**Remedial Investigation/Feasibility Study
of the Clinch River/Poplar Creek
Operable Unit**

Volume 5. Other Supporting Information

Appendixes J, K, L, M, N

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In response to regulators' requests, the D2 version has been reorganized. This volume differs significantly from Vol. 5 in the D1 version. Items in this volume may have appeared in a different volume in the D1 version or may be new. For a breakdown of the origin of the elements in this volume, please refer to page iii.

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Energy Systems Environmental Restoration Program

**Remedial Investigation/Feasibility Study
of the Clinch River/Poplar Creek
Operable Unit**

Volume 5. Other Supporting Information

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Environmental Restoration Activities
OAK RIDGE Y-12 PLANT
Oak Ridge, Tennessee 37831-8169
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

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NOTE: The following chart shows the various elements in this volume of *Remedial Investigation/Feasibility Study of the Clinch River/Poplar Creek Operable Unit* (DOE/OR/01-1393/D2) and their correlation to elements in the previous version of this document (DOE/OR/01-1393/D1).

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Tables K4–K8	Tables C1–C5
Figs. L1 and L2	Figs. A1 and A2
Tables L1–L4	Tables A1–A4
Tables L5–L15	Tables A7–A17
Tables L16–L27	Tables A30–A38
Table L28	This table did not appear in D1 version
Appendix M	Material in this appendix did not appear in D1 version
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EXECUTIVE SUMMARY

This report presents the findings of an investigation into contamination of the Clinch River and Poplar Creek near the U.S. Department of Energy's (DOE's) Oak Ridge Reservation (ORR) in eastern Tennessee. For more than 50 years, various hazardous and radioactive substances have been released to the environment as a result of operations and waste management activities at the ORR. In 1989, the ORR was placed on the National Priorities List (NPL), established and maintained under the federal Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Under CERCLA, NPL sites must be investigated to determine the nature and extent of contamination at the site, assess the risk to human health and the environment posed by the site, and, if necessary, identify feasible remedial alternatives that could be used to clean the site and reduce risk. To facilitate the overall environmental restoration effort at the ORR, CERCLA activities are being implemented individually as distinct operable units (OUs). This document is the combined Remedial Investigation and Feasibility Study Report for the Clinch River/Poplar Creek OU.

This report is organized into five volumes, the first of which presents the main text. Chapter 1 describes the regulatory setting, and Chapter 2 broadly portrays the environmental setting. Chapter 3 depicts the operational and release history of the site and characterizes in detail the nature and extent of contamination. Chapter 4 briefly identifies other regulatory requirements that are applicable or appropriate to the site. Chapters 5 and 6 assess the risk to human health and the environment, respectively. Chapter 7 explains the purpose and organization of the feasibility study. Chapter 8 defines remedial action objectives for the site; identifies pathways and contaminants of concern; and screens general response actions, potential remedial technologies, and process options. Chapter 9 develops remedial alternatives based on the remedial action objectives, the screened technologies, and representative process options. Chapter 10 analyzes, evaluates, and compares the remedial alternatives. Chapter 11 lists the references cited in the main text.

Volumes 2–5 consist of appendices that contain supporting data and information. Volume 2 characterizes the biota on the ORR (Appendix A) and summarizes data related to contaminant concentrations in water (Appendix B), in sediment (Appendix C), and in biota (Appendix D). Volume 3 presents information related to human health risk assessment (Appendix E) and ecological risk assessments (Appendix F). Volume 4 focusses on the feasibility study, detailing the selection of remedial process options and providing the basis for the cost estimates for each remedial alternative. Appendix I presents the applicable or relevant and appropriate requirements (ARARs), which help define the extent of the remedial response. Volume 5 is a compilation of data from individual studies that were conducted as part of the overall remedial investigation. As such, the volume addresses the quality assurance objectives for measuring the data (Appendix J), presents selected historical data (Appendix K), contains data from several discrete water characterization studies (Appendix L), provides data supporting the sediment characterization (Appendix M), and contains data related to several biota characterization studies (Appendix N).

BACKGROUND

The ORR is a 34,600-acre tract of land in Anderson and Roane counties, Tennessee. It is administered by DOE, and it houses three main facilities: the Oak Ridge Y-12 Plant, the K-25 Site (formerly known as the Oak Ridge Gaseous Diffusion Plant), and Oak Ridge National Laboratory (ORNL). Each facility was created in the early 1940s as part of the U.S. government's war effort. The K-25 Site was used for the large-scale production of enriched uranium until its shutdown in 1985. The Y-12 Plant had several missions, but it primarily manufactured nuclear weapons components; production there ended in 1992. ORNL was initially a pilot-scale plant for the production of plutonium, but its post-war mission has centered on nuclear reactor research and the production of radionuclides for use in medicine and science. In addition to these operations, each plant has housed large support operations, including maintenance shops; waste treatment, storage, and disposal areas; steam plants; storm and sewer drains; and infrastructure.

The Clinch River/Poplar Creek OU is located adjacent to the ORR and consists of the Clinch River and several tributary embayments in Melton Hill and Watts Bar reservoirs. Both reservoirs are large multipurpose impoundments created and maintained by the Tennessee Valley Authority. The OU extends from the upstream boundary of the ORR at Clinch River mile (CRM) 49 in Melton Hill Reservoir, downstream to the mouth of the Clinch River in Watts Bar Reservoir at Kingston. It also includes several embayments that extend up tributary streams, including the McCoy Branch embayment of Melton Hill Reservoir and the Poplar Creek embayment [up to Poplar Creek mile (PCM) 5.5] of Watts Bar Reservoir. Originally, the OU included all of Watts Bar Reservoir downstream of the confluence of the Clinch and Tennessee rivers, but this area was segregated into a new OU (the lower Watts Bar Reservoir OU) in 1994, and a CERCLA Record of Decision was reached in 1995. No action-based remedial alternatives were implemented in lower Watts Bar Reservoir. The OU is currently being monitored to ensure that exposure to contaminants remains low.

REMEDIAL INVESTIGATION

The remedial investigation had two primary objectives: (1) to characterize the nature and extent of contamination, and (2) to assess the baseline risk to human health and the environment. Under CERCLA, if site risks are too high, remedial action is generally warranted. This investigation was implemented in a phased approach. First, existing environmental data were used to develop a preliminary site model, which considered the known or suspected contaminant sources, the physical characteristics of the site, and the environmental fate of various contaminants. An initial round (Phase 1) of limited sampling of water, sediment, and fish was then conducted (in 1989) to confirm these historical data and to refine the site model. A much more extensive sampling effort (Phase 2) was conducted in 1994 to more definitively meet the objectives.

Nature and Extent of Contamination

Several contaminant sources were included in the site model. The waters of Poplar Creek were known to receive effluent from the Y-12 Plant (and the City of Oak Ridge) via East Fork Poplar Creek (EFPC), which enters the Poplar Creek at PCM 5.5. Large quantities of elemental mercury were released from the Y-12 Plant in the late 1950s, and small quantities currently continue to

escape from contaminated buildings, equipment, and soils. Increased levels of mercury, therefore, were predicted in water, sediment, and biota of Poplar Creek downstream of EFPC. (Contamination at the Y-12 Plant and contamination in the EFPC floodplain have been addressed separately in efforts at other ORR OUs). Other contaminants known to have been released from the Y-12 Plant include uranium, polychlorinated biphenyls (PCBs), and several metals. Poplar Creek also has historically received a variety of effluents from the K-25 Site, through which the creek flows. Numerous metals, uranium, PCBs, laboratory chemicals, and organic solvents are thought to have been released from the site. In addition, the downstream reaches of Poplar Creek formerly received coal ash from the K-770 steam plant at the K-25 Site, and sediment at this location was expected to contain elevated levels of several metals, particularly arsenic.

The contaminants of potential concern in the Clinch River below Melton Hill Dam are primarily man-made radionuclides, by-products of nuclear fission. Contaminants were released to the Clinch River via White Oak Creek, which enters at CRM 20.8. Studies in the 1960s demonstrated that water-soluble radionuclides were rapidly and greatly diluted upon entering the Clinch River and were quickly transported downstream, with little loss of contaminant mass (i.e., they remained in solution). However, those contaminants that adsorbed to particulate matter became bound to particles of suspended sediment and accumulated in areas of sediment deposition. Earlier studies indicated that the principal radionuclide of potential concern in Clinch River sediment at the beginning of this investigation was ^{137}Cs , which is strongly particle-associated and has a relatively long (30-year) half-life. Because peak releases of ^{137}Cs from ORNL occurred at the same time as peak releases of mercury from the Y-12 Plant, peak concentrations of each were known to co-occur in the lower Clinch River, buried under several inches of cleaner sediment. Although one would have expected sediment in the Clinch River below White Oak Creek to contain the highest levels of ^{137}Cs and other radionuclides, there was actually very little sediment in this portion of the river, most having been scoured and transported downstream by the periodic high-volume releases of water from Melton Hill Dam, located approximately 2 miles upstream.

Current contaminant releases from ORNL are much lower than those of the 1950s and 1960s and are largely due to leaching or runoff from waste disposal areas. Most of these areas are no longer in use and are themselves the focus of environmental restoration efforts at ORNL.

Fly ash from the Y-12 steam plant was formerly disposed of in a settling pond located near the headwaters of McCoy Branch on Chestnut Ridge. As a result, several contaminants associated with coal ash, particularly arsenic, were known to be present at elevated levels in surface water and sediment in the McCoy Branch embayment of Melton Hill Reservoir. Because the embayment is bisected by a road built on fill material, conditions were expected to be worse in the upper embayment, whose water had limited mixing (via a culvert) with waters of the lower embayment and the main reservoir.

In addition to these ORR-specific concerns, it was known that fish collected on and near the reservation contained more PCBs than fish found at most upstream reference areas. PCBs had been used at each of the three facilities. The ORR as a whole has likely been a source of PCBs to the environment. However, PCBs have been widely used in transformers and in industrial operations, and numerous potential sources exist throughout eastern Tennessee. The identification of sources is difficult because PCBs bioaccumulate in fish and other organisms to much greater levels than in

water or sediment, where they are largely undetected. The extent to which the ORR had contributed to the problem was unclear.

The knowledge of these site conditions was used to guide the remedial investigation. Much of the sampling focused on Poplar Creek, where the combination of multiple sources and site conditions (e.g., areas of significant sedimentation, less water volume than in the Clinch River) were expected to result in some of the highest levels of contamination. Sampling in the Clinch River focused on fish and sediment, media in which contaminants tend to accumulate. Sediment sampling was limited in the Clinch River between Melton Hill Dam and Poplar Creek because sediment was scarce there.

The results of the site characterization phase of the remedial investigation were consistent with the site model. The nature and extent of contamination were evaluated by identifying those study reaches in which levels of any contaminant in water, sediment, or biota were elevated in comparison with levels in upstream reference reaches. The nature and extent of contamination are described as follows.

- **Arsenic in surface water and sediment of upper McCoy Branch Embayment.** Average concentrations of arsenic ($4.1 \mu\text{g/L}$) in surface water exceeded the state of Tennessee's recreation-based Ambient Water Quality Criterion. This criterion is designed to protect persons who regularly consume fish taken from a particular body of water. In sediment, elevated levels of arsenic, vanadium, and boron were found throughout McCoy Branch Embayment, but concentrations were highest in the upper embayment.
- **Radionuclide levels in water, sediment, and biota of the Clinch River downstream of White Oak Creek.** Average gross alpha and gross beta levels and mean activities of ^{90}Sr and ^3H in surface water were a factor of ten higher than reference values. These data were extremely variable, probably as a result of the extreme variability in flow below Melton Hill Dam. A conservative evaluation of the radionuclide concentrations indicated that, even immediately below White Oak Creek, the state's Ambient Water Quality Criterion for protection of domestic supplies was not exceeded.

Levels of ^{137}Cs were elevated in Clinch River sediment below the mouth of White Oak Creek. This radionuclide has a strong affinity for particles, particularly the clay minerals that make up a significant portion of Clinch River sediment. However, the discharge of water from Melton Hill Dam resulted in the scouring of most of the sediment from this portion of the river, creating larger inventories of ^{137}Cs in the lower Clinch River, where sedimentation is greater.

Bluegill sunfish and largemouth bass collected in 1989 from the Clinch River near the mouth of White Oak Creek contained ^{137}Cs at levels 100 times that of fish from upstream reference areas. Catfish were found to have levels approximately ten times that of reference areas. Although elevated, these levels do not pose a significant risk to persons or wildlife consuming these fish, so radionuclide analysis was discontinued after the initial round of sampling.

- **Mercury in surface water, sediment, and biota of Poplar Creek downstream of East Fork Poplar Creek.** Average mercury concentrations in surface water, sediment, and biota were significantly elevated in Poplar Creek downstream of EFPC in comparison with average values

upstream of EFPC. Elevated concentrations (up to 0.19 $\mu\text{g/L}$) measured in Poplar Creek surface water below EFPC and in the Clinch River downstream of Poplar Creek exceed the state's Continuous Concentration Criterion (0.012 $\mu\text{g/L}$). This criterion is designed to protect aquatic life from chronic exposure to mercury. Although also elevated above reference values, mean mercury levels in fish did not exceed the Federal Drug Administration's action level (1.0 mg/kg) in any species sampled. Several individual largemouth bass, however, had mercury levels that exceeded this value. Increased body burdens of mercury were also found in benthic organisms living in Poplar Creek, in heron eggs and chicks from a rookery near Poplar Creek, and in laboratory mink fed a diet high in fish from Poplar Creek. A decreasing gradient of biological effects, as measured by a suite of physiological and physical indices, was found to extend from upper Poplar Creek downstream through the Clinch River. This gradient in effects can be roughly correlated with a decreasing gradient in fish body burdens of mercury and PCBs in the downstream direction.

- **Metals and radionuclides in the sediment of Poplar Creek.** In addition to mercury, contaminants in Poplar Creek sediment that were elevated above reference levels were silver, arsenic, boron, cadmium, copper, chromium, nickel, vanadium, ^{238}U , ^{235}U , ^{234}U , ^{99}Tc , ^{137}Cs , and ^{60}Co . PCBs (Aroclor 1254), rarely detected in sediment anywhere in the system, were detected in Poplar Creek. As with mercury, concentrations of copper, cadmium, and chromium increased immediately below EFPC and likely represented releases from the Y-12 Plant. Concentrations of silver, nickel, ^{99}Tc , and the uranium isotopes were elevated below K-25 discharge points, and copper and chromium concentrations in this area were substantially increased above the already elevated levels found below EFPC. Increased levels of arsenic, vanadium, and boron were found in lower Poplar Creek and were associated with an area where the disposal of coal ash from the K-770 steam plant historically took place. The increased levels of ^{137}Cs and ^{60}Co were restricted to the last mile of Poplar Creek and are thought to be caused by backflow from the Clinch River, which regularly takes place as a result of reservoir operations.
- **PCBs in fish of Poplar Creek and the Clinch River.** Mean PCB levels in largemouth bass were highest in Poplar Creek. Although no bass were available from the reference reach of Poplar Creek, concentrations were still greater than at most other study and reference sites.

Mean concentrations of PCBs in catfish were highest in Phase 1 samples collected from the White Oak Creek Embayment (now part of a separate OU) and in fish from the Clinch River immediately downstream. Levels were significantly increased over those in Melton Hill and Norris Reservoir catfish. Mean concentrations in catfish from Poplar Creek below the confluence with EFPC were greater than those in catfish from above the confluence. Mean total PCB concentrations in largemouth bass did not exceed the FDA action level (2.0 mg/kg) at any location. The mean concentration in catfish did not exceed this action level at any location (except at the White Oak Creek Embayment). However, individual fish from the Clinch River and Poplar Creek had concentrations that exceeded this level.

The PCBs detected in fish flesh were almost exclusively Aroclor 1254 and Aroclor 1260. An analysis of individual PCB congeners in catfish did not reveal any patterns that could explain additional sources of PCB contamination.

Risk Assessment

The data used to characterize the nature and extent of contamination were also used to meet the second objective of the remedial investigation, risk assessment. The baseline risk assessment contained in this report consists of a human health risk assessment and an ecological risk assessment.

Risk to human health was evaluated for seven exposure scenarios, each of which contained one or more pathways through which exposure actually occurs. The seven scenarios were (1) the use of surface water as an untreated drinking water source, (2) the consumption of fish, (3) the use of the reservoir shoreline during winter drawdown, (4) swimming, (5) the hunting and consumption of waterfowl that frequent the ORR, (6) the dredging and subsequent land disposal of sediment, and (7) the use of surface water for irrigation. In each scenario, risk from carcinogens was assessed by assuming a 30-year exposure duration, and risk from noncarcinogens was assessed by assuming a 6-year exposure period. Under CERCLA, media whose pathways result in either a cumulative excess cancer risk of $1.0E-04$ or a Hazard Quotient of 1.0 (a measure of noncarcinogenic exposure) generally warrant remedial action at the site.

The human health risk assessment evaluated the risk from each contaminant for which sufficient data existed to obtain a representative concentration. Therefore, the human health risk assessment identified certain analytes whose presence did not appear to be the result of the ORR operations. Because these contaminants might have contributed significantly to overall risk, they generally were included in the risk assessment.

Thirty-five potential contaminants of concern were identified in Clinch River and Poplar Creek water, sediment, and fish. The majority of contaminants were found in deep sediment, and the greatest risks were identified through the agricultural pathways. Of the contaminants identified, only 2 in water, 7 in fish, and 19 in sediment were clearly site-related.

Eight contaminants of concern, all noncarcinogens, were identified in surface water in the OU. Five were identified in the drinking water scenario; the non-site-related analyte manganese drove the risk in all reaches except in upper McCoy Branch, where arsenic contributed most of the risk. Seven contaminants of concern were identified in the irrigation scenario, and two were identified in the swimming scenario (Poplar Creek only). The two contaminants identified in the swimming scenario (Di-n-octylphthalate and Aroclor 1254, also identified in the irrigation scenario) were detected infrequently and therefore might not be contaminants of concern. In general, the number of contaminants of concern in each scenario was greatest in Poplar Creek and least in McCoy Branch.

Seven contaminants of concern were identified in the shoreline-use scenario, which was based on contaminant concentrations in near-shore sediment only. No such data were collected for McCoy Branch embayment; therefore, assessment of this scenario was not conducted for the area. Noncarcinogenic risk was common throughout near-shore areas along both the Clinch River and Poplar Creek, and it was driven almost exclusively by manganese via inhalation of resuspended sediment. A significant ($<1.0E-04$) excess cancer risk existed in one subreach of Poplar Creek, primarily because of chromium exposure via the inhalation pathway.

Eleven contaminants of concern were found in fish. Most of the contaminants were organic compounds (PCBs and pesticide residues) and were found in catfish and largemouth bass from both the Clinch River and Poplar Creek. The excess cancer risk from the consumption of catfish exceeded $1.0\text{E}-03$ in all study reaches, primarily as a result of Aroclor 1260. The excess cancer risk from the ingestion of largemouth bass was generally equal to or less than one half of that from the ingestion of catfish. Arsenic and Aroclor 1260 were the primary contributors to carcinogenic risk from the ingestion of largemouth bass. Several radionuclides were also identified as carcinogenic contaminants of concern, but they generally contributed only a small portion of the total risk. The exception was ^{137}Cs , which contributed a significant portion of the risk associated with the ingestion of largemouth bass from the Clinch River immediately below the mouth of White Oak Creek. Contaminants of concern that were important noncarcinogens included mercury, Aroclor 1254, and chlordane in one or more species in Poplar Creek and the Clinch River.

