9	5.17	2.51	<1	<1	5.4	2.97	<1	<1
Barium	mg/kg	--	245	142.20	NA	NA	478	125.41	NA	NA	447	92.48	NA	NA	90.4	45.38	NA	NA
Beryllium	mg/kg	--	2.19	1.20	NA	NA	3.52	1.08	NA	NA	1.09	0.66	NA	NA	0.769	0.58	NA	NA
Boron	mg/kg	--	88	23.25	NA	NA	51.8	14.71	NA	NA	10.3	6.38	NA	NA	ND	5.57	NA	NA
Cadmium	mg/kg	1	ND	0.14	<1	NA	ND	0.14	<1	NA	ND	0.14	<1	NA	ND	0.14	<1	NA
Chromium	mg/kg	52.3	86	38.79	<1	2	42.4	22.35	<1	<1	24.3	9.96	<1	<1	13.8	9.01	<1	<1
Cobalt	mg/kg	50	46.6	18.75	<1	<1	38.1	13.74	<1	<1	20.4	7.14	<1	<1	10.5	5.70	<1	<1
Copper	mg/kg	18.7	31.7	17.57	<1	2	47.1	16.48	<1	3	13.2	5.08	<1	<1	6.83	5.46	<1	<1
Hex. Chromium	mg/kg	52.3	1.2	0.70	<1	<1	0.45	0.54	<1	<1	ND	0.59	<1	NA	0.37	1	<1	<1
Lead	mg/kg	30.2	126	27.63	<1	4	79.5	21.44	<1	3	14	6.69	<1	<1	10.4	7.07	<1	<1
Manganese	mg/kg	1100	2910	955.58	<1	3	4120	826.22	<1	4	2940	557.35	<1	3	689	315.38	<1	<1
Mercury	mg/kg	0.13	0.13	0.07	<1	1	0.12	0.07	<1	<1	ND	0.06	<1	NA	ND	0.06	<1	NA
Molybdenum	mg/kg	--	ND	5.66	NA	NA	ND	5.52	NA	NA	ND	5.52	NA	NA	ND	5.57	NA	NA
Nickel	mg/kg	15.9	40.6	19.83	1	3	54.7	19.07	1	3	22.4	8.56	<1	1	14.7	7.73	<1	<1
Selenium*	mg/kg	2	3.05	1.63	<1	2	3.64	1.53	<1	2	ND	1.38	<1	NA	ND	1.39	<1	NA
Silver	mg/kg	2	ND	0.71	<1	NA	ND	0.69	<1	NA	ND	0.69	<1	NA	ND	0.70	<1	NA
Strontium	mg/kg	--	149	39.87	NA	NA	321	43.27	NA	NA	19.9	8.13	NA	NA	16.3	8.05	NA	NA
Thallium	mg/kg	--	ND	1.42	NA	NA	ND	1.38	NA	NA	ND	1.38	NA	NA	ND	1.39	NA	NA
Vanadium	mg/kg	--	80.1	46.90	NA	NA	78.6	31.53	NA	NA	36.6	13.08	NA	NA	26.3	14.42	NA	NA
Zinc	mg/kg	124	132	58.99	<1	1	113	46.95	<1	<1	84.8	32.35	<1	<1	54.1	32.38	<1	<1
Calcium	mg/kg	--	3630	1712.17	NA	NA	58700	4810.78	NA	NA	1200	537.90	NA	NA	1630	764.40	NA	NA
Iron	mg/kg	--	48200	32966.67	NA	NA	40000	21851.11	NA	NA	19100	9607	NA	NA	18500	11126	NA	NA
Magnesium	mg/kg	--	9000	2544.17	NA	NA	7070	1807.61	NA	NA	2920	799.70	NA	NA	1490	773.20	NA	NA
Potassium	mg/kg	--	24700	4679.17	NA	NA	11700	2593.61	NA	NA	3340	1038.60	NA	NA	1480	835.60	NA	NA
Sodium	mg/kg	--	257	155.67	NA	NA	498	157.50	NA	NA	158	140.10	NA	NA	ND	139.20	NA	NA

Notes: Screening values based off of USEPA (United States Environmental Protection Agency) Region 4 Sediment Screening Value.
* = Screening value obtained from Lemley, A.D. 2002. Selenium assessment in aquatic ecosystems. U.S. Forest Service, Blacksburg, VA.
-- = No screening value available.
Maximum detection exceeds the USEPA Region 4 Sediment Screening Value.
Mean with full RL exceeds the USEPA Region 4 Sediment Screening Value.
COPEC = Constituent of potential ecological concern.
ER = Emory River.
HQ = Hazard quotient.
mg/kg = Milligram per kilogram.
NA = Not available.
ND = All samples were non-detects.
RL = Reporting limit.