In the dredging scenario, 31 contaminants of concern were identified in sediment. This scenario assessed the risk from contaminant exposure that would occur if dredge spoil were placed on land where it was accessible to humans. Several direct exposure pathways were evaluated, as were several agricultural scenarios in which contaminant concentrations in produce, milk, and beef were modeled from sediment contaminant concentrations.

Of the direct pathways, external exposure to gamma-emitting radionuclides in spoil from throughout most of the Clinch River (including Melton Hill Reservoir) and at the mouth of Poplar Creek would result in an excess cancer risk greater than $1.0\text{E}-04$. At all locations downstream of White Oak Creek, the primary contributor to risk via external exposure was ^{137}Cs . In Melton Hill Reservoir, the risk was primarily due to ^{60}Co from a non-DOE source (now closed) on Braden Branch. In all reaches for which data were available, manganese in spoil posed the greatest risk to adults and children via the inhalation of resuspended sediment. Barium similarly posed ubiquitous risk but generally only to children. In addition to this noncarcinogenic risk, the inhalation of resuspended spoil from lower Poplar Creek would result in an excess cancer risk of $2.1\text{E}-04$, primarily due to arsenic and chromium. Finally, the incidental ingestion of arsenic and mercury in spoil from lower Poplar Creek would be potentially harmful to children.

In the three agricultural pathways evaluated under the dredging scenario, the milk and meat ingestion pathways showed the most carcinogenic potential. Evaluation of the majority of the reaches for which data were available indicated that the ingestion of milk and beef produced with vegetation grown on dredge spoil would result in an excess cancer risk greater than $1.0\text{E}-04$ and that many reaches had risk values an order of magnitude greater. The contaminants responsible for the majority of this risk were members of a class of ubiquitous contaminants known as polycyclic aromatic hydrocarbons. In particular, benzo(a)pyrene and dibenz(a,h)anthracene drove this risk. In addition, in those reaches where it was detected, Aroclor 1260 contributed significantly to the risk. By contrast, the excess cancer risk in vegetables was generally lower, exceeding the $1.0\text{E}-04$ threshold in only two locations; in these locations the risk was driven by different analytes than in the other two pathways. In Poplar Creek adjacent to the K-25 Site, ^{99}Tc was the primary contributor to risk, although nine other analytes at this location were also of concern. At one location in the Clinch River, the organic analyte N-nitroso-di-n-propylamine was identified as a contaminant of concern but was detected in only one of three samples from that reach.

Evaluation of every subreach for which there were data indicated that one or more of the agricultural pathways posed an unacceptable risk under the dredging scenario. Fourteen noncarcinogenic contaminants of concern were identified. Risk in the milk and meat pathways was frequently driven by mercury and Aroclor 1254. Risk in the vegetable ingestion pathway was frequently driven by manganese, except in the Poplar Creek subreaches, where mercury was the concern.

The ecological baseline risk assessment estimated the ecological risk due to contaminants in the Clinch River/Poplar Creek OU. Seven assessment endpoints were evaluated during the assessment: (1) reduced species richness or abundance or the increased frequency of gross pathologies in fish; (2) reduced species richness or abundance of benthic macroinvertebrate communities; (3) reduced abundance or production of piscivorous wildlife populations; (4) reduced abundance or production of flying insectivorous wildlife populations; (5) reduced production in terrestrial plant communities; (6) reduced abundance or production of terrestrial wildlife populations; and (7) reduced viability of any individuals of a threatened or endangered species. For each endpoint, the reduction in the parameter was required to be 20% or more and to be the result of toxicity.

Three lines of evidence were used in the ecological risk assessment. First, the site and media-specific contaminant data used in the site characterization were evaluated against a series of benchmark values (e.g., the no-observed-effects level) to determine whether concentrations were great enough to cause adverse effects. Second, site-specific toxicity data were used to determine whether these levels were actually causing a toxic effect at a particular site. Finally, site-specific biological survey data (species richness and abundance) were used to help assess whether any toxicity was actually having an impact at the population or community level. When all lines of evidence were not available for each of the endpoints, risk assessment was usually based on contaminant data alone. The assessment for the fish endpoint used data on fish pathologies and fecundity as a fourth line of evidence.

The fish community in Poplar Creek was found to be at significant risk from episodically high concentrations of several metals (copper, mercury, nickel, and silver). Toxicity to fish was assessed by using several test protocols and organisms. Poplar Creek water was toxic to Japanese medaka and redbreast sunfish embryos, but not to fathead minnows or *Ceriodaphnia*. The fish community of Poplar Creek exhibited decreased species richness and abundance in comparison with a reference site with similar habitat (Bull Run Creek embayment of Melton Hill Reservoir). The results of the ecological risk assessment for fish indicated that, while individual fish were probably suffering some physiological impacts immediately below WOC, the fish community was not being significantly impacted in the Clinch River. In McCoy Branch, adverse impacts could not be ruled out, but data were unavailable for some of the lines of evidence (data on fish community, pathology, and fecundity).

The benthic macroinvertebrate community of Poplar Creek was identified as being at significant risk from several metals (arsenic, mercury, nickel, and silver) and PCBs in surface sediment. The benthic community contained fewer species and had less abundance of organisms than the communities at other sites. The toxicity data did not reveal consistently toxic effects, but in at least one test from each site a toxic response was observed in test organisms of at least one species. The benthic communities of the Clinch River and the McCoy Branch embayment were found not to be significantly impacted by contaminants.

Risks to piscivorous wildlife were assessed by using two avian species (great blue heron and osprey) and two mammalian species (mink and river otter). Two lines of evidence, biomonitoring data and contaminant data in whole fish, were available for assessing risk to heron and osprey. Partly because of their wide foraging behavior, osprey were found to be not at risk from contaminants even though mercury levels in Poplar Creek fish exceeded benchmark values. Although the data indicated that individual heron feeding exclusively in certain portions of Poplar Creek might be at risk, the local populations of the avian species were not expected to be impacted. This conclusion was supported by surveys of the reproductive success of osprey and great blue heron in Poplar Creek: the surveys found high reproduction and no increase in deformities. Mink were not identified as being at risk from contaminants in either Poplar Creek or the Clinch River. However, individual river otter feeding in Poplar Creek near the mouth of EFPC would be expected to have a significant risk of impaired reproduction. Although river otter do not currently exist within the OU, they have recently been reintroduced into east Tennessee, and the natural expansion of their range is expected to lead to their re-establishment on the ORR. Because the otter is a state threatened species, impacts to individual otter would be considered significant.

The risk to insectivorous wildlife was assessed by using one avian species, the rough-winged swallow, and two mammalian species, the gray and little brown bats. In each case, only one line of evidence (contaminant concentrations in benthic insects) was available for the assessment. These data indicate that a colony of rough-winged swallows feeding in Poplar Creek near the mouth of EFPC could suffer impaired reproductive potential as a result of mercury exposure, but the magnitude of the effects could not be evaluated. Populations of neither species of bat were found to be at risk. Although mercury concentrations in Poplar Creek were high enough to put individual bats at risk if they were to forage exclusively within this area, the foraging range of bats is great enough that this possibility is unlikely.

The ecological risk assessment for terrestrial wildlife was based on a dredging scenario much like that used in the human health risk assessment. The assessment examined risk both to the plant community that would develop on dredge spoil and to a herbivorous mammal (eastern cottontail) foraging there. A single line of evidence (contaminant concentrations in sediment) was available for use in the assessment. In the sediment of one or more study reaches, 12 metals were found at concentrations that exceeded benchmarks indicative of plant toxicity. The greatest number of metals were found in lower Poplar Creek, which contained arsenic, boron, cadmium, chromium, mercury, nickel, selenium, uranium, and vanadium. Benchmark numbers for plants were not available for a large number (i.e., 37) of the organic compounds; therefore, these analytes could not be evaluated. Populations of cottontails foraging on future spoil from lower Poplar Creek or from the Clinch River immediately downstream of Poplar Creek would be at significant risk of impaired reproduction due to levels of mercury and cadmium. A number of other analytes from these (and most other) reaches might pose a risk to individual cottontails foraging on future spoil; however, population-level effects from these contaminants would not be expected.

Ecological risk from radiation exposure was assessed separately. Risks to many of the same endpoint species were assessed, including a benthic organism (a mayfly), epibenthic (bottom-dwelling) fish, piscivorous wildlife (great blue heron), and a terrestrial herbivore (eastern cottontail). The assessment used the contaminant data for radionuclides to calculate the total radiation dose to these organisms. The DOE limit of 1.0 rad/day was used to assess acceptable exposures for most organisms; the International Atomic Energy Agency's recommended limit of 0.1 rad/day for

terrestrial organisms was used to assess exposure for cottontail rabbits. None of the calculated doses approached the appropriate benchmarks above; thus, the radiological contaminants in the various environmental media of the OU did not pose a significant ecological risk.

Based on the findings of the site characterization and risk assessments, a number of pathway and media-specific remedial goal options (RGOs) were developed for individual analytes, which represent concentrations corresponding to an ARAR or to an acceptable human health or ecological risk level. RGOs were developed only for those reaches containing one or more environmental media that exceeded one of the criteria and thus indicated the potential need for remedial action in that reach. In almost every reach studied, RGOs were developed for one or more analytes for each of the three media evaluated.

FEASIBILITY STUDY

On the basis of the remedial investigation, a feasibility study was conducted to identify remedial alternatives that would be effective in reducing contaminant concentrations or reducing or eliminating exposure and that could be feasibly implemented. The overall approach taken in the feasibility study was to focus on remedies for site-related contaminants as identified in the site characterization. Therefore, remedies were not evaluated for those reaches in which risk was primarily the result of non-site-related contaminants (e.g., manganese-driven risks in surface sediment or in water). In addition, no remedies were evaluated for surface water contaminants. Remediation of surface water is best effected at the source of the contamination, which in each case is primarily in upstream OUs. Moreover, remediation of the large volumes of flowing water is not practical. The use of institutional controls is the only remedy considered for limiting human exposure to fish. Therefore, active remedies evaluated in the feasibility study focus on site-related contaminants of concern in sediment.

Four alternatives are evaluated in the feasibility study. Alternative 1, the no-action alternative, is required by CERCLA to be evaluated. As the name implies, this alternative would be easily implemented at no cost (except for limited monitoring activities). However, the risk assessments indicate that the no-action alternative would not be protective of human health or the environment.

Alternative 2 consists of the use of only institutional controls and advisories to reduce exposure to contaminants in fish and sediment. Although not empowered under CERCLA, the state of Tennessee, the Tennessee Valley Authority, and the U.S. Army Corps of Engineers each have separate regulatory authority to regulate activities that could result in the disturbance of sediment in the Clinch River and Poplar Creek. Each of these agencies is party to an interagency agreement with DOE that requires the multiagency review, on a case-by-case basis, of all permit applications that propose activities with the potential to disturb sediment. The state of Tennessee currently issues fish consumption advisories warning the public to avoid or limit consumption of certain species of fish in which contaminant levels are unacceptably high. Currently, the state warns against the consumption of catfish from Melton Hill Reservoir and recommends limiting the consumption of catfish and sauger from the Clinch River below Melton Hill Dam. In both cases, the advisory is based on total PCB levels. The overall cost of implementing alternative 2, including future monitoring and administrative costs, is estimated to be \$3.4M annually.

Alternative 3 incorporates the institutional controls described in alternative 2 and in addition proposes the combined containment and removal of contaminated sediment from Poplar Creek. As noted earlier, the near-shore area (bottom elevation >733 ft msl) of Poplar Creek adjacent to the K-25 Site contained elevated levels of chromium that could result in an excess cancer risk greater than $1.0E-04$ via the inhalation pathway. Peak concentrations were found over an estimated 99,200-ft² area. Containment of contaminants in this area with a geotextile membrane and riprap would cost approximately \$5.5M to implement. In addition, the presence of several contaminants in the sediment of Poplar Creek posed a risk to benthic organisms. Seven separate locations in Poplar Creek would be remediated, through the use of a combination of sediment containment technologies in the near-shore areas (bottom elevation >733 ft msl) and sediment removal technologies in deep water areas (bottom elevation <733 ft msl). A total area of 388,800 ft² is proposed for containment, and a total of 179,250 yd³ for removal (the top 3 ft of sediment), at a total cost of \$109.6M. Removal of the deep sediment would also address the potential for future risks to human health and the environment in the dredging scenario.

Alternative 4 also incorporates the institutional controls of alternative 2, but in addition it proposes the removal of contaminated sediment from Poplar Creek. The near-shore area of Poplar Creek that is adjacent to the K-25 Site and that poses an excess risk to human health would require the removal and safe disposal of approximately 12,800 yd³ of sediment at a cost of approximately \$9.5M. Removal of those sediments in Poplar Creek that pose an ecological risk would require the removal and safe disposal of approximately 226,500 yd³ of sediment, at a cost of approximately \$123.5M. Because benthic habitat extends bank-to-bank, addressing the existing ecological risk by removing sediment would also address both the existing human health risk in the near-shore scenario and the potential for future human health risk and ecological risk in the dredging scenario.

Appendix J

**QUALITY ASSURANCE/QUALITY
CONTROL DATA**

J. QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT OF DATA

The Quality Assurance/Quality Control (QA/QC) Program for Phase 2 of the Clinch River Remedial Investigation (CRRI) was designed to comply with both Department of Energy (DOE) Order 5700.6C and Environmental Protection Agency (EPA) QAMS-005/80 (EPA 1980a) guidelines. QA requirements and the general QA objectives for Phase 2 data were defined in the Phase 2 Sampling and Analysis Plan (SAP) (DOE/OR/01-1111&D3)-Quality Assurance Project Plan, and scope changes noted in the Phase 2 Sampling and Analysis Plan Addendum-DOE/OR/01-1254&D1). The QA objectives for Phase 2 data were the following:

- Scientific data generated will withstand scientific and legal scrutiny.
- Data will be gathered using appropriate procedures for sample collection, sample handling and security, chain of custody (COC), laboratory analyses, and data reporting.
- Data will be of known precision and accuracy.
- Data will meet data quality objectives (DQOs) defined in the Phase 2 SAP.

The QA objective for all data collected during Phase 2 was, therefore, to obtain reproducible, precise, and accurate measurements consistent with the intended use of the data and the limitations of the sampling and analytical procedures used. These objectives were met through the development and implementation of a thorough data assessment process that included data evaluation, data quality indicators, sampling uncertainty, field quality control, analytical laboratory quality control, data and records management systems, and a QA oversight program of audits and surveillances.

One hundred and thirty-four sampling events were conducted for sediment and water. Separate contaminant studies on heron, mink, geese, and fish were also conducted. Approximately 4,400 inorganic, 3,000 organic, and 2,000 radiological samples were analyzed by ten laboratories during the Phase 2 site characterization. Matrices included sediment, water, fish, heron, mink, mayflies, geese and duck. In addition, over 500 pH, alkalinity, and total suspended particle determinations were conducted by CRERP staff. Toxicity and bioindicator measurements were also performed by Environmental Sciences Division (ESD) staff for the Clinch River Environmental Restoration Program..

The data were compiled by the laboratories into over 900 sample data packages that contained raw sample data and all quality control associated with each sample for most of the samples collected prior to July 1994. After July 1994, approximately 90% of the sediment and water data were reported as Level C or Level III data packages. Level C packages contained signed chain-of-custody forms, case narratives, sample results, and all quality control information such as calibration, spike, blank, and duplicate data. The only difference between the Level C (or III) and Level D (or IV) packages was that the Level D packages contained raw data, sample preparation records, and copies of pertinent logbook information. Sample results were also received electronically by the project data base manager and loaded into a large working data base.

Both qualitative and quantitative criteria are used as indicators of the quality of the data. In determining whether the data are usable, especially for the decision process, the integrity and authenticity of the data must be evaluated, and the analytical uncertainty must be known. Indicators generally used

to assess the data quality are completeness, precision, accuracy, representativeness, comparability, and sensitivity.

J1. COMPLETENESS

The overall QA completeness goal for the program was to obtain valid analytical results for at least 90% of the samples collected during the program. Overall completeness for all Phase 2 media and analyses exceeded this goal. Less than one percent of the analyses were rejected. Rejected data occurred because of low spike recoveries and low sensitivity.

J2. PRECISION

Analysis of laboratory replicates provided an assessment of the precision associated with the laboratory method. Precision was expressed as relative percent difference (RPD) for inorganic and organic analyses. For the inorganic analyses performed by Lockheed for surface and pore water, approximately 62% of the duplicates had a mean relative percent difference (RPD) of <10%. Of the duplicates, 83% had a mean RPD of <20%. For the inorganic analyses performed by TMA-ARLI for sediment, approximately 48% of the duplicates had a mean RPD of <10%, while 70% had a mean RPD <20%. Mercury speciation analyses performed at Brooks Rand had an overall mean RPD of <10%. The duplicate error ratio (DER) was used to assess duplicate agreement for radiological analyses. The DER is the ratio of the absolute difference of duplicate results compared to the sum of the uncertainties for the results expressed as a percent. The DER should be less than one. For the ESD Radiological Analysis Laboratory that performed the gamma analyses, the DER was <0.3. For other radiological analyses performed at Oak Ridge Analytical Services, the DER was <0.4, except for gross alpha and gross beta where the DER was <0.8.

Because it includes both the field and laboratory variability, analysis of field duplicates provided a total assessment of the overall precision of the sample data. For sediment, 75% of the semivolatile field duplicates had a mean RPD between 20-40%. Of the pesticide/PCB field duplicates, 75% had a mean RPD greater than 40%. Of the inorganic field duplicates for sediment, 85% had a mean RPD <30%. Overall, 21% of the sediment field duplicates exceeded the 35% criteria. For filtered surface water, overall, 23% of the field duplicates exceeded the 20% criteria. Failure to meet criteria was most often attributed to antimony, boron, copper, or zinc. For total surface water, overall, 15% of the field duplicates exceeded the 20% criteria with aluminum, boron, copper, iron, and nickel showing low precision. For pore water, overall, 40% of the field duplicates exceeded 20%.

Evaluation of sampling precision may be determined from the difference between the overall precision and the analytical precision. The usefulness of the precision data is limited to samples that contain contaminants at concentrations above the method detection limit (DL). Also, the analytical process must be in statistical control or the estimates of precision will not be meaningful.

J3. ACCURACY

Accuracy was primarily evaluated in Phase 2 through holding times, blanks, calibrations, LCSs, matrix spikes, surrogate spikes, and performance evaluation samples. Percent recovery was used to express the common systematic error component of accuracy, bias.

Holding times were met for approximately 95% of the samples. Of the holding times that were missed, only 68 resulted in rejected data (sediment and water, mercury).

Blanks, both in the field and the analytical laboratory, were used to check for bias resulting from contamination. Blanks were treated the same as samples. No blank corrections were performed on the Phase 2 data. Aldrin, benzo(ghi)perylene, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, and diethylphthalate were found in the method blanks that were analyzed with the surface water and pore water samples. Benzoic acid, 1,4-dichlorobenzene, 4-nitrophenol, butylbenzylphthalate, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, diethylphthalate, methoxychlor, pentachlorophenol, pyrene, and alpha-BHC were detected in some of the method blanks that were analyzed with the sediment samples. No significant contamination was found in the inorganic blanks. A few compounds were reported at levels less than the required detection limit.

Calibration data were used to estimate data variability whenever possible because analytical error could be introduced from variability in calibration constants, infrequent recalibration or over-calibration of the analytical system, and unstable calibration standards. Most of the calibrations met criteria. Several batches exhibited continuing calibration criterion outside the acceptance limits in the sediment semivolatile data. For ^{90}Sr analyses, two of the instrument performance assessments were not within acceptance criteria which resulted in flagged data.

Evaluation of the laboratory control samples showed that most met criteria. None of the exceptions resulted in rejected data. Boron recovery for some sample results failed to meet requirements because of the use of borosilicate glassware in the laboratory. Deviations occurred with the semivolatile water LCSs for 4-chloroaniline, 2,4-dinitrotoluene, hexachloroethane, and diethylphthalate. Since none of these compounds were detected in the samples, no qualification of the data was necessary.

Analytical, matrix, and surrogate spikes were used to assess accuracy also. Metals, anions, total kjeldahl nitrogen, and total organic carbon recoveries ranged from 80-100%. For sediment, average recoveries for acidic semivolatile compounds ranged from 40-90%, basic semivolatile compounds ranged from 50-90%, pesticide/PCB compounds ranged from 65-80%, and metals ranged from 15-100%. The lowest metal average recoveries were for antimony, cadmium, and selenium. For surface water and pore water, average recoveries for acidic semivolatile compounds ranged around 60%, basic semivolatile compounds ranged from 15-65%, and pesticide/PCB compounds ranged around 60-80%.

Average recoveries for the organic surrogates are summarized below:

	Sediment	Water	Pore water	Fish
2-chlorophenol-d4	76%			
phenol-d5	82%	63%	58%	
2-fluorophenol	79%	71%	64%	
2,4,6-tribromophenol	84%	85%	75%	
1,2-dichlorobenzene-d4	68%			
nitrobenzene-d5	73%	78%	75%	
2-fluorobiphenyl	83%	74%	72%	
terphenyl-d14	97%	82%	52%	
tetrachloro-m-xylene	87%	63%	48%	90%
decachlorobiphenyl	92%	67%	41%	90%

J4. REPRESENTATIVENESS

All measures taken to ensure that bias was not introduced into the sampling and analysis also contributed to sample representativeness. Measures such as proper preservation, use of standard analytical methods, adherence to appropriate holding times, and use of field and laboratory blanks, equipment rinsates, and proper containers were utilized so that the data would accurately reflect the analyte of interest at the environmental site.

J5. COMPARABILITY

The use of accepted methods and SOPs and participation in intralaboratory performance evaluation testing demonstrated comparability. Sample collection, preservation, storage, preparation, analysis, and reporting were performed consistently so that the end user could confidently compare data sets generated by different sampling events or different laboratories.

J5.1 Comparison of mercury results

Results for total mercury from two different laboratories were compared (Brooks Rand and Lockheed for surface water, Brooks Rand and TMA-ARLI for sediment). Sediment samples were splits from the same core, while surface water samples were collected at the same site, on the same date, at approximately the same time. Eleven surface water and 70 sediment sample pairs were available for comparison.

Results for total mercury from Lockheed for surface water were consistently higher than Brooks Rand results. The correlation coefficient (r) when all samples are included is relatively low (0.286). This low correlation is due primarily to two observations. When observation 10 is removed from consideration, r increases to 0.524, and when both observation 6 and 10 are removed, r increases to 0.875. Samples sent to Brooks Rand were collected by a specialized technique requested by the laboratory, in order to minimize contamination. The consistently higher mercury values from Lockheed may be a result of contamination during sample collection and processing.

Of the 70 sediment sample pairs compared, results from both laboratories were always lower than 13 mg/kg with five exceptions. Results from four of those pairs showed higher than average values from both laboratories (30 to 141 mg/kg). The fifth sample pair had a high result from TMA-ARLI (104 mg/kg) and an approximately average value from Brooks Rand (3 mg/kg). The correlation coefficient, r , for all sediment sample pairs is 0.477. When the five sample pairs discussed above were removed from consideration, sample results from both pairs were relatively consistent ($r = 0.881$).

J5.2 Comparison of Total and Dissolved Concentrations

The total analyte concentration is the concentration determined on an unfiltered samples following vigorous digestion. The dissolved analyte is defined as the analyte present in a representative water sample which passes through a 0.45 micron membrane filter. Dissolved concentration of an analyte must not exceed total concentration in a sample analyzed by the same analytical method. The relative difference is calculated as the percent of the difference between the dissolved and total concentrations divided by the total concentration. The difference was only computed when both the dissolved and total concentrations were greater than the detection limit. Most of the differences between the concentrations can be attributed to the error associated with approaching the detection limit for antimony, arsenic,

chromium, copper, lead, molybdenum, nickel, uranium, vanadium, and zinc. Problems with boron may possibly be due to the use of borosilicate glass by the laboratory.

J6. SENSITIVITY

Sensitivity was achieved by requesting the lowest detection limits possible for each analysis, as well as meeting holding times and using the correct sample preservation. The ability to accurately report a contaminant of concern at or above the detection limits was a primary concern in evaluating false positives and false negatives. Early in the project, Brooks Rand failed to qualify data near the method detection limit. During evaluation of the data, the average of the trip blanks was used to qualify the data as detects or nondetects.

J7. CORRECTIVE ACTIONS

During the sampling and analysis process as well as the review process, problems were documented using a Programmatic Exception Report (PER) form (ER/CR-SOP1024). Approximately 400 PERs were filed containing ~850 individual exceptions. A FoxPro data base was used to track each exception and to provide responses back to the disposition team, composed of quality assurance staff, the Analytical Services Coordinator (ASC), the Data Base Manager, and other pertinent personnel. Each deficiency was tracked to closure by Clinch River personnel. Key words that summarized a type of quality problem were assigned to each exception to track quality control trends. The problems were further categorized into internal or external problems to denote those items which were internal to the program and thus root cause could be addressed. Root cause was not pursued for those items categorized as external problems. Several types of problems were considered repairable during the review process. These included missing information, transcription errors, illegible information, missing chain-of-custody forms, errors in calculation, and missing or incorrect units.

Two major quality control problems identified in internal PERs were data package and field errors. Root causes listed most frequently were inattention to detail, mistakes in specifications, and procedural problems. Externally, the most frequent quality control problems were errors in data packages, electronic data, sample identifications and sample results/units. Although these problems were corrected with no long-term effects on the data quality, the errors did create scheduling conflicts and increased chances of error during the data assessment.

J8. QUALIFICATION OF THE DATA

During review of the field and analytical data, two sets of qualifiers were assigned to the data. The first set was assigned by the analytical laboratory, as required by each individual method. The second set was assigned by the data reviewers. The review qualifiers were also accompanied by one or more reason codes. Analytical results included the concentration of the analyte in the sample if it was present and measurable. When an analyte was not detected in a sample, the sample minimum quantitation limit for that particular sample was reported accompanied by a "U" suffix. When spectral data indicated the presence of an organic compound that met the identification criteria but the result was less than the sample quantitation limit, a "J" qualifier was assigned, indicating that the result was an estimated value. In data analyses, these "J" values were treated as measurable results.

The result qualifiers assigned by the laboratories, validators, and electronic screening were summarized into an overall qualifier for end users. Only qualifiers which affected how the data are used were included in the overall qualifier. Under the risk assessment guidelines used for the project, data were either rejected, treated as nondetects, or used as reported. Additional data checking was performed as the data were summarized and evaluated for the health and ecological baseline risk assessments.

An end result use flag was also assigned to each data result. The use flag was either "Y" to symbolize that the data were usable or "N" for unusable data. Although rejected data was assigned an "N" for unusable, the primary reason for unusable data was duplication of sample results because of dilution, reanalysis, analysis by another method, or second column confirmation analysis for pesticides/PCBs.

An overall summary of the quality control problems found during data validation using the assigned reason codes shows that the predominant reasons for rejected results were poor spike recoveries and holding times.

J9. DATA REVIEW

The primary goal of the Clinch River Environmental Restoration Program was to ensure that the analysis of all these environmental samples produced data of known quality. According to EPA, "the quality of data is known when all components associated with its derivation are thoroughly documented, with such documentation being verifiable and defensible" (EPA 1990). To meet this goal, data used in this CRRI report were evaluated using the following techniques, as applicable: field data review, electronic data verification, data inventory, contract compliance screening, electronic review, manual review, and Level C or D validation. During each level of review, if problems were found which might affect the useability of the data, the sample results were qualified. The origination of the qualifier and the reason for qualifying the data were also documented. These qualifiers were condensed into one final useability code for the end user. The final phase of the evaluation which entailed assessing the contaminant data by location and risk used these final qualifiers and useability codes as indicators of the quality of the data.

For the field data review, a field data package containing all field sampling related documentation was assembled for each water and sediment sampling event. The field sampling related documentation included the weekly sampling schedule, the Field COCs, the Field Collection Task Map (FCTM), the Laboratory Processing Task Map (LPTM), the Sample Collection Information form, site maps or geographic positioning system data, field data forms, the Field Sampling Review Checklist, and copies of pertinent field logbook pages. An internal inventory and field data review was initially conducted by the sampling team leader according to ER/CR-SOP2020. Documentation of the internal inventory and review was also included in the field data package. Following the internal review, an independent assessment was performed by a field validator. The field validator was a person experienced in field sample collection who was not a member of the sampling team. Field data obtained during the sample collection event were assigned qualifiers by the field validator.

The first five sampling events for Phase 2 occurred in November 1993. Seventy-two PER indices were initiated which pertained to the sample collection and processing activities for these five sampling events. Twenty-four indices pertained to improper/missing signature or corrections, twenty-three pertained to missing data, six pertained to inadequate sample volume, six pertained to incorrect task maps, and four pertained to COC problems. The remaining nine indices pertained to six other quality control categories.

The remaining 126 sampling events for Phase 2 occurred after November 1993. Only 24 additional PER indices were initiated which pertained to sample collection and processing activities. For the five quality control categories which accounted for 63 of the 72 PER indices initiated for the first five sampling events, only 5 additional PER indices were initiated for the subsequent 126 sampling events. Seven PER indices pertained to field equipment failure, three PER indices pertained to calibration problems, and three PER indices pertained to inadequate equipment backup. The remaining 11 PER indices pertained to 10 other quality control categories. The considerable reduction of PER indices initiated for the last 126 sampling events versus the first five sampling events demonstrates the value of both a field sample collection documentation/field data validation review process and a program level exception documentation and resolution process for environmental restoration activities. As a result of the field data review, the sampling events were completely and consistently documented.

During the **electronic data verification**, an evaluation of the project data base was performed to ensure accountability, traceability, correctness, and completeness. Accountability checks included confirming that data collectors and generators were identified and reviewing data transfer and data entry documentation. Data base entries were cross checked with hard copy sources such as COCs, Sample Collection forms, data packages and data validation reports. Correctness checks involved verification of data transfer processes, double data entry, and comparison of data base values with the source. Completeness checks verified that all required descriptors for both samples and individual results were present, correct, and consistent with applicable plans and procedures, and/or Oak Ridge Environmental Information System (OREIS) formats. These checks reviewed locations, coordinates, sample IDs, units, dates laboratory sample IDs, methods, parameter names, result formats, laboratory flags, and validation flags, among others.

Data inventory of all data packages was conducted to verify completeness and ensure that any missing deliverables could be obtained before the final report was compiled. Inventory was conducted according to procedure ER/CR-SOP1019.

A **manual review** of all data package batch narratives was conducted and summarized. These reviews were also used to flag data that did not meet criteria.

Contract compliance screening (CCS) was used initially for EPA Contract Laboratory Program (CLP) electronic deliverables to assess the adequacy of the electronic files. One hundred and twelve electronic deliverables were screened for potential formatting problems and CLP SOW compliance.

An **electronic review** of selected quality control information was conducted. Results of these checks were compared with other available information such as the CCS, inventory and validation. Data that did not meet criteria were flagged with the appropriate qualifiers and reason codes and the type of review was designated. Organic laboratory blank contamination for sediment and water samples was assessed electronically and the data were flagged according to the guidelines in ER/CR-SOP1020. Holding times, surrogates, matrix spikes, and detection limits were also evaluated for sediment and water data. Biota data were evaluated when available electronically.

Validation was conducted according to ER/CR-SOP1020 which was written to address EPA criteria, Clinch River data quality objectives as expressed in a given laboratory Statement of Work (SOW), and specific method requirements. Approximately 118 sample data packages were validated by an independent third-party subcontractor from the 900 data packages that were received. Subcontractor personnel performing the validation were required by the Clinch River ER Program SOW to be trained, experienced, and proven able to perform the review procedures. The Clinch River ER Program required,

reviewed, and approved resumes and work training records. Data review deliverables for the validation consisted of the following:

- A data validation narrative summarizing by fraction the problems found that affected the data quality and the potential impact on the sample results. (Each narrative includes the name and signature of the data reviewer.)
- A completed checklist that detailed the review elements and QC problems
- Report forms for each sample with validation qualifiers and reason codes assigned to each analyte result
- A list of data review qualifiers and their meanings for use in the data evaluation

After validation was completed, the subcontractor entered the validation qualifiers into the data base. Each qualifier was also accompanied by one or more reason codes that summarized the qualifier assignment as well as a code which identified the source of the qualifier.

J10. DATA MANAGEMENT SYSTEMS

A comprehensive Information Management System (IMS) was used to provide organization, integrity, security, traceability, and consistency of the data generated during Phase 2. Specifically, the IMS supported the project data life cycle, including field sampling preparation, field measurements, sample tracking, laboratory analyses of environmental samples, data verification and validation, data consolidation and storage, and data transfer to OREIS, data analysis and interpretation, summarization and reduction of data, risk assessment calculations, data presentation, and data and document archival.

An ORACLE® data base was used to implement the IMS. Constraints were defined in the data base to ensure proper linkage of sample collection and analysis data and to enforce use of standardized codes. The data base resides on the Clinch River Project SPARC 10 workstation. The data base is protected from unauthorized access, deletion and modification by the ORACLE® security. Daily and weekly backups of the data base were performed and the weekly backup tapes were stored off-site.

Records generated by the program that are required to (1) provide a complete and accurate history of sample collection, analysis, and data reporting; (2) document conduct of program business; and (3) support any future legal or administrative actions that may be taken are retained in the project files. Similarly, records that furnish documentation or evidence of quality (e.g., program work plans and results of QA oversight activities) were designated QA records and added to the project files.

Records identified for Phase 2 sampling and analysis activities included project plans and approvals, field and laboratory notebooks, chain-of-custody and request-for-analysis forms, instrument listings for gamma spectroscopy, analytical laboratory data packages, and data validation summary reports.

A hard-copy repository is maintained in the Clinch River ER Program Document Management Center (DMC), which is located at ORNL, Building 1505. This repository and associated index data base provide for the organization, protection, retrievability, and accountability of project records. The indexing system provides sufficient information to permit identification of the record and the items or activities to which it applies. A CERCLA administrative record file will be the recipient of officially designated documents.

J11. AUDITS AND SURVEILLANCES

Audits and surveillances were performed by DOE Oak Ridge Operations (DOE-ORO); Martin Marietta Energy Systems, Inc. Central QA; and the Energy Systems Environmental Restoration (ER) QA specialist who reviewed and evaluated the adequacy of field and laboratory performance and ascertained whether the QA/QC Plan was completely and uniformly implemented. Results of these audits and surveillances were documented and reported to management. Follow-up corrective actions were taken as needed. Implementation was monitored by the Clinch River QA specialist and verified by the auditing organization.

The chronology of Readiness Review Assessments, Audits and Surveillances was as follows:

March 23-25, 1993	93CRRI-Q1 Surveillance to assess the state of readiness for Phase-2 Biota Field Sampling and Analysis.
April 28, 1993	93CRRI-L1 Surveillance to determine the TVA-Chattanooga Environmental Chemistry Laboratory plans to document and track all corrective actions for internal and external problems associated with samples received from the CR-ERP.
April 30, 1993	93CRRI-Q2 Surveillance to assess the state of readiness for Phase-2 Sediment Field Sampling and Analysis(S&A) & Water Toxicity Testing.
May 26, 1993	93CRRI-Q3 Surveillance to assess the state of readiness for Phase-2 Expanded Water & Sediment Toxicity Field Sampling and Analysis.
June 23, 1993	93CRRI-M3 Surveillance to verify that Phase-2 Biota(fish) Field Sampling and Analysis is conducted in accordance with the Phase-2 S&A Plan & SOPs.
June 28-July 21, 1993	DOE-ER Annual CR-ER Program Audit to evaluate the overall effectiveness of the CR-RI in collecting data of sufficient quality for technically defensible site remediation decisions.
August 30, 1993	Readiness Assessment Meeting for Phase-2 of the CR-RI.
September 28, 1993	93CRRI-M4 Surveillance to monitor and assess Phase-2 Sediment Field Sampling.
October 26, 1993	93CRRI-M5 Surveillance to verify that Phase-2 Biota(fish) S&A done by the TVA-Norris Aquatic Biology Group is being accomplished in accordance with the CRRI-Phase-2 S&A Plan and SOPs.
November 18, 1993	93CRRI-M6 Surveillance conducted to verify that CR-ERP Phase-2 Expanded Water S&A Field Activities are being done in accordance with the CR-ERP Phase-2 S&A Plan and SOPs.
December 20, 1993	93CRRI-M7 Surveillance to verify that corrective actions for deficiencies identified in surveillance 93CRRI-M6 have been satisfactorily completed.
December 15-16, 1993	DOE-ER CR-ERP Field Surveillance to evaluate the overall effectiveness of the CR-RI Phase-2 Sampling Program in collecting data of sufficient quality for technically defensible site remediation decisions.
February 24, 1994	94CRRI-M1 Surveillance to verify that Phase-2 Sample Management/Tracking and Related Documentation are being conducted according to CR-ERP Phase-2 guidelines and procedures.
February 24-25, 1994	94CRRI-M2 Surveillance to verify the Traceability of Records from Phase-2 Field S&A activities are being maintained according to applicable sections of the CR-ERP Phase-2 Technical Management Plan.

March 30, 1994	94CRRI-M3 Surveillance to determine the Status of Corrective Actions that are due for completion from past DOE-ER, MMES-ER, and other Phase-2 internal/project audits/surveillances.
April 25-29, 1994	94CRRI-M4 Surveillance to verify that Phase-2 Multi-Head Ballchek Sediment Core S&A is conducted in accordance with the CRRI Phase-2 S&A Plan, Sect. 3.3, and CR-ERP Work Aid WA-93-SW-10.
May 9-23, 1994	94CRRI-M5 Surveillance to verify that Field Sampling Activities for Other Biota(Blue Heron, Woodduck, & Contaminant Pathways in Food webs-MayFlies & Crayfish) is being conducted in accordance with the CR-ERP S&A Plan, Sect.3,4 and pertinent Phase-2 CR-ERP Biota procedure or work aid.
June 10, 1994	94CRRI-M6 Surveillance to verify that Phase-2 Deliverables from Subcontracted Analytical laboratories are being tracked to assure Phase-2 Task/SOW requirements and time frames are met.
July, 1994– August 26, 1994	DOE-ER Annual CR-ER Program Audit. 94CRRI-M7 Surveillance to evaluate the effectiveness of the system being used to track all types(i.e., QC) of Phase-2 samples for the QA/QC report.
Sept. 28-29,1994	94CRRI-M8 Surveillance to evaluate the Phase-2 Data Validation results and assessment to date.
October 26, 1994	94CRRI-M9 Surveillance to verify that Phase-2 Biota(fish-Biology Survey) Field S&A is conducted in accordance with the Phase-2 CR-ERP S&A and SOPs.
Nov. 29-30, 1994	94CRRI-M10 Surveillance to verify that all CR-ERP Phase-2 Task Leaders can account for all of their samples per requirements of Phase-2 S&A Plan, Addendum DOE/OR/01-1254&D1, Sect. 3.0.
December 19, 1994	94CRRI-M11 Surveillance to verify that all CR-ERP Phase-2 documentation and records are being maintained in a traceable manner to ensure the defensibility of all Phase-2 data.
January 27, 1995	95CRRI-M1 Surveillance to verify that all Phase-2 Deliverables from Subcontracted Analytical Laboratories, and Data Validation results are being completed and useability determined(per CR-ERP FY-95 milestone schedule for the RI/FS.
February 28, 1995	95CRRI-M2 Surveillance to determine if the Status and Schedule for the Preparation and Peer Review Process for the CR/Poplar Creek RI/FS Report has been established to ensure that all RI/FS sub-elements are completed in time to meet established dates.
March 30, 1995	95CRRI-M3 Surveillance to determine the Status of Corrective Actions that are due for completion from past DOE-ER, MMES-ER, and other internal/project audits/surveillances.

J12. STANDARD OPERATING PROCEDURES AND TRAINING

Whenever applicable, existing procedures were used for CRRI activities. Field sampling procedures from Kimbrough et al. (1990) were used, and many EPA Contract Laboratory Program (CLP) analytical procedures (field and laboratory) were specified. Procedures were developed to support technical and administrative activities of the CRRI when none existed. These activities included the following:

- Sampling processes
- Sample handling/custody
- Calibration of equipment used in obtaining samples and/or data
- Analytical processes
- Data reduction, validation, and reporting
- Internal QC checks
- Audits
- Surveillance and corrective action processes
- Specific routine functions required to assess data precision and completeness

The CRRI training program consisted of a training plan, which defined requirements for training frequency and trainer designation; a training needs assessment, which identified personnel to be trained; and the actual training on CRRI procedures. Training was completed as required in the appropriate SOP, and training records were maintained by the training coordinator for the CRRI. Generally, the extent of training was commensurate with the scope, complexity, and nature of the activity and the education, experience, and proficiency of the person.

J13. LESSONS LEARNED

Project Statements of Work

- Provide guidance/requirements in SOWs on how the laboratory should proceed if sample volume is insufficient to perform all requested analyses, including that the laboratory will be required to get guidance from CR-ERP as to which analyses are priority. This applies especially to biota samples, where volumes may vary depending on individual animals.
- Specify that the case narrative must list the IDs for samples reported in the package and must provide a cross-reference to laboratory sample IDs. Specify that any references to samples must include the project sample ID.
- Specify that the pages in the data package must be single-sided and on 8-1/2 x 11 paper and that notes should not be left on pages unless they are taped down so that they will go through the copier. (Response to TVA packages)
- In the future, the SOW should state that if the laboratory needs to report sample matrix/type other than as on COC (perhaps for software reasons), the laboratory should explain why in the case narrative (i.e., why the forms don't match COC). For example, if the sample matrix is listed as CART F on the COC and the laboratory had to report it as water due to software/program requirements, the case narrative should state that this occurred. (See PER-0228)
- All method numbers listed in SOWs should be verified before the SOW is final to ensure that the numbers referenced are for the desired method.
- Require that laboratories batch, analyze, and report no more than 20 samples in a batch. Check logins to ensure that no more than 20 are listed.

- Do not assign SDGs before samples are shipped. Track outgoing samples by the COC number. After the samples are logged in by the laboratory, track them by the SDG assigned by the laboratory.
- In results, laboratories sometimes discussed/referenced only pesticides or only PPCBs. Clarify the meaning of the acronym PPCB. (See response to PER-0093.)
- Resolve with Brooks Rand the question of the volume required for spikes. (Reference PER-0111.) They received what they requested but responded to PERs regarding batches of more than 20 samples by saying they had inadequate sample volume.
- Require the laboratory to more fully document the temperature and condition of cooler contents when they send confirmation of receipt of a shipment. Revise the sample login form to include a blank space for the laboratory to record temperature.
- To the extent possible, it is preferable to have only one SOW with a laboratory for like matrices and analyses (i.e., it would have been preferable to have SOWs 191 and 194 combined rather than separate.)
- To eliminate the possibility of misunderstanding, the SOWs with the laboratories should state that the due dates for deliverables are based on calendar days, not work days (i.e., 60 days means 60 calendar days, not 12 work weeks).
- Place more emphasis on and include specific instructions regarding how the laboratories should notify the project about problems, especially those discovered at receipt of samples.

APO Statements of Work

- Review of analytical laboratory SOWs needs to include a requirement that laboratories have back-up analytical equipment, parts, or access to back-up equipment in the event that primary equipment fails. (Ref. PER-94-CRRI-0108) (Suzanne Benson's file: 006769)
- The laboratory should prepare an EDD as part of the PE package. The ability of the laboratory to provide an acceptable EDD should be considered part of the qualification of the laboratory to provide services.

Field Data Validation

- Field validation proved to be very successful in identifying types of errors made at the beginning of field sample collection and processing. This enabled the field teams to proactively implement corrective actions that prevented recurrences of the errors.
- The proceduralized, real-time internal review by the sampling team of collection activities through examination of documentation precluded the need for programmatic exception reports.

Shipping

- The Coleman Sample Manager™ brand aluminum coolers proved to be more effective than the plastic coolers in consistently maintaining the samples at the desired temperature range of 4°C (+/- 2°) while in transit to the designated laboratory. Typically, these metal coolers were capable of maintaining the desired internal chamber temperature for one day longer than the plastic coolers.
- The metal coolers provided more protection for the glass sample containers, resulting in less breakage.
- For the first few months, glass sample containers were wrapped with plastic air-bubble packaging only once around the entire glass circumference, including the top and bottom. In response to the recurring problem of glass bottle breakage, sample containers were double wrapped with the bubble wrap material, and this significantly reduced instances of glass container breakage.
- Preparing coolers simultaneously for shipments to multiple analytical laboratories resulted in incorrect marking of the outside of one cooler, delivery to the wrong laboratory, and a two-day delay in delivery of samples to the correct laboratory. The temperatures of the affected samples were elevated above required preservation levels. To prevent this type of incident from recurring, whenever samples were shipped to two or more off-site laboratories on the same day, all shipping transactions were completed for one laboratory at a time.
- There was a total inventory of 25 coolers used for shipping Phase 2 samples to the various laboratories. This number was just barely adequate even under the scaled down volume of revised Phase 2 volume of sample collections. During each of the three separate "mega sampling events," the number of available coolers was less than adequate. CRERP should probably have had between 15 to 20 more coolers in order to have been able to consistently ship samples within one or two days after field collection rather than sometimes waiting three to four days to ship organic samples, and five to 8 days when shipping inorganic samples. Additionally, supplies of blue ice packs sometimes became a bigger issue than the coolers themselves during peak periods of shipping "mega sampling event" samples.
- Lockheed Analytical Services was the best of all the laboratories used during Phase 2 in returning coolers and ice pack supplies in a consistent, timely manner (i.e., return receipt usually within four days of leaving ORNL). The other out-of-state laboratories were slower, usually taking about ten to fourteen days for a cooler to return. There were several instances when the laboratory was contacted and faster turnaround times on returning CR-ERP coolers was requested. This resulted in only marginal, sporadic improvements. No consistent improvements were noticed. The only way to compensate for most of the laboratories being slow to return coolers would be to have more coolers and associated cooler supplies.
- Since the original sampling volume for Phase 2 was significantly scaled down, the available refrigerator storage space was always sufficient. The refrigerator storage space was sometimes a little tight, but nevertheless adequate. However, had there been no sample collection reduction for Phase 2, the existing refrigerator storage space would have been a problem. One large commercial TRUE™ refrigerator and two standard household-type refrigerators were used during Phase 2. Had the numbers of samples been collected as originally planned for Phase 2, one or more refrigerators would most likely have to have been procured and set up in the greenhouse.

- During Phase 2, leakage of water from sediments collected in the 8 oz. and 16 oz. plastic jars was a continuing problem even though there were internal adjustments to sample collection and processing. The root cause was determined to be excessive sediment on the threads of the sample jar even though CRERP personnel wiped the jar threads and lids. In the future, jars with wider openings will be used so that sediments can be put into the jars without getting grains of sample on the threads.
- Double bagging samples in plastic bags prevented liquid leaking out of the bags when sample containers broke or lids cracked during shipment.
- Include a temperature trip blank with shipments. Also include additional volume of chilled water in the cooler if only a few samples (i.e., 6-10) are shipped in a large cooler.
- During Phase 2, samples were wrapped the day before they were scheduled to be shipped from ORNL. This proved to be a good practice because it always allowed sufficient time to correct or compensate for any unplanned deviation or added work task associated with preparing a specific batch of samples for off-site shipment.
- Ensure that all samples, including biota samples, are shipped according to CRERP procedures or alternative procedures that have been reviewed and accepted by CRERP.
- Shipping work aids were written and implemented for preparation of required shipping records, sample tracking, and sample packaging and shipping. All three of these work aids proved to be very helpful.
- The use of a separate shipping folder for each day for each laboratory was very helpful.
- The establishment and use of a sample shipment checklist was very helpful to ensure a minimum number of errors or omissions when packing coolers and shipping to the associated analytical laboratory.

Data Package Receipt, Tracking, Handling

- For future projects, the data group assigned by the laboratory should be entered into the data base from the login faxed from the laboratory instead of when the data package is received.
- Improve review of the login for correct entry by the laboratory of sample ID, analysis, date received, etc.
- DMC photocopying errors indicate a need for upgraded photocopying equipment.
- In the future a space similar to that provided for the data base support staff would enable analytical services staff to work more efficiently. The space could also be used for the collection and maintenance of a project file.
- The use of colored folders was very helpful.

Data Base

- Do not start the project until the data base is ready.
- The use of data base-generated COC and SAR forms worked well. The project believes this approach contributed to quality by eliminating errors related to transcription, poor handwriting, or reproduction of handwritten COC or SAR forms.
- Consider supplying an electronic form of the COC to laboratories when samples are shipped. Having the laboratory use the electronic COC could eliminate transcription errors in IDs by the laboratory.
- Track all samples, including biota samples, in one data base.
- Use ORACLE rather than SAS for interactive data entry-type systems to avoid data base deadlock.

Electronic Data Deliverables

- The format of EDDs should be determined and communicated to the laboratory before the project begins.
- The laboratory should be required to demonstrate its ability to provide data in desired formats as part of qualification for the work.
- Memos transmitting EDDs to the Information Management Group should include the date the EDD was received.
- All copies of all disks should have the date received written on the label, including copies made by Information Management Group.
- Printing a list of files on diskette deliverables and taping the list to the diskette was a good idea.
- Lesson reinforced: All diskettes and data received by the project, including data received via modem, should be scanned for viruses.
- File EDDs and revised EDDs in diskette box holders by laboratory and SOW. After all diskettes are received, transfer to notebooks. This will enable all versions of a diskette to be filed together sequentially easily during the project. Don't attempt to submit EDDs to the DMC until the end of the project.
- Require the laboratories to submit a printed copy of the electronic files and verify in writing that the EDD has been checked against the hardcopy data package. Until no problems with the EDD exist, verify all electronic files against hardcopy packages.

Biota Samples

- Avoid the use of the following letters in sample IDs: "O," which may be incorrectly entered by the laboratory as a zero; "S," which may be entered as 5; "Z," which may be entered as 2; and "L" or

"I," which may be entered as 1. Handwritten zeroes should be crossed to avoid confusion with the letter "O."

- Ensure that biota samples are shipped according to CR-ERP procedures or alternative procedures that have been reviewed and accepted by CR-ERP.
- Generate Task Maps and COC and Sample Analysis Request forms for biota samples from the data base in the future.

Inventory

- Revise the inventory procedure, refining what is to be reviewed (e.g., CAS numbers?).
- Revise the inventory procedure to require that all handwritten PERs identify samples affected by the CRERP ID number, i.e., that the PER does just not say "a sample was ____" without identifying the sample by ID.
- Revise the inventory procedure to note that if a case narrative says all QC parameters were in control, the inventory specialist should take that to include calibration, continuing calibration, spikes, blanks, holding times.
- Revise inventory procedure to identify forms not required for a given analysis (e.g., Form 4 for tritium analyses, Form 11 for ICP/MS analyses.)

Validation

- Revise the validation procedure so that any detection limits that are below the method detection limits will be reviewed specifically for compliance to the SOW, not the method.

Programmatic Exception Reports

- Review and close PERs in a more timely manner.
- When items are identified as missing during inventory or validation, before contacting the laboratory review the hard copy original received from the laboratory to ensure that omission is not a project photocopying error.
- To avoid entering the same item twice in the PER tracking data base, write a program that will query the operator when a sample ID is entered and has already been entered once.
- Centralize the PER data base.
- Revise the PER procedure to lessen paperwork and redefine responsibilities.

Appendix K

SELECTED HISTORICAL CONTAMINANT DATA

Table K1. Selected metals concentrations in surface sediment

Parameter (ppm) ^a	East Fork Poplar Creek			Bear Creek			White Oak Creek			Poplar Creek		
	Max	Min (n=16)	Mean	Max	Min (n=3)	Mean	Max	Min (n=4)	Mean	Max	Min (n=3)	Mean
Mercury	165.0	11.0	40.0	0.7	<0.1	0.3	6.0	2.2	3.3	5.9	0.1	3.4
Arsenic	14.0	3.8	6.9	11.0	4.8	6.5	12.0	5.0	8.7	11.0	7.4	8.9
Cadmium	8.2	<0.5	1.6	8.6	<0.5	8.6	2.4	0.6	1.4	3.5	2.1	2.9
Chromium	58.0	24.0	37.0	35.0	16.0	22.0	290.0	66.0	163.0	38.0	19.0	27.0
Lead	170.0	36.0	80.0	85.0	35.0	52.0	51.0	33.0	40.0	38.0	23.0	32.0
Nickel	74.0	20.0	37.0	155.0	28.0	67.0	30.0	24.0	26.0	65.0	43.0	56.0
Silver	45.0	2.0	8.0	<1.0	<1.0	<1.0	10.0	2.0	6.0	2.0	<1.0	2.0
Zirconium	590.0	350.0	448.0	500.0	430.	500.0	480.0	260.0	365.0	470.0	220.0	340.0

Parameter (ppm) ^a	Clinch River Watts Bar			Background stations					
				Clinch River Melton Hill			Norris Reservoir ^b		
	Max	Min (n=4)	Mean	Max	Min (n=1)	Mean	Max	Min (n=3)	Mean
Mercury	2.8	0.3	0.8	<0.1	<0.1	<0.1	0.1	0.1	0.1
Arsenic	11.0	5.1	8.1	17.0	17.0	17.0	26.0	16.0	22.0
Cadmium	4.2	0.7	1.8	0.5	0.5	0.5	<0.5	<0.5	<0.5
Chromium	25.0	9.0	16.0	25.0	25.0	25.0	23.0	21.0	22.0
Lead	38.0	14.0	30.0	28.0	28.0	28.0	77.0	58.0	67.0
Nickel	38.0	14.0	21.0	36.0	36.0	36.0	28.0	24.0	26.0
Silver	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Zirconium	890.0	400.0	650.0	230.0	230.0	230.0	270.0	180.0	220.0

^appm is equivalent to mg/kg^bValues for Norris Reservoir include Clinch River miles 85.3 and 94.1 and Powell River mile 6.0.Source: Tennessee Valley Authority. 1985. *Instream Contaminant Study-Task 2, Sediment Characterization*, Vol. II. Office of Natural Resources and Economic Development, Knoxville, Tenn.

Table K2. Maximum concentrations (pCi/g) in fine-particle surface sediment

	Clinch River	East Fork Poplar Creek	Bear Creek	White Oak Creek	Poplar Creek	Norris Reservoir Control Station		Comparison data	
						Clinch River	Powell River	Tennessee River ^a	Clinch River ^b
Analysis/isotope									
Gross alpha	11	160	32	3	11	4	3	15	100
Gross beta	398	110	150	6600	60	42	37	65	91
Uranium (mg/kg)	7	90	200	4.1	14	5.9	2.3	^c	2.0
Sr-89	4	0.7	0.5	0	1	4	1	14	12.1
Sr-90	1.8	0.1	0.1	900	0.2	0.4	0.5	0.6	0.6
Gamma Spectral Analysis									
Co-60	1.2	^d	-	184	-	-	-	0.6	2.7
Cs-134	-	-	-	1.2	-	-	-	0.13	0.01
Cs-137	167	8.6	0.2	12100	1.9	0.9	0.7	5.5	83
K-40	27	21	18	25	16	27	16	27	84
Ra-226	0.7	-	-	-	-	-	-	2.3	1.4
Th-234	4	23	63	-	3.8	-	-	-	-
Eu-152	-	-	-	8	-	-	-	-	-
Eu-154	-	-	-	7	-	-	-	-	-
Am-241	-	-	-	4	-	-	-	-	-
Ac-228	2.2	2	1.8	4	1.1	2.2	1.8	2.7	2.1
Pa-234	-	-	-	-	-	-	-	4.6	4.8
Transuranics									
Pu-239	0.73	0.10	0.001	1.08	0.02				
Pu-238	0.03	0.02	0.001	0.007	<0.0002				
Am-241	0.51	0.05	0.04	0.46	0.02				
Cm-244	0.02	0.01	0.009	0.01	<0.0008				

^aMaximum concentrations reported by the Tennessee Valley Authority in surface sediment samples collected from the Tennessee River from 1981-1983

^bMaximum concentrations reported by the Tennessee Valley Authority in surface sediment samples collected from the Clinch River from 1974-1983

^cBlank cell indicates no analysis was performed

^dDash indicates isotope was not detected

NOTE: The lower limits of detection for all isotopes are typically 1 pCi/g, dry weight

Source: Tennessee Valley Authority. 1985. Instream Contaminant Study-Task 2, Sediment Characterization, Vol. II, Appendices. Office of Natural Resources and Economic Development, Knoxville, Tenn.

Table K3. Concentrations of ^{137}Cs and selected metals in sediment at recreation area beaches and at water intakes in the Clinch River. All units are mg/kg unless otherwise noted.

Analyte	Location			
	Emory River Mile 2 - Kingston Steam Plant intake	Clinch River Mile 13 - K-25 intake	Clinch River Mile 17 - campground beach	Upstream (maximum of all upstream sites)
^{137}Cs (pCi/g)	2.05	23.74	0.19	0.18 - CRM ^a 36 and 52.5
Arsenic	19	15	3.8	20 - CRM 36
Chromium	28	22	56	87 - CRM 120
Copper	18	13	17	25 - CRM 120
Lead	30	29	35	150 - CRM 87.5
Mercury	0.5	0.45	<0.1	0.16 - CRM 36
Nickel	17	29	42	61 - CRM 36
Phenanthrene	ND ^b	1.1	ND	0.44 - CRM 52.5
Pyrene	ND	0.96	ND	0.48 - CRM 52.5
Bis (2-ethyl-hexyl) phthalate	ND	0.42	ND	1.8 - CRM 41.5
Benzo(a)- anthracene	ND	0.44	ND	ND
Flouranthene	ND	ND	ND	0.63 - CRM 52.5

^aCRM = Clinch River mile

^bND = Not Detected

Source: Tennessee Valley Authority. 1991. *Results of Sediment and Water Sampling for Inorganic, Organic, and Radionuclide Analysis at Recreation Areas and Water Intakes—Norris, Melton Hill, and Watts Bar Lakes—Data Report*. Water Resources. Chattanooga, Tenn.

**Table K4. Concentration of radionuclides in Clinch River fish
(pCi/kg fresh weight)**

Fish species	Sample period	⁹⁰ Sr		¹³⁷ Cs		¹⁰⁶ Ru		⁶⁰ Co	
		Flesh	Total ^a	Flesh	Total ^a	Flesh	Total ^a	Flesh	Total ^a
Carp	1960–1962 1963	(17) ^b 500±140 (20) 91±22	(40) 5100±1700	(71) 510±57 (20) 320±110	(39) 560±79	(69) 170±18	(39) 290±78	(67) 66±6.1	(39) 49±9.9
Carp sucker	1960–1962 1963	(18) 540±190 (20) 22±4.4	(39) 940±120 (39) 4800	(122) 1200±460 (20) 460±82	(37) 640±67	(22) 120±30	(37) 56±16	(22) 120±19	(37) 32±6.8
Buffalo	1960–1962 1963	(3) 240±89 (20) 43±14	(30) 830±110	(5) 480±94 (21) 560±84	(30) 590±92	(5) 110±32	(30) 150±38	(5) 78±21	(30) 32±6.8
Sight feeders ^c	1960–1962	(109) 180±83		(126) 680±120		(127) 120±32		(127) 22±11	

^aflesh and carcasses, including bones, combined

^bNumber of samples

^cwhite crappie, bluegill, white bass, largemouth bass, sauger, and drum

Source: Cowser, K. E. And W. S. Snyder. 1966. *Safety Analysis of Radionuclide Release to the Clinch River*. ORNL-3271 Suppl. 3. Oak Ridge National Laboratory, Oak Ridge, Tenn.

Table K5. Comparison of mean values for various chemical parameters in fish in the lower Clinch River below Melton Hill Dam^a

Parameter	Bluegill	Largemouth Bass	Gizzard Shad	Lepomis	Approximate range of background concentrations ^{b, c}	Food and Drug Administration action level
Mercury	0.30	0.23	0.05	0.37	0.05–0.20	1.0
Cadmium	0.01	0.01	0.01	0.01	0.02–0.07	—
Chromium	0.05	0.08	0.17	0.03	0.03–0.10	—
Copper	0.25	0.33	0.63	0.30	0.15–0.90	—
Lead	0.07	0.12	0.10	0.14	0.03–0.70	^d
Nickel	0.72	0.55	0.51	0.60	0.20–0.60	—
Zinc	6.4	5.8	4.1	11.1	5–10	^d
PCB	—	0.20	0.22	0.15	<0.10	5.0

^aNumbers given are averages of the available data, 1976–1983.

^bAll concentrations given in $\mu\text{g/g}$ (ppm).

^cBased primarily on the statewide mean concentrations for trace metals in fish and on average concentrations in Melton Hill Reservoir at CRM 52.2.

^dThe U.S. Food and Drug Administration has no recommended action level for lead or zinc, but the Canadian Food and Drug Directorate has set standards of 10 and 100 ppm, respectively, for these metals.

Source: Tennessee Valley Authority. 1983. Summary of Existing Water, Sediment, Fish, and Soil Data in the Vicinity of the Oak Ridge Reservation. Report to the Department of Energy from the Tennessee Valley Authority Water Quality Control Branch.

Table K6. Comparison of average concentrations for selected parameters in fish from Poplar Creek^a

Species	Mercury	Chromium	Nickel	PCB
Bluegill	0.31	0.16	0.78	0.17
Largemouth Bass	0.59	0.19	0.56	0.38
Gizzard Shad	0.04	0.07	1.28	0.27
Lepomis	0.43	0.03	0.66	0.30
Channel Catfish	0.39	0.33	1.42	1.6
Approximate range of background concentrations ^b	(0.05–0.20)	(0.03–0.10)	(0.20–0.60)	<0.10

^aNumbers given are averages of the available data, 1976–1983. All concentrations given in $\mu\text{g/g}$ (ppm).

^bBased primarily on statewide mean concentrations for trace metals in fish and on average concentrations in Melton Hill Reservoir at CRM 52.2.

Source: Tennessee Valley Authority. 1983. Summary of Existing Water, Sediment, Fish, and Soil Data in the Vicinity of the Oak Ridge Reservation. Report to the Department of Energy from the Tennessee Valley Authority Water Quality Control Branch.

Table K7. Instream contaminant study – task 4, total PCBs in fish flesh samples from 16 sites in the vicinity of Oak Ridge, Tennessee**

Sample Site	Species	Individuals										Mean
		1	2	3	4	5	6	7	8	9	10	
Scarboro Creek	Channel catfish	U	U	U	U	U	U	U	U	U	U	–
McCoy Branch	Channel catfish	U	1.0	U	U	U	U	U	U	U		0.1
	Yellow bullhead	U										–
Melton Hill Dam	Channel catfish	U	U	4.7*								1.6
	Yellow bullhead	U	U	U	U							–
White Oak Creek Mile 0.2	Channel catfish	3.0*	2.4	2.2	5.6*	2.7	3.5*	2.8	2.8			3.1*
	Black bullhead	U	U									–
White Oak Lake	Common carp	U	0.2	0.6	U	1.0	U	U	0.4			0.3
Clinch River Mile 11.0	Channel catfish	1.1	1.5	0.3	2.1	0.9	0.4	1.7	0.7	0.5	U	0.9
Clinch River Mile 6.0	Channel catfish	0.4	0.6	1.1	0.2	0.6	0.5	0.6	1.6	0.8	1.0	0.7
Clinch River Mile 2.0	Channel catfish	0.3	0.4	0.9	0.6	0.7	1.5	0.6	0.7	0.7	U	0.6
Emory River Mile 1.0	Channel catfish	0.6	1.0	0.8	1.4	0.9	U	U	0.5	0.3	U	0.6
TRM 572	Channel catfish	U	0.3	U	0.2	0.2	0.5	U	0.4	0.4	0.3	0.2
TRM 558	Channel catfish	1.3	0.2	U	0.6	1.4	1.1	0.8	0.5	0.3	U	0.6
EFPC Mile 13.8	Bluegill	U	U									–
	Largemouth bass	U	0.5	0.9								0.5
	Common carp	3.1*	3.7*	2.0								2.9
EFPC Mile 8.8	Rock bass	U	U	U	U	U	U	U	U	U	U	–
EFPC Mile 4.0	Channel catfish	0.6										0.6
	Spotted sucker	U										–
	Northern hog sucker	U										–
Bear Creek Mile 0.4	Rock bass	U	U	U	U	U	U	U	U	U	0.2	Trace
Poplar Creek Mile 0.2	Channel catfish	U	U	2.1	U	U	U	0.7	1.8	2.5	3.4*	1.1

U – Undetectable level; * – Above FDA action level; ** – Total concentrations obtained by summing detectable levels. Source: Same as Table K6.

**Table K8. Instream contaminant study – Task 4, significant maximum concentrations for radioisotopes in fish flesh samples –
pCi/g, dry weight**

Analysis/isotope	NRC reporting level ^a	Tennessee River ^b	Lower limit of detection ^c	Clinch River	East Fork Poplar Creek	White Oak Lake	White Oak Embayment	Bear Creek
Gross Alpha	^d	5	0.1	.07	.9	.05	.07	.02
Gross Beta	^d	45	0.1	64	74	76	40	29
Sr-89	^d	1.2	0.5	.1	.2	.2	-1.6 ^e	^f
Sr-90	^d	0.3	0.3	.01	.06	.25	1.3	^f
Gamma spectral analysis^g								
Co-60	40	.03	.01	–	.03	.12	.07	–
Cs-134	4	–	.08	–	.11	.04	–	–
Cs-137	8	.2	.02	18	2.6	26	9.7	.4
K-40	^d	20	1.00	18	22	17	14	18

^aReporting levels for radioactivity concentrations in environmental samples as outlined in Draft NUREG-0472, Rev. 3, *Standard Radiological Effluent Technical Specifications for Pressurized Water Reactors*, January 1983.

^bMaximum concentrations reported by TVA in fish samples collected from the Tennessee River from 1981–1983.

^cLower limit of detection as determined by the method developed by Pasternack and Harley and described in Nucl. Instr. Methods 91, 533-4- (1971).

^dNo reporting level given.

^eNegative value is an artifact of counting statistics and does not infer a negative activity.

^fAnalysis not performed.

^gDash indicates isotope not identified in gamma spectral analysis.

Source: Tennessee Valley Authority. 1985. *Instream Containment Study–Task 5, Summary Report*. Office of Natural Resources and Economic Development. Knoxville, Tenn.

Appendix L

**SURFACE WATER CHARACTERIZATION-
SUPPORTING STUDIES**

Fig. L1. Relationship between precipitation, flow in White Oak Creek, and flow in the Clinch River during Phase 2 biased event sampling. Rainfall at NOAA/ATDL (top), flow rates at White Oak Dam (solid line), dilution of White Oak Creek water by the Clinch River (shading), and sampling events (Roman numerals). April–August 1994.

Fig. L2. Plots of rainfall, April–August 1994, at three gauges (see legend) on the Oak Ridge Reservation.

Table L1. Analytical results for the study of the distribution of contaminants downstream from the Central Neutralization Facility (PCM 3.4)

Distance downstream (m)	Media	Analyte	Qtr full	Half full	Full channel	Units
LOW FLOW PCM 3.4						
1	WHOL	Alkalinity as C	1.30E+00	1.40E+00	1.30E+00	MEQ/L
1	WHOL	Gross Alpha act	2.53E+00	1.24E+00	2.23E+00	PC/L
10	WHOL	Gross Alpha act	1.34E+00	.	1.24E+00	PC/L
100	WHOL	Gross Alpha act	1.62E+00	1.41E+00	1.19E+00	PC/L
1000	WHOL	Gross Alpha act	1.90E+00	.	1.73E+00	PC/L
1	WHOL	Gross Beta acti	3.99E+00	1.98E+00	1.70E+00	PC/L
10	WHOL	Gross Beta acti	1.76E+00	.	2.24E+00	PC/L
100	WHOL	Gross Beta acti	3.48E+00	2.85E+00	1.74E+00	PC/L
1000	WHOL	Gross Beta acti	2.79E+00	.	1.98E+00	PC/L
1	WHOL	pH	7.80E+00	7.60E+00	7.60E+00	
1	RE	Suspend partiel	3.40E+00	8.00E-01	8.00E-01	MG/L
10	RE	Suspend partiel	2.20E+00	.	6.00E-01	MG/L
100	RE	Suspend partiel	2.20E+00	2.00E+00	1.00E+00	MG/L
1000	RE	Suspend partiel	1.20E+00	.	1.60E+00	MG/L
1	WHOL	Turbidity	9.00E+00	3.90E+00	3.40E+00	NTU
10	WHOL	Turbidity	3.90E+00	.	3.50E+00	NTU
100	WHOL	Turbidity	3.60E+00	3.50E+00	3.30E+00	NTU
1000	WHOL	Turbidity	3.60E+00	.	3.80E+00	NTU
HIGH FLOW PCM 3.4						
1	WHOL	Gross Alpha act	2.51E+00	1.99E+00	2.00E+00	PC/L
10	WHOL	Gross Alpha act	1.60E+00	.	1.29E+00	PC/L
100	WHOL	Gross Alpha act	1.85E+00	2.25E+00	1.82E+00	PC/L
1000	WHOL	Gross Alpha act	1.80E+00	.	1.58E+00	PC/L
1	WHOL	Gross Beta acti	3.57E+00	4.94E+00	1.74E+00	PC/L
10	WHOL	Gross Beta acti	2.69E+00	.	2.25E+00	PC/L
100	WHOL	Gross Beta acti	2.50E+00	2.84E+00	6.99E+00	PC/L
1000	WHOL	Gross Beta acti	2.17E+00	.	2.37E+00	PC/L
1	RE	Suspend partiel	2.60E+01	1.92E+01	1.96E+01	MG/L
10	RE	Suspend partiel	2.08E+01	.	2.08E+01	MG/L
100	RE	Suspend partiel	2.28E+01	2.08E+01	2.04E+01	MG/L
1000	RE	Suspend partiel	1.96E+01	.	3.20E+01	MG/L
1	WHOL	Turbidity	.	2.10E+01	2.20E+01	NTU
10	WHOL	Turbidity	2.30E+01	.	2.00E+01	NTU
100	WHOL	Turbidity	2.10E+01	2.40E+01	2.20E+01	NTU
1000	WHOL	Turbidity	2.20E+01	.	.	NTU

Table L2. Analytical results for the study of the distribution of contaminants downstream from the mouth of Mitchell Branch (PCM 4.6)

Distance downstream (m)	Media	Analyte	Qtr full	Half full	Full channel	Units
LOW FLOW						
1	WHOL	Alkalinity as C	1.80E+00	1.50E+00	1.50E+00	meq/L
1	WHOL	Gross Alpha act	2.82E+00	2.65E+00	9.81E-01	pCi/L
10	WHOL	Gross Alpha act	2.03E+00	.	1.74E+00	pCi/L
100	WHOL	Gross Alpha act	2.72E+00	1.98E+00	1.92E+00	pCi/L
1000	WHOL	Gross Alpha act	1.62E+00	.	2.22E+00	pCi/L
1	WHOL	Gross Beta acti	4.34E+00	4.00E+00	2.10E+00	pCi/L
10	WHOL	Gross Beta acti	6.13E+00	.	3.72E+00	pCi/L
100	WHOL	Gross Beta acti	3.42E+00	5.92E+00	4.46E+00	pCi/L
1000	WHOL	Gross Beta acti	2.10E+00	.	9.39E+00	pCi/L
1	WHOL	pH	7.60E+00	7.60E+00	7.60E+00	
10	WHOL	pH	7.30E+00	.	7.32E+00	
100	WHOL	pH	7.39E+00	7.41E+00	7.46E+00	
1000	WHOL	pH	7.49E+00	.	7.50E+00	
1	RE	Suspend particl	4.20E+00	4.20E+00	4.00E+00	mg/L
10	RE	Suspend particl	4.80E+00	.	4.80E+00	mg/L
100	RE	Suspend particl	4.00E+00	4.80E+00	5.20E+00	mg/L
1000	RE	Suspend particl	5.20E+00	.	5.80E+00	mg/L
1	WHOL	Turbidity	4.10E+00	4.00E+00	4.40E+00	NTU
10	WHOL	Turbidity	4.10E+00	.	4.00E+00	NTU
100	WHOL	Turbidity	4.10E+00	4.50E+00	4.40E+00	NTU
1000	WHOL	Turbidity	4.20E+00	.	4.60E+00	NTU

Table L3. Analytical results for the study of the distribution of contaminants downstream from the mouth of East Fork Poplar Creek (PCM 5.5)

Distance downstream (m)	Media	Analyte	Qtr full	Half full	Full channel	Units
LOW FLOW, PCM 5.5						
1	WHOL	Alkalinity as C	2.40E+00	1.80E+00	1.20E+00	meq/L
1	WHOL	Aluminum	5.05E-02	1.44E-01	1.60E-01	mg/L
10	WHOL	Aluminum	1.32E-01	.	2.06E-01	mg/L
100	WHOL	Aluminum	1.43E-01	1.91E-01	1.86E-01	mg/L
1000	WHOL	Aluminum	1.83E-01	.	1.40E-01	mg/L
1	WHOL	Antimony	1.00E-03	1.00E-03	1.00E-03	mg/L
1	WHOL	Barium	3.34E-02	3.39E-02	3.45E-02	mg/L
10	WHOL	Barium	3.33E-02	.	3.45E-02	mg/L
100	WHOL	Barium	3.35E-02	3.40E-02	3.43E-02	mg/L
1000	WHOL	Barium	3.33E-02	.	3.35E-02	mg/L
1	WHOL	Boron	4.11E-02	2.01E-02	1.69E-02	mg/L
10	WHOL	Boron	1.99E-02	.	3.00E-03	mg/L
100	WHOL	Boron	5.20E-03	3.01E-02	2.32E-02	mg/L
1000	WHOL	Boron	1.65E-02	.	7.00E-03	mg/L
1	WHOL	Calcium	4.45E+01	2.83E+01	2.31E+01	mg/L
10	WHOL	Calcium	3.17E+01	.	2.52E+01	mg/L
100	WHOL	Calcium	3.05E+01	2.94E+01	2.82E+01	mg/L
1000	WHOL	Calcium	3.07E+01	.	2.84E+01	mg/L
1	WHOL	Chromium	1.79E-03	1.70E-03	1.60E-03	mg/L
10	WHOL	Chromium	1.60E-03	.	1.50E-03	mg/L
100	WHOL	Chromium	1.30E-03	2.10E-03	1.40E-03	mg/L
1000	WHOL	Chromium	1.70E-03	.	1.30E-03	mg/L
1	WHOL	Copper	1.86E-03	2.00E-03	2.20E-03	mg/L
10	WHOL	Copper	1.40E-03	.	1.40E-03	mg/L
100	WHOL	Copper	1.60E-03	1.50E-03	1.70E-03	mg/L
1000	WHOL	Copper	1.60E-03	.	1.40E-03	mg/L
1	WHOL	Iron	4.41E-01	4.24E-01	4.44E-01	mg/L
10	WHOL	Iron	4.49E-01	.	4.55E-01	mg/L
100	WHOL	Iron	4.55E-01	4.52E-01	4.47E-01	mg/L
1000	WHOL	Iron	4.68E-01	.	4.51E-01	mg/L
1	WHOL	Magnesium	7.66E+00	6.89E+00	6.88E+00	mg/L
10	WHOL	Magnesium	7.25E+00	.	7.06E+00	mg/L
100	WHOL	Magnesium	7.13E+00	7.30E+00	7.28E+00	mg/L
1000	WHOL	Magnesium	7.24E+00	.	7.28E+00	mg/L
1	WHOL	Manganese	2.43E-02	7.53E-02	9.35E-02	mg/L
10	WHOL	Manganese	6.71E-02	.	9.03E-02	mg/L
100	WHOL	Manganese	6.88E-02	7.57E-02	7.99E-02	mg/L
1000	WHOL	Manganese	6.98E-02	.	7.82E-02	mg/L

Table L3 (continued)

Distance downstream (m)	Media	Analyte	Qtr full	Half full	Full channel	Units
1	WHOL	Mercury	6.89E-05	5.33E-05	4.69E-06	mg/L
10	WHOL	Mercury	4.56E-05	.	1.61E-05	mg/L
100	WHOL	Mercury	3.50E-05	2.42E-05	2.10E-05	mg/L
1000	WHOL	Mercury	3.23E-05	.	2.71E-05	mg/L
1	WHOL	Methyl Mercury	1.54E-07	1.09E-07	5.00E-08	mg/L
10	WHOL	Methyl Mercury	1.04E-07	.	6.50E-08	mg/L
100	WHOL	Methyl Mercury	1.01E-07	8.20E-08	7.70E-08	mg/L
1000	WHOL	Methyl Mercury	1.08E-07	.	9.40E-08	mg/L
1	WHOL	Nickel	3.53E-03	4.40E-03	4.10E-03	mg/L
10	WHOL	Nickel	3.90E-03	.	4.30E-03	mg/L
100	WHOL	Nickel	4.40E-03	4.30E-03	4.30E-03	mg/L
1000	WHOL	Nickel	4.20E-03	.	4.20E-03	mg/L
1	WHOL	pH	7.75E+00	7.66E+00	7.47E+00	
10	WHOL	pH	7.37E+00	.	7.19E+00	
100	WHOL	pH	7.50E+00	7.47E+00	7.50E+00	
1000	WHOL	pH	7.53E+00	.	7.59E+00	
1	WHOL	Potassium	1.76E+00	1.24E+00	1.06E+00	mg/L
10	WHOL	Potassium	1.32E+00	.	1.14E+00	mg/L
100	WHOL	Potassium	1.32E+00	1.31E+00	1.28E+00	mg/L
1000	WHOL	Potassium	1.32E+00	.	1.24E+00	mg/L
1	WHOL	Sodium	1.02E+01	4.98E+00	3.27E+00	mg/L
10	WHOL	Sodium	6.03E+00	.	3.76E+00	mg/L
100	WHOL	Sodium	5.62E+00	5.13E+00	4.79E+00	mg/L
1000	WHOL	Sodium	5.53E+00	.	4.84E+00	mg/L
1	RE	Suspend particl	8.00E-01	2.20E+00	3.00E+00	mg/L
10	RE	Suspend particl	2.20E+00	.	3.40E+00	mg/L
100	RE	Suspend particl	3.20E+00	2.80E+00	2.80E+00	mg/L
1000	RE	Suspend particl	3.20E+00	.	2.80E+00	mg/L
1	WHOL	Uranium	1.03E-02	2.70E-03	1.00E-03	mg/L
10	WHOL	Uranium	4.00E-03	.	1.00E-03	mg/L
100	WHOL	Uranium	3.50E-03	2.70E-03	2.10E-03	mg/L
1000	WHOL	Uranium	3.50E-03	.	2.30E-03	mg/L
1	WHOL	Zinc	9.69E-03	6.60E-03	7.00E-03	mg/L
10	WHOL	Zinc	5.40E-03	.	5.90E-03	mg/L
100	WHOL	Zinc	6.20E-03	5.90E-03	6.10E-03	mg/L
1000	WHOL	Zinc	6.10E-03	.	6.00E-03	mg/L
HIGH FLOW						
1	WHOL	Alkalinity as C	1.30E+00	1.20E+00	6.00E-01	meq/L
10	WHOL	Alkalinity as C	1.00E+00	.	8.00E-01	meq/L

Table L3 (continued)

Distance downstream (m)	Media	Analyte	Qtr full	Half full	Full channel	Units
100	WHOL	Alkalinity as C	8.00E-01	8.00E-01	7.00E-01	meq/L
1000	WHOL	Alkalinity as C	1.30E+00	.	6.00E-01	meq/L
1	WHOL	Aluminum	6.97E-01	6.34E-01	1.00E+00	mg/L
10	WHOL	Aluminum	6.15E-01	.	7.19E-01	mg/L
100	WHOL	Aluminum	8.20E-01	7.39E-01	8.73E-01	mg/L
1000	WHOL	Aluminum	9.14E-01	.	1.18E+00	mg/L
1	WHOL	Barium	3.06E-02	2.82E-02	3.25E-02	mg/L
10	WHOL	Barium	3.04E-02	.	3.10E-02	mg/L
100	WHOL	Barium	3.17E-02	3.18E-02	3.30E-02	mg/L
1000	WHOL	Barium	3.19E-02	.	3.37E-02	mg/L
1	WHOL	Boron	7.00E-03	7.00E-03	7.00E-03	mg/L
10	WHOL	Boron	7.00E-03	.	7.00E-03	mg/L
100	WHOL	Boron	7.00E-03	8.50E-03	7.00E-03	mg/L
1000	WHOL	Boron	7.00E-03	.	7.00E-03	mg/L
1	WHOL	Calcium	2.30E+01	1.98E+01	1.13E+01	mg/L
10	WHOL	Calcium	2.01E+01	.	1.46E+01	mg/L
100	WHOL	Calcium	1.49E+01	1.53E+01	1.29E+01	mg/L
1000	WHOL	Calcium	1.54E+01	.	1.27E+01	mg/L
1	WHOL	Chromium	1.90E-03	2.00E-03	2.90E-03	mg/L
10	WHOL	Chromium	1.80E-03	.	2.10E-03	mg/L
100	WHOL	Chromium	1.90E-03	2.30E-03	1.90E-03	mg/L
1000	WHOL	Chromium	2.00E-03	.	2.40E-03	mg/L
1	WHOL	Cobalt	1.00E-03	1.00E-03	1.70E-03	mg/L
10	WHOL	Cobalt	1.00E-03	.	1.20E-03	mg/L
100	WHOL	Cobalt	1.20E-03	1.20E-03	1.30E-03	mg/L
1000	WHOL	Cobalt	1.00E-03	.	1.30E-03	mg/L
1	WHOL	Copper	5.72E-03	4.00E-03	4.50E-03	mg/L
10	WHOL	Copper	5.00E-03	.	4.80E-03	mg/L
100	WHOL	Copper	3.90E-03	4.70E-03	4.60E-03	mg/L
1000	WHOL	Copper	4.40E-03	.	4.80E-03	mg/L
1	WHOL	Iron	9.37E-01	1.04E+00	1.68E+00	mg/L
10	WHOL	Iron	9.69E-01	.	1.23E+00	mg/L
100	WHOL	Iron	1.33E+00	1.34E+00	1.47E+00	mg/L
1000	WHOL	Iron	1.33E+00	.	1.62E+00	mg/L
1	WHOL	Lead	2.70E-03	2.20E-03	2.50E-03	mg/L
10	WHOL	Lead	2.00E-03	.	2.30E-03	mg/L
100	WHOL	Lead	2.40E-03	2.20E-03	1.90E-03	mg/L
1000	WHOL	Lead	1.80E-03	.	2.10E-03	mg/L
1	WHOL	Magnesium	4.26E+00	4.08E+00	4.41E+00	mg/L
10	WHOL	Magnesium	4.25E+00	.	4.19E+00	mg/L

Table L3 (continued)

Distance downstream (m)	Media	Analyte	Qtr full	Half full	Full channel	Units
100	WHOL	Magnesium	4.38E+00	4.24E+00	4.48E+00	mg/L
1000	WHOL	Magnesium	4.41E+00	.	4.59E+00	mg/L
1	WHOL	Manganese	4.86E-02	5.94E-02	1.24E-01	mg/L
10	WHOL	Manganese	6.63E-02	.	9.52E-02	mg/L
100	WHOL	Manganese	9.80E-02	9.57E-02	1.12E-01	mg/L
1000	WHOL	Manganese	9.43E-02	.	1.13E-01	mg/L
1	WHOL	Mercury	5.52E-04	3.74E-04	7.27E-06	mg/L
10	WHOL	Mercury	2.26E-04	.	2.20E-04	mg/L
100	WHOL	Mercury	1.09E-04	1.39E-04	5.16E-05	mg/L
1000	WHOL	Mercury	1.30E-04	.	3.84E-05	mg/L
1	WHOL	Methyl Mercury	2.39E-07	2.27E-07	6.70E-08	mg/L
10	WHOL	Methyl Mercury	4.94E-07	.	1.27E-07	mg/L
100	WHOL	Methyl Mercury	2.21E-07	2.52E-07	1.23E-07	mg/L
1000	WHOL	Methyl Mercury	3.13E-07	.	8.70E-08	mg/L
1	WHOL	Nickel	4.33E-03	4.40E-03	6.70E-03	mg/L
10	WHOL	Nickel	5.30E-03	.	4.90E-03	mg/L
100	WHOL	Nickel	5.60E-03	5.10E-03	5.80E-03	mg/L
1000	WHOL	Nickel	5.00E-03	.	5.60E-03	mg/L
1	WHOL	pH	7.60E+00	7.60E+00	7.30E+00	
10	WHOL	pH	7.20E+00	.	7.90E+00	
100	WHOL	pH	7.80E+00	7.80E+00	7.60E+00	
1000	WHOL	pH	7.50E+00	.	7.80E+00	
1	WHOL	Potassium	1.46E+00	1.37E+00	1.49E+00	mg/L
10	WHOL	Potassium	1.42E+00	.	1.40E+00	mg/L
100	WHOL	Potassium	1.41E+00	1.40E+00	1.49E+00	mg/L
1000	WHOL	Potassium	1.43E+00	.	1.51E+00	mg/L
1	WHOL	Sodium	3.96E+00	3.49E+00	2.91E+00	mg/L
10	WHOL	Sodium	3.87E+00	.	3.24E+00	mg/L
100	WHOL	Sodium	3.01E+00	3.69E+00	3.11E+00	mg/L
1000	WHOL	Sodium	3.22E+00	.	3.15E+00	mg/L
1	RE	Suspend particl	2.12E+01	1.80E+01	1.52E+01	mg/L
10	RE	Suspend particl	1.92E+01	.	3.24E+01	mg/L
100	RE	Suspend particl	3.40E+01	3.52E+01	3.56E+01	mg/L
1000	RE	Suspend particl	3.20E+01	.	3.80E+01	mg/L
1	WHOL	Thallium	1.00E-03	1.00E-03	1.00E-03	mg/L
10	WHOL	Thallium	1.00E-03	.	1.00E-03	mg/L
100	WHOL	Thallium	1.00E-03	1.00E-03	1.00E-03	mg/L
1000	WHOL	Thallium	1.00E-03	.	1.00E-03	mg/L
1	WHOL	Turbidity	1.60E+01	1.90E+01	2.10E+01	NTU
10	WHOL	Turbidity	1.80E+01	.	2.20E+01	NTU

Table L3 (continued)

Distance downstream (m)	Media	Analyte	Qtr full	Half full	Full channel	Units
100	WHOL	Turbidity	1.70E+01	2.20E+01	2.60E+01	NTU
1000	WHOL	Turbidity	1.80E+01	.	1.80E+01	NTU
1	WHOL	Uranium	7.45E-03	5.60E-03	1.00E-03	mg/L
10	WHOL	Uranium	4.90E-03	.	2.30E-03	mg/L
100	WHOL	Uranium	2.40E-03	2.40E-03	1.00E-03	mg/L
1000	WHOL	Uranium	2.30E-03	.	1.00E-03	mg/L
1	WHOL	Vanadium	1.18E-03	1.50E-03	2.40E-03	mg/L
10	WHOL	Vanadium	1.40E-03	.	2.00E-03	mg/L
100	WHOL	Vanadium	1.20E-03	1.70E-03	1.30E-03	mg/L
1000	WHOL	Vanadium	1.90E-03	.	2.30E-03	mg/L
1	WHOL	Zinc	1.63E-02	1.36E-02	2.24E-02	mg/L
10	WHOL	Zinc	2.13E-02	.	1.86E-02	mg/L
100	WHOL	Zinc	2.05E-02	2.34E-02	2.40E-02	mg/L
1000	WHOL	Zinc	1.96E-02	.	2.45E-02	mg/L

Table L4. Description of subtasks, listing of requested analyses, locations, and sample collection frequency during the Phase 2 RI on the Clinch River and Poplar Creek Operable Units

Description	Analytical Classes ^a	Locations (reach)	Number of sites sampled
Water contaminant concentrations and water quality in Poplar Creek	Total + Filtered (SVOA, PPCB, ICP-MS metals, Hg-spec., Cyanide, Gamma spec.), Gross Alpha-Beta, ³ H, ⁹⁰ Sr, Anions, Ammonia, NO ₃ +NO ₄ , TSP, Alkalinity, NTU, pH,	PCM 1 (3.04)	n=12 ^b (includes 3 W1.1T for TOX)
		PCM 2.9 (3.03)	n=14 ^b (includes 3 W1.1T for TOX)
		PCM 4.3 (3.02)	n=14 ^b (includes 3 W1.1T for TOX)
		PCM 5.1 (3.01)	n=13 ^b (includes 3 W1.1T for TOX)
		PCM 6 (13)	n=14 ^b (includes 3 W1.1T for TOX)
		PCM 6.5 (13)	n=12 ^b
		PCM 7 (13)	n=12 ^b
		PCM 7.5 (13)	n=11 ^b
Water contaminant concentrations and ambient toxicity testing	W1.1T: Total + Filtered (SVOA, PPCB, ICP-MS metals, Hg-spec., Cyanide, Gamma spec.), Gross Alpha-Beta, ³ H, ⁹⁰ Sr, Anions, Ammonia, NO ₃ +NO ₄ , TSP, Alkalinity, NTU, pH W2: <i>C. dubia</i> , Fathead minnow, Japanese medaka, chromotest ^c	CRM 22 (2.01)	W1.1T n=3, W2, n=6
		CRM 19 (2.03)	W1.1T n=3, W2 n= 6
		PCM 5.1 (3.01)	W1.1T see above, W2 n=6
		PCM 4.3 (3.02)	W1.1T see above, W2 n=6
		PCM 2.9 (3.03)	W1.1T see above, W2 n=6
		PCM 1 (3.04)	W1.1T see above, W2 n= 6
		CRM 9 (4.01)	W1.1T n=3, W2 n= 6
		PCM 6 (13)	W1.1T see above, W2 n= 6
		PCM 11.3 (13)	W2 n=6

Table L4 (continued)

Description	Analytical Classes ^a	Locations (reach).	Number of sites sampled
		MBM 0.2 (7.02)	W1.1T n=2, W2 n=2 ^d
		MBM 0.4 (7.01)	W1.1Tn=2, W2 n=2 ^d
		Walker Branch (WBM) 0.4 (8)	W1.1T n=2, W2 n=2 ^d
Mixing of contaminants with distance from EFPC (PCM 5.5)	Total ICP-MS metals, Hg-spec, TSP, Alkalinity, NTU, pH	PCM 5.5: 10 sites (transects at 0, 10, 100 and 1000 m)	n=20 (1 set during winter low flow and 1 during winter high flow)
Mixing of contaminants with distance from Mitchell Branch (PCM 4.6)	Gross Alpha- Beta, TSP, Alkalinity, NTU, pH	PCM 4.6: 10 sites (transects at 0, 10, 100 and 1000 m)	n=10 (1 set during winter low flow)
Mixing of contaminants with distance from CNF outfall (PCM 3.4)	Gross Alpha- Beta, TSP, Alkalinity, NTU, pH	PCM 3.4:10 sites, (transects at 0, 10, 100 and 1000 m)	n=20 (1 set during winter low flow and 1 during winter high flow)
Biased Event Sampling, McCoy Branch	Total + Filtered (SVOA, PPCB, ICP-MS metals, Hg-spec., Cyanide, Gamma spec.), Gross Alpha-Beta, ³ H, ⁹⁰ Sr, Anions, Ammonia, NO ₃ +NO ₂ , TSP, Alkalinity, NTU, pH	CRM 36.9B ^c (1)	n=3, April 19, July 28, August 29
		MBM 0.2A (7.02)	n=3, April 19, July 28, August 29
		MBM 0.2B (7.02)	n=3, April 19, July 28, August 29
		MBM 0.2C (7.02)	n=3, April 19, July 28, August 29
		MBM 0.4B (7.01)	n=3, April 19, July 28, August 29
Biased Event Sampling, White Oak Creek	Total + Filtered (SVOA, PPCB, ICP-MS metals, Cyanide, Gamma spec.), Gross Alpha-Beta, ³ H, ⁹⁰ Sr, Anions, Ammonia, NO ₃ +NO ₂ , TSP, Alkalinity, NTU, pH Note: no mercury speciation data were collected at this source.	CRM 19B (2.03)	n=3, April 19, July 28, August 29
		CRM 20.2A (2.02)	n=3, April 19, July 28, August 29
		CRM 20.2B (2.02)	n=3, April 19, July 28, August 29

Table L4 (continued)

Description	Analytical Classes ^a	Locations (reach)	Number of sites sampled
		CRM 20.2C (2.02)	n=3, April 19, July 28, August 29
		WOCM 0B (2.02)	n=3, April 19, July 28, August 29
Biased Event Sampling, Poplar Creek	Total + Filtered (SVOA, PPCB, ICP-MS metals, Hg-spec., Cyanide, Gamma spec.), Gross Alpha-Beta, ³ H, ⁹⁰ Sr, Anions, Ammonia, NO ₃ +NO ₄ , TSP, Alkalinity, NTU, pH	CRM 9B (4.01)	n = 3, April 20, July 29, August 30
		CRM 11.8A (4.01)	n = 3, April 20, July 29, August 30
		CRM 11.8B (4.01)	n = 3, April 20, July 29, August 30
		CRM 11.8C (4.01)	n = 3, April 20, July 29, August 30
		PCM 0.25B (3.04)	n = 3, April 20, July 29, August 30
Biased Event Sampling, Reference area	Total + Filtered (SVOA, PPCB, ICP-MS metals, Hg-spec., Cyanide, Gamma spec.), Gross Alpha-Beta, ³ H, ⁹⁰ Sr, Anions, Ammonia, NO ₃ +NO ₄ , TSP, Alkalinity, NTU, pH	CRM 41.5B (1)	n=3, April 20, July 29, August 30
		CRM 43B (1)	n=3, April 20, July 29, August 30
		CRM 46B (1)	n=3, April 20, July 29, August 30
		CRM 1B (4.04)	n=3, April 20, July 29, August 30
Contaminant remobilization from sediments (samples collected from 1m above sediment surface)	Total + Filtered (SVOA, PPCB, ICP-MS metals, Hg-spec., Cyanide, Gamma spec.), Gross Alpha-Beta, ³ H, ⁹⁰ Sr, Anions, Ammonia, NO ₃ +NO ₄ , TSP, Alkalinity, NTU, pH	CRM 41.5 (1)	n=6, 3 samples per season ^d
		MBM 0.2 (7.02)	n=6, 3 samples per season ^d
		CRM 6 (4.02)	n=6, 3 samples per season ^d
		CRM 1 (4.04)	n=6, 3 samples per season ^d
Oak Ridge Reservation Environmental Monitoring Program	General water quality, total metals, radionuclides, including ²⁴¹ Am, ²⁴⁴ Cm, ²³⁸ Pu, ²³⁹ Pu, ⁹⁹ Tc, ²³⁴ U, ²³⁵ U, ²³⁸ U and total U activity, volatile organic analytes.	see DOE/OR-1066	see DOE/OR-1066

Table L4 (continued)

Description	Analytical Classes ^a	Locations (reach)	Number of sites sampled
TVA Collection of water samples from source areas to Melton Hill and Watts Bar Reservoir (Task 4.2 of DE-A105-91OR22007)	Total + Filtered (ICP metals, AA metals, CVAA - Hg, Cyanide), ³ H, TSP	see Task 4.2 of DE-A105-91OR22007	once per site

^aSee Appendix B in ORNL/ER-218 for analytical methods. Applicable to all listed subtasks except for non-CR-ERP and Historic data.

^bWinter, spring, and summer seasons sampled.

^cSee DOE/OR/01-1111&D3 for toxicity testing information.

^dSpring and summer seasons sampled.

^eLetter designation following location indicates lateral position in the stream channel relative to the outfall position: "A" = one-quarter distance from outfall shore to mid-channel, "B" = mid-channel, "C" = three-quarters distance from outfall shore to opposite shore.

Table L5. Unfiltered and filtered metal concentrations (mg/L) for biased sampling events (April 18-19, 1994, July 28-29, 1994, and August 29-30, 1994). One sample per site per event.
 Analytes at a given site that were below detection for all events were omitted from this table.

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
McCoy	MBM 0.4B	Unfiltered	Arsenic	3.300E-03	5.400E-03	2.400E-03
McCoy	MBM 0.4B	Unfiltered	Barium	3.440E-02	3.240E-02	3.110E-02
McCoy	MBM 0.4B	Unfiltered	Boron	8.520E-02	6.130E-02	3.000E-02
McCoy	MBM 0.4B	Unfiltered	Chromium	<0.002	<0.001	1.900E-03
McCoy	MBM 0.4B	Unfiltered	Copper	5.300E-03	1.700E-03	2.360E-02
McCoy	MBM 0.4B	Unfiltered	Iron	2.910E-01	2.000E-01	1.440E-01
McCoy	MBM 0.4B	Unfiltered	Lead	1.200E-03	<0.001	1.300E-03
McCoy	MBM 0.4B	Unfiltered	Manganese	4.240E-02	5.100E-02	6.040E-02
McCoy	MBM 0.4B	Unfiltered	Molybdenum	1.500E-03	<0.005	<0.005
McCoy	MBM 0.4B	Unfiltered	Nickel	3.000E-03	<0.001	5.500E-03
McCoy	MBM 0.4B	Unfiltered	Vanadium	1.300E-03	1.600E-03	<0.001
McCoy	MBM 0.4B	Unfiltered	Zinc	1.550E-02	7.200E-03	1.750E-02
McCoy	MBM 0.4B	Filtered	Aluminum	<0.0010	<0.006	1.140E-02
McCoy	MBM 0.4B	Filtered	Antimony	5.600E-03	4.400E-03	6.900E-03
McCoy	MBM 0.4B	Filtered	Arsenic	3.400E-03	5.100E-03	1.700E-03
McCoy	MBM 0.4B	Filtered	Barium	2.910E-02	2.730E-02	2.630E-02
McCoy	MBM 0.4B	Filtered	Boron	6.630E-02	5.160E-02	3.350E-02
McCoy	MBM 0.4B	Filtered	Chromium	<0.002	<0.001	1.400E-03
McCoy	MBM 0.4B	Filtered	Copper	2.100E-03	2.700E-03	4.000E-03
McCoy	MBM 0.4B	Filtered	Iron	2.140E-02	<0.0018	<0.0018
McCoy	MBM 0.4B	Filtered	Manganese	2.080E-02	<0.001	2.500E-03
McCoy	MBM 0.4B	Filtered	Molybdenum	1.600E-03	<0.005	<0.005
McCoy	MBM 0.4B	Filtered	Nickel	2.900E-03	1.000E-02	1.200E-03
McCoy	MBM 0.4B	Filtered	Vanadium	<0.001	1.300E-03	<0.001
McCoy	MBM 0.4B	Filtered	Zinc	4.200E-03	5.500E-03	3.800E-03
McCoy	MBM 0.2A	Unfiltered	Aluminum	2.590E-01	3.350E-02	1.010E-01
McCoy	MBM 0.2A	Unfiltered	Arsenic	1.300E-03	1.000E-03	<0.001
McCoy	MBM 0.2A	Unfiltered	Barium	2.640E-02	2.850E-02	3.240E-02
McCoy	MBM 0.2A	Unfiltered	Boron	4.190E-02	1.130E-01	5.200E-02
McCoy	MBM 0.2A	Unfiltered	Chromium	<0.002	<0.001	1.900E-03
McCoy	MBM 0.2A	Unfiltered	Copper	5.600E-03	1.400E-03	2.270E-02
McCoy	MBM 0.2A	Unfiltered	Iron	4.340E-01	3.230E-02	1.460E-01
McCoy	MBM 0.2A	Unfiltered	Lead	1.500E-03	<0.001	1.300E-03
McCoy	MBM 0.2A	Unfiltered	Manganese	4.560E-02	3.120E-02	6.540E-02
McCoy	MBM 0.2A	Unfiltered	Nickel	2.800E-03	<0.001	5.500E-03
McCoy	MBM 0.2A	Unfiltered	Vanadium	1.100E-03	<0.001	<0.001
McCoy	MBM 0.2A	Unfiltered	Zinc	1.180E-02	6.200E-03	2.250E-02
McCoy	MBM 0.2A	Filtered	Aluminum	1.420E-02	1.020E-02	8.800E-03
McCoy	MBM 0.2A	Filtered	Antimony	1.900E-03	1.300E-03	3.000E-03

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
McCoy	MBM 0.2A	Filtered	Arsenic	<0.001	1.500E-03	1.000E-03
McCoy	MBM 0.2A	Filtered	Barium	2.070E-02	3.210E-02	2.520E-02
McCoy	MBM 0.2A	Filtered	Boron	5.350E-02	1.100E-01	3.380E-02
McCoy	MBM 0.2A	Filtered	Chromium	<0.002	<0.001	1.700E-03
McCoy	MBM 0.2A	Filtered	Copper	9.500E-03	2.500E-03	3.700E-03
McCoy	MBM 0.2A	Filtered	Iron	3.300E-02	1.800E-02	<0.0018
McCoy	MBM 0.2A	Filtered	Manganese	5.900E-03	<0.001	1.500E-03
McCoy	MBM 0.2A	Filtered	Nickel	1.800E-03	1.400E-03	1.400E-03
McCoy	MBM 0.2A	Filtered	Zinc	8.600E-03	2.700E-03	3.800E-03
McCoy	MBM 0.2B	Unfiltered	Aluminum	2.870E-01	4.810E-02	6.580E-02
McCoy	MBM 0.2B	Unfiltered	Barium	2.340E-02	2.830E-02	2.810E-02
McCoy	MBM 0.2B	Unfiltered	Boron	4.120E-02	9.250E-02	4.100E-02
McCoy	MBM 0.2B	Unfiltered	Chromium	<0.002	<0.001	1.900E-03
McCoy	MBM 0.2B	Unfiltered	Copper	5.100E-03	1.300E-03	3.220E-02
McCoy	MBM 0.2B	Unfiltered	Iron	4.640E-01	4.860E-02	1.080E-01
McCoy	MBM 0.2B	Unfiltered	Lead	<0.001	<0.001	1.300E-03
McCoy	MBM 0.2B	Unfiltered	Manganese	4.050E-02	2.870E-02	4.130E-02
McCoy	MBM 0.2B	Unfiltered	Nickel	1.500E-03	<0.001	8.700E-03
McCoy	MBM 0.2B	Unfiltered	Zinc	8.200E-03	3.000E-03	2.340E-02
McCoy	MBM 0.2B	Filtered	Aluminum	1.200E-02	<0.006	1.350E-02
McCoy	MBM 0.2B	Filtered	Antimony	2.800E-03	<0.001	3.800E-03
McCoy	MBM 0.2B	Filtered	Arsenic	1.100E-03	<0.001	<0.001
McCoy	MBM 0.2B	Filtered	Barium	2.070E-02	2.800E-02	2.520E-02
McCoy	MBM 0.2B	Filtered	Boron	3.340E-02	1.160E-01	4.780E-02
McCoy	MBM 0.2B	Filtered	Chromium	<0.002	<0.001	1.800E-03
McCoy	MBM 0.2B	Filtered	Copper	2.900E-03	3.000E-03	4.200E-03
McCoy	MBM 0.2B	Filtered	Iron	2.690E-02	<0.0018	<0.0018
McCoy	MBM 0.2B	Filtered	Manganese	4.800E-03	<0.001	1.500E-03
McCoy	MBM 0.2B	Filtered	Nickel	1.400E-03	4.200E-03	1.100E-03
McCoy	MBM 0.2B	Filtered	Selenium	3.200E-03	<0.001	<0.001
McCoy	MBM 0.2B	Filtered	Zinc	5.100E-03	2.000E-03	3.900E-03
McCoy	MBM 0.2C	Unfiltered	Aluminum	5.330E-01	5.370E-02	6.940E-02
McCoy	MBM 0.2C	Unfiltered	Barium	2.890E-02	2.890E-02	3.010E-02
McCoy	MBM 0.2C	Unfiltered	Boron	4.508E-02	1.120E-01	4.320E-02
McCoy	MBM 0.2C	Unfiltered	Chromium	<0.002	2.500E-03	2.100E-03
McCoy	MBM 0.2C	Unfiltered	Copper	5.260E-03	1.800E-03	3.680E-02
McCoy	MBM 0.2C	Unfiltered	Iron	4.400E-01	5.670E-02	1.040E-01

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
McCoy	MBM 0.2C	Unfiltered	Lead	1.440E-03	<0.001	1.700E-03
McCoy	MBM 0.2C	Unfiltered	Manganese	3.829E-02	2.890E-02	3.840E-02
McCoy	MBM 0.2C	Unfiltered	Nickel	3.620E-03	<0.001	1.000E-02
McCoy	MBM 0.2C	Unfiltered	Selenium	<0.003	<0.001	1.100E-03
McCoy	MBM 0.2C	Unfiltered	Zinc	1.683E-02	3.900E-03	1.590E-02
McCoy	MBM 0.2C	Filtered	Aluminum	<0.0010	<0.006	6.000E-03
McCoy	MBM 0.2C	Filtered	Antimony	5.300E-03	<0.001	2.400E-03
McCoy	MBM 0.2C	Filtered	Arsenic	1.300E-03	<0.001	<0.001
McCoy	MBM 0.2C	Filtered	Barium	2.170E-02	2.790E-02	2.300E-02
McCoy	MBM 0.2C	Filtered	Boron	2.610E-02	6.820E-02	4.040E-02
McCoy	MBM 0.2C	Filtered	Chromium	<0.002	<0.001	1.500E-03
McCoy	MBM 0.2C	Filtered	Copper	3.000E-03	2.000E-03	3.200E-03
McCoy	MBM 0.2C	Filtered	Iron	3.460E-02	<0.0018	<0.0018
McCoy	MBM 0.2C	Filtered	Manganese	3.700E-03	1.200E-03	<0.001
McCoy	MBM 0.2C	Filtered	Nickel	1.300E-03	4.300E-03	1.100E-03
McCoy	MBM 0.2C	Filtered	Zinc	2.000E-03	<0.002	3.700E-03
McCoy	CRM 39.6B	Unfiltered	Aluminum	2.070E-01	6.730E-02	7.140E-02
McCoy	CRM 39.6B	Unfiltered	Barium	2.690E-02	2.790E-02	2.420E-02
McCoy	CRM 39.6B	Unfiltered	Boron	4.310E-02	9.980E-02	6.430E-02
McCoy	CRM 39.6B	Unfiltered	Chromium	<0.002	1.100E-03	2.400E-03
McCoy	CRM 39.6B	Unfiltered	Copper	6.500E-03	2.100E-03	2.900E-03
McCoy	CRM 39.6B	Unfiltered	Iron	3.770E-01	7.560E-02	7.400E-02
McCoy	CRM 39.6B	Unfiltered	Lead	1.400E-03	<0.001	<0.001
McCoy	CRM 39.6B	Unfiltered	Manganese	8.630E-02	5.000E-02	3.690E-02
McCoy	CRM 39.6B	Unfiltered	Nickel	2.100E-03	<0.001	1.300E-03
McCoy	CRM 39.6B	Unfiltered	Zinc	1.800E-02	4.300E-03	5.400E-03
McCoy	CRM 39.6B	Filtered	Aluminum	<0.0010	3.371E-02	3.188E-02
McCoy	CRM 39.6B	Filtered	Antimony	4.600E-03	<0.001	3.520E-03
McCoy	CRM 39.6B	Filtered	Barium	2.320E-02	2.505E-02	2.215E-02
McCoy	CRM 39.6B	Filtered	Boron	3.690E-02	7.463E-02	8.393E-02
McCoy	CRM 39.6B	Filtered	Chromium	<0.002	1.360E-03	2.260E-03
McCoy	CRM 39.6B	Filtered	Copper	7.400E-03	2.520E-03	5.080E-03
McCoy	CRM 39.6B	Filtered	Iron	3.910E-02	<0.0018	<0.0018
McCoy	CRM 39.6B	Filtered	Manganese	1.200E-02	<0.001	1.650E-03
McCoy	CRM 39.6B	Filtered	Nickel	1.800E-03	1.660E-03	1.860E-03
McCoy	CRM 39.6B	Filtered	Zinc	1.490E-02	4.790E-03	8.260E-03

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
Poplar Cr.	PCM 0.1 B	Unfiltered	Aluminum	1.320E-01	2.260E-01	1.480E-01
Poplar Cr.	PCM 0.1 B	Unfiltered	Antimony	1.900E-03	<0.001	<0.001
Poplar Cr.	PCM 0.1 B	Unfiltered	Arsenic	1.400E-03	<0.001	<0.001
Poplar Cr.	PCM 0.1 B	Unfiltered	Barium	3.050E-02	2.990E-02	2.440E-02
Poplar Cr.	PCM 0.1 B	Unfiltered	Boron	2.250E-02	9.260E-02	1.080E-01
Poplar Cr.	PCM 0.1 B	Unfiltered	Chromium	<0.002	1.300E-03	1.600E-03
Poplar Cr.	PCM 0.1 B	Unfiltered	Copper	2.100E-03	3.300E-03	1.900E-03
Poplar Cr.	PCM 0.1 B	Unfiltered	Iron	3.220E-01	3.060E-01	1.670E-01
Poplar Cr.	PCM 0.1 B	Unfiltered	Lead	<0.001	1.300E-03	<0.001
Poplar Cr.	PCM 0.1 B	Unfiltered	Manganese	6.230E-02	5.250E-02	4.530E-02
Poplar Cr.	PCM 0.1 B	Unfiltered	Nickel	3.700E-03	1.900E-03	1.400E-03
Poplar Cr.	PCM 0.1 B	Unfiltered	Uranium	1.600E-03	<0.001	<0.001
Poplar Cr.	PCM 0.1 B	Unfiltered	Zinc	1.410E-02	1.980E-02	2.700E-03
Poplar Cr.	PCM 0.1 B	Filtered	Aluminum	2.190E-02	3.060E-02	1.450E-02
Poplar Cr.	PCM 0.1 B	Filtered	Antimony	1.300E-03	2.600E-03	8.400E-03
Poplar Cr.	PCM 0.1 B	Filtered	Arsenic	1.100E-03	<0.001	1.100E-03
Poplar Cr.	PCM 0.1 B	Filtered	Barium	2.820E-02	2.620E-02	2.310E-02
Poplar Cr.	PCM 0.1 B	Filtered	Boron	3.550E-02	1.300E-02	6.120E-02
Poplar Cr.	PCM 0.1 B	Filtered	Chromium	<0.002	<0.001	1.100E-03
Poplar Cr.	PCM 0.1 B	Filtered	Copper	1.200E-03	6.120E-02	7.900E-03
Poplar Cr.	PCM 0.1 B	Filtered	Iron	1.710E-01	<0.0018	<0.0018
Poplar Cr.	PCM 0.1 B	Filtered	Manganese	4.930E-02	6.300E-03	2.000E-03
Poplar Cr.	PCM 0.1 B	Filtered	Nickel	3.400E-03	1.600E-03	2.200E-03
Poplar Cr.	PCM 0.1 B	Filtered	Uranium	1.600E-03	<0.001	<0.001
Poplar Cr.	PCM 0.1 B	Filtered	Zinc	3.700E-03	1.280E-01	3.600E-03
Poplar Cr.	CRM 11.8 A	Unfiltered	Aluminum	9.870E-02	3.560E-01	1.120E-01
Poplar Cr.	CRM 11.8 A	Unfiltered	Barium	2.610E-02	3.080E-02	2.440E-02
Poplar Cr.	CRM 11.8 A	Unfiltered	Boron	1.800E-02	6.030E-02	5.390E-02
Poplar Cr.	CRM 11.8 A	Unfiltered	Chromium	<0.002	1.300E-03	1.500E-03
Poplar Cr.	CRM 11.8 A	Unfiltered	Copper	1.200E-03	8.140E-02	1.700E-03
Poplar Cr.	CRM 11.8 A	Unfiltered	Iron	3.200E-01	4.390E-01	1.320E-01
Poplar Cr.	CRM 11.8 A	Unfiltered	Lead	<0.001	2.400E-03	<0.001
Poplar Cr.	CRM 11.8 A	Unfiltered	Manganese	5.080E-02	5.380E-02	4.080E-02
Poplar Cr.	CRM 11.8 A	Unfiltered	Nickel	3.200E-03	2.500E-03	1.100E-03
Poplar Cr.	CRM 11.8 A	Unfiltered	Zinc	4.100E-03	1.860E-01	3.000E-03
Poplar Cr.	CRM 11.8 A	Filtered	Aluminum	2.350E-02	3.800E-02	9.000E-03
Poplar Cr.	CRM 11.8 A	Filtered	Antimony	<0.001	3.400E-03	7.300E-03
Poplar Cr.	CRM 11.8 A	Filtered	Barium	2.220E-02	2.640E-02	2.390E-02
Poplar Cr.	CRM 11.8 A	Filtered	Boron	2.780E-02	2.090E-02	5.130E-02

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
Poplar Cr.	CRM 11.8 A	Filtered	Chromium	3.000E-03	<0.001	1.300E-03
Poplar Cr.	CRM 11.8 A	Filtered	Copper	2.200E-03	6.570E-02	3.200E-03
Poplar Cr.	CRM 11.8 A	Filtered	Iron	2.350E-01	<0.0018	1.800E-02
Poplar Cr.	CRM 11.8 A	Filtered	Manganese	9.400E-03	3.500E-03	2.100E-03
Poplar Cr.	CRM 11.8 A	Filtered	Nickel	3.000E-03	1.700E-03	1.800E-03
Poplar Cr.	CRM 11.8 A	Filtered	Zinc	4.300E-03	1.280E-01	2.800E-03
Poplar Cr.	CRM 11.8 B	Unfiltered	Aluminum	9.310E-02	5.230E-01	9.430E-02
Poplar Cr.	CRM 11.8 B	Unfiltered	Antimony	<0.001	<0.001	1.700E-03
Poplar Cr.	CRM 11.8 B	Unfiltered	Arsenic	<0.001	<0.001	1.000E-03
Poplar Cr.	CRM 11.8 B	Unfiltered	Barium	2.390E-02	3.390E-01	2.500E-02
Poplar Cr.	CRM 11.8 B	Unfiltered	Boron	<0.0018	7.590E-02	5.880E-02
Poplar Cr.	CRM 11.8 B	Unfiltered	Chromium	<0.002	2.200E-03	1.700E-03
Poplar Cr.	CRM 11.8 B	Unfiltered	Copper	1.100E-03	5.100E-03	2.000E-03
Poplar Cr.	CRM 11.8 B	Unfiltered	Iron	2.960E-01	6.990E-01	1.170E-01
Poplar Cr.	CRM 11.8 B	Unfiltered	Lead	<0.001	2.100E-03	<0.001
Poplar Cr.	CRM 11.8 B	Unfiltered	Manganese	4.560E-02	6.460E-02	4.130E-02
Poplar Cr.	CRM 11.8 B	Unfiltered	Nickel	2.800E-03	2.900E-03	1.200E-03
Poplar Cr.	CRM 11.8 B	Unfiltered	Uranium	<0.001	1.500E-03	<0.001
Poplar Cr.	CRM 11.8 B	Unfiltered	Vanadium	<0.001	1.400E-03	<0.001
Poplar Cr.	CRM 11.8 B	Unfiltered	Zinc	2.800E-03	3.290E-02	4.200E-03
Poplar Cr.	CRM 11.8 B	Filtered	Aluminum	1.570E-02	2.970E-02	1.100E-02
Poplar Cr.	CRM 11.8 B	Filtered	Antimony	<0.001	4.600E-03	6.300E-03
Poplar Cr.	CRM 11.8 B	Filtered	Arsenic	1.100E-03	<0.001	<0.001
Poplar Cr.	CRM 11.8 B	Filtered	Barium	2.090E-02	2.740E-02	2.320E-02
Poplar Cr.	CRM 11.8 B	Filtered	Boron	1.800E-02	8.150E-02	7.130E-02
Poplar Cr.	CRM 11.8 B	Filtered	Chromium	<0.002	1.600E-03	<0.001
Poplar Cr.	CRM 11.8 B	Filtered	Copper	1.200E-03	1.030E-02	3.400E-03
Poplar Cr.	CRM 11.8 B	Filtered	Iron	2.130E-01	2.280E-02	<0.0018
Poplar Cr.	CRM 11.8 B	Filtered	Manganese	3.600E-03	1.000E-02	1.900E-03
Poplar Cr.	CRM 11.8 B	Filtered	Nickel	2.900E-03	3.700E-03	2.600E-03
Poplar Cr.	CRM 11.8 B	Filtered	Selenium	<0.005	1.100E-03	1.200E-03
Poplar Cr.	CRM 11.8 B	Filtered	Uranium	<0.001	1.500E-03	<0.001
Poplar Cr.	CRM 11.8 B	Filtered	Zinc	4.800E-03	7.400E-03	3.800E-03
Poplar Cr.	CRM 11.8 C	Unfiltered	Aluminum	9.310E-02	8.610E-01	2.840E-01
Poplar Cr.	CRM 11.8 C	Unfiltered	Arsenic	<0.001	<0.001	1.300E-03
Poplar Cr.	CRM 11.8 C	Unfiltered	Barium	2.480E-02	3.630E-02	2.920E-02
Poplar Cr.	CRM 11.8 C	Unfiltered	Boron	4.450E-02	8.620E-02	6.830E-02

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
Poplar Cr.	CRM 11.8 C	Unfiltered	Chromium	<0.002	2.300E-03	2.000E-03
Poplar Cr.	CRM 11.8 C	Unfiltered	Copper	1.700E-03	8.320E-02	1.800E-03
Poplar Cr.	CRM 11.8 C	Unfiltered	Iron	3.060E-01	9.710E-01	3.230E-01
Poplar Cr.	CRM 11.8 C	Unfiltered	Lead	<0.001	3.200E-03	<0.001
Poplar Cr.	CRM 11.8 C	Unfiltered	Manganese	4.500E-02	7.340E-02	6.540E-02
Poplar Cr.	CRM 11.8 C	Unfiltered	Nickel	2.800E-03	4.300E-03	1.700E-03
Poplar Cr.	CRM 11.8 C	Unfiltered	Uranium	<0.001	2.000E-03	1.300E-03
Poplar Cr.	CRM 11.8 C	Unfiltered	Vanadium	<0.001	1.900E-03	<0.001
Poplar Cr.	CRM 11.8 C	Unfiltered	Zinc	7.900E-03	2.000E-01	4.700E-03
Poplar Cr.	CRM 11.8 C	Filtered	Aluminum	1.750E-02	2.770E-02	1.090E-02
Poplar Cr.	CRM 11.8 C	Filtered	Antimony	<0.001	4.100E-03	7.100E-03
Poplar Cr.	CRM 11.8 C	Filtered	Arsenic	1.200E-03	<0.001	1.200E-03
Poplar Cr.	CRM 11.8 C	Filtered	Barium	2.290E-02	2.910E-02	2.600E-02
Poplar Cr.	CRM 11.8 C	Filtered	Boron	<0.0018	6.050E-02	8.030E-02
Poplar Cr.	CRM 11.8 C	Filtered	Chromium	<0.002	4.900E-03	1.200E-03
Poplar Cr.	CRM 11.8 C	Filtered	Copper	1.000E-03	9.700E-03	4.000E-03
Poplar Cr.	CRM 11.8 C	Filtered	Iron	2.260E-01	5.340E-02	1.800E-02
Poplar Cr.	CRM 11.8 C	Filtered	Lead	1.400E-03	1.300E-03	<0.001
Poplar Cr.	CRM 11.8 C	Filtered	Manganese	3.800E-03	1.500E-02	2.900E-03
Poplar Cr.	CRM 11.8 C	Filtered	Nickel	4.000E-03	5.200E-03	1.700E-03
Poplar Cr.	CRM 11.8 C	Filtered	Selenium	<0.005	<0.001	1.100E-03
Poplar Cr.	CRM 11.8 C	Filtered	Uranium	<0.001	1.700E-03	1.100E-03
Poplar Cr.	CRM 11.8 C	Filtered	Zinc	3.800E-03	1.740E-02	4.100E-03
Poplar Cr.	CRM 9.0 B	Unfiltered	Aluminum	1.120E-01	1.050E-01	9.500E-02
Poplar Cr.	CRM 9.0 B	Unfiltered	Antimony	<0.001	<0.001	2.000E-03
Poplar Cr.	CRM 9.0 B	Unfiltered	Arsenic	<0.001	<0.001	1.100E-03
Poplar Cr.	CRM 9.0 B	Unfiltered	Barium	2.660E-02	2.820E-02	2.470E-02
Poplar Cr.	CRM 9.0 B	Unfiltered	Boron	<0.0018	4.130E-02	1.270E-01
Poplar Cr.	CRM 9.0 B	Unfiltered	Chromium	<0.002	1.400E-03	1.700E-03
Poplar Cr.	CRM 9.0 B	Unfiltered	Copper	1.300E-03	2.840E-02	2.300E-03
Poplar Cr.	CRM 9.0 B	Unfiltered	Iron	3.590E-01	1.190E-01	9.120E-02
Poplar Cr.	CRM 9.0 B	Unfiltered	Lead	<0.001	1.800E-03	<0.001
Poplar Cr.	CRM 9.0 B	Unfiltered	Manganese	5.160E-02	3.530E-02	3.640E-02
Poplar Cr.	CRM 9.0 B	Unfiltered	Molybdenum	1.800E-03	<0.005	<0.005
Poplar Cr.	CRM 9.0 B	Unfiltered	Nickel	2.900E-03	2.500E-03	1.200E-03
Poplar Cr.	CRM 9.0 B	Unfiltered	Zinc	3.800E-03	6.390E-02	3.400E-03
Poplar Cr.	CRM 9.0 B	Filtered	Aluminum	1.560E-02	3.280E-02	1.631E-02
Poplar Cr.	CRM 9.0 B	Filtered	Antimony	<0.001	4.720E-03	7.730E-03
Poplar Cr.	CRM 9.0 B	Filtered	Arsenic	1.200E-03	<0.001	<0.001

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
Poplar Cr.	CRM 9.0 B	Filtered	Barium	2.130E-02	2.518E-02	2.421E-02
Poplar Cr.	CRM 9.0 B	Filtered	Boron	2.040E-02	2.145E-02	6.587E-02
Poplar Cr.	CRM 9.0 B	Filtered	Chromium	<0.002	<0.001	1.450E-03
Poplar Cr.	CRM 9.0 B	Filtered	Copper	1.400E-03	5.605E-02	3.730E-03
Poplar Cr.	CRM 9.0 B	Filtered	Iron	2.570E-01	1.800E-02	3.219E-02
Poplar Cr.	CRM 9.0 B	Filtered	Manganese	5.200E-03	<0.001	2.520E-03
Poplar Cr.	CRM 9.0 B	Filtered	Nickel	3.300E-03	1.610E-03	1.950E-03
Poplar Cr.	CRM 9.0 B	Filtered	Zinc	3.300E-03	1.116E-01	4.820E-03
Reference	CRM 46.0 B	Unfiltered	Aluminum	6.470E-02	9.370E-02	8.900E-02
Reference	CRM 46.0 B	Unfiltered	Arsenic	<0.001	<0.001	1.100E-03
Reference	CRM 46.0 B	Unfiltered	Barium	2.440E-02	2.620E-02	2.940E-02
Reference	CRM 46.0 B	Unfiltered	Boron	<0.0018	1.160E-02	7.780E-02
Reference	CRM 46.0 B	Unfiltered	Chromium	<0.002	1.600E-03	5.100E-03
Reference	CRM 46.0 B	Unfiltered	Copper	1.500E-03	6.900E-03	8.800E-03
Reference	CRM 46.0 B	Unfiltered	Iron	3.410E-01	1.320E-01	1.200E-01
Reference	CRM 46.0 B	Unfiltered	Lead	<0.001	1.400E-03	2.500E-03
Reference	CRM 46.0 B	Unfiltered	Manganese	5.010E-02	5.780E-02	6.050E-02
Reference	CRM 46.0 B	Unfiltered	Nickel	3.000E-03	2.600E-03	4.700E-03
Reference	CRM 46.0 B	Unfiltered	Zinc	3.900E-03	2.640E-02	2.550E-02
Reference	CRM 46.0 B	Filtered	Aluminum	1.910E-02	3.200E-02	5.670E-02
Reference	CRM 46.0 B	Filtered	Antimony	<0.001	4.700E-03	8.400E-03
Reference	CRM 46.0 B	Filtered	Arsenic	<0.001	<0.001	1.700E-03
Reference	CRM 46.0 B	Filtered	Barium	2.250E-02	2.300E-02	2.810E-02
Reference	CRM 46.0 B	Filtered	Boron	2.180E-02	2.570E-02	6.720E-02
Reference	CRM 46.0 B	Filtered	Chromium	<0.002	1.500E-03	5.500E-03
Reference	CRM 46.0 B	Filtered	Copper	1.100E-03	3.600E-03	2.040E-02
Reference	CRM 46.0 B	Filtered	Iron	2.560E-01	<0.0018	5.100E-02
Reference	CRM 46.0 B	Filtered	Lead	<0.001	<0.001	3.000E-03
Reference	CRM 46.0 B	Filtered	Manganese	1.090E-02	6.200E-03	2.380E-02
Reference	CRM 46.0 B	Filtered	Molybdenum	2.200E-03	<0.005	<0.005
Reference	CRM 46.0 B	Filtered	Nickel	3.200E-03	2.000E-03	8.000E-03
Reference	CRM 46.0 B	Filtered	Zinc	4.200E-03	5.500E-03	3.450E-02
Reference	CRM 43.0 B	Unfiltered	Aluminum	8.720E-02	1.250E-01	8.750E-02
Reference	CRM 43.0 B	Unfiltered	Arsenic	<0.001	<0.001	1.100E-03
Reference	CRM 43.0 B	Unfiltered	Barium	4.710E-02	2.680E-02	2.770E-02
Reference	CRM 43.0 B	Unfiltered	Boron	2.880E-02	5.000E-02	7.330E-02
Reference	CRM 43.0 B	Unfiltered	Chromium	<0.002	1.300E-03	4.300E-03

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
Reference	CRM 43.0 B	Unfiltered	Copper	1.700E-03	8.290E-02	1.380E-02
Reference	CRM 43.0 B	Unfiltered	Iron	3.390E-01	1.370E-01	1.250E-01
Reference	CRM 43.0 B	Unfiltered	Lead	<0.001	2.600E-03	1.700E-03
Reference	CRM 43.0 B	Unfiltered	Manganese	7.670E-02	6.620E-02	5.260E-02
Reference	CRM 43.0 B	Unfiltered	Nickel	3.500E-03	2.800E-03	4.000E-03
Reference	CRM 43.0 B	Unfiltered	Zinc	4.000E-03	1.910E-01	2.350E-02
Reference	CRM 43.0 B	Filtered	Aluminum	1.640E-02	8.400E-03	2.770E-02
Reference	CRM 43.0 B	Filtered	Antimony	<0.001	2.200E-03	6.100E-03
Reference	CRM 43.0 B	Filtered	Arsenic	<0.001	<0.001	1.300E-03
Reference	CRM 43.0 B	Filtered	Barium	2.470E-02	2.310E-02	2.490E-02
Reference	CRM 43.0 B	Filtered	Boron	3.040E-02	3.460E-02	6.800E-02
Reference	CRM 43.0 B	Filtered	Chromium	<0.002	1.200E-03	3.000E-03
Reference	CRM 43.0 B	Filtered	Copper	2.200E-03	2.400E-03	1.440E-02
Reference	CRM 43.0 B	Filtered	Iron	2.530E-01	1.800E-02	3.430E-02
Reference	CRM 43.0 B	Filtered	Lead	<0.001	<0.001	1.200E-03
Reference	CRM 43.0 B	Filtered	Manganese	1.080E-02	<0.001	1.730E-02
Reference	CRM 43.0 B	Filtered	Nickel	3.400E-03	1.100E-03	3.600E-03
Reference	CRM 43.0 B	Filtered	Zinc	7.300E-03	2.100E-03	1.900E-02
Reference	CRM 41.5 B	Unfiltered	Aluminum	6.660E-02	8.550E-02	9.560E-02
Reference	CRM 41.5 B	Unfiltered	Arsenic	<0.001	<0.001	1.500E-03
Reference	CRM 41.5 B	Unfiltered	Barium	5.630E-02	2.640E-02	2.860E-02
Reference	CRM 41.5 B	Unfiltered	Boron	4.160E-02	1.120E-01	1.070E-01
Reference	CRM 41.5 B	Unfiltered	Chromium	<0.002	2.600E-03	3.900E-03
Reference	CRM 41.5 B	Unfiltered	Copper	3.100E-03	6.100E-03	1.180E-02
Reference	CRM 41.5 B	Unfiltered	Iron	3.390E-01	1.000E-01	1.340E-01
Reference	CRM 41.5 B	Unfiltered	Lead	<0.001	1.300E-03	1.300E-03
Reference	CRM 41.5 B	Unfiltered	Manganese	6.490E-02	4.780E-02	5.050E-02
Reference	CRM 41.5 B	Unfiltered	Nickel	3.500E-03	2.800E-03	3.100E-03
Reference	CRM 41.5 B	Unfiltered	Zinc	6.700E-03	1.420E-02	2.050E-02
Reference	CRM 41.5 B	Filtered	Aluminum	1.524E-02	2.248E-02	1.360E-02
Reference	CRM 41.5 B	Filtered	Antimony	1.240E-03	3.820E-03	8.700E-03
Reference	CRM 41.5 B	Filtered	Arsenic	<0.001	<0.001	1.200E-03
Reference	CRM 41.5 B	Filtered	Barium	2.150E-02	2.270E-02	2.020E-02
Reference	CRM 41.5 B	Filtered	Boron	2.576E-02	7.410E-02	5.160E-02
Reference	CRM 41.5 B	Filtered	Chromium	<0.002	1.850E-03	1.700E-03
Reference	CRM 41.5 B	Filtered	Copper	<0.001	3.880E-03	1.010E-02
Reference	CRM 41.5 B	Filtered	Iron	2.352E-01	<0.0018	<0.0018
Reference	CRM 41.5 B	Filtered	Manganese	1.043E-02	<0.001	8.400E-03
Reference	CRM 41.5 B	Filtered	Nickel	2.950E-03	1.880E-03	2.100E-03

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
Reference	CRM 41.5 B	Filtered	Zinc	1.444E-02	3.390E-03	3.700E-03
Reference	CRM 41.5 B	Unfiltered	Aluminum	9.640E-02	1.240E-01	1.190E-01
Reference	CRM 41.5 B	Unfiltered	Arsenic	1.400E-03	1.000E-03	2.800E-03
Reference	CRM 41.5 B	Unfiltered	Barium	2.520E-02	2.700E-02	2.860E-02
Reference	CRM 41.5 B	Unfiltered	Boron	1.800E-02	3.490E-02	1.130E-01
Reference	CRM 41.5 B	Unfiltered	Chromium	<0.002	2.500E-03	8.200E-03
Reference	CRM 41.5 B	Unfiltered	Copper	1.800E-03	6.000E-03	1.200E-02
Reference	CRM 41.5 B	Unfiltered	Iron	2.920E-01	1.820E-01	1.730E-01
Reference	CRM 41.5 B	Unfiltered	Lead	<0.001	1.400E-03	1.800E-03
Reference	CRM 41.5 B	Unfiltered	Manganese	4.540E-02	4.760E-02	5.690E-02
Reference	CRM 41.5 B	Unfiltered	Nickel	3.000E-03	2.500E-03	5.600E-03
Reference	CRM 41.5 B	Unfiltered	Vanadium	<0.001	1.400E-03	1.200E-03
Reference	CRM 41.5 B	Unfiltered	Zinc	3.900E-03	2.620E-02	2.310E-02
Reference	CRM 41.5 B	Filtered	Aluminum	2.690E-02	2.770E-02	3.380E-02
Reference	CRM 41.5 B	Filtered	Antimony	<0.001	3.600E-03	4.400E-03
Reference	CRM 41.5 B	Filtered	Arsenic	1.700E-03	<0.001	2.300E-03
Reference	CRM 41.5 B	Filtered	Barium	2.330E-02	2.240E-02	2.810E-02
Reference	CRM 41.5 B	Filtered	Boron	5.140E-02	8.040E-02	7.790E-02
Reference	CRM 41.5 B	Filtered	Chromium	<0.002	1.400E-03	4.700E-03
Reference	CRM 41.5 B	Filtered	Copper	1.800E-03	3.400E-03	1.120E-02
Reference	CRM 41.5 B	Filtered	Iron	2.120E-01	<0.0018	3.330E-02
Reference	CRM 41.5 B	Filtered	Lead	<0.001	<0.001	1.600E-03
Reference	CRM 41.5 B	Filtered	Manganese	1.800E-02	1.400E-03	4.700E-03
Reference	CRM 41.5 B	Filtered	Nickel	3.400E-03	1.600E-03	3.400E-03
Reference	CRM 41.5 B	Filtered	Selenium	<0.005	<0.001	1.600E-03
Reference	CRM 41.5 B	Filtered	Zinc	5.700E-03	4.600E-03	2.400E-02
Reference	CRM 1.0 B	Unfiltered	Aluminum	9.640E-02	1.240E-01	1.190E-01
Reference	CRM 1.0 B	Unfiltered	Arsenic	1.400E-03	1.000E-03	2.800E-03
Reference	CRM 1.0 B	Unfiltered	Barium	2.520E-02	2.700E-02	2.860E-02
Reference	CRM 1.0 B	Unfiltered	Boron	1.800E-02	3.490E-02	1.130E-01
Reference	CRM 1.0 B	Unfiltered	Chromium	<0.002	2.500E-03	8.200E-03
Reference	CRM 1.0 B	Unfiltered	Copper	1.800E-03	6.000E-03	1.200E-02
Reference	CRM 1.0 B	Unfiltered	Iron	2.920E-01	1.820E-01	1.730E-01
Reference	CRM 1.0 B	Unfiltered	Lead	<0.001	1.400E-03	1.800E-03
Reference	CRM 1.0 B	Unfiltered	Manganese	4.540E-02	4.760E-02	5.690E-02
Reference	CRM 1.0 B	Unfiltered	Nickel	3.000E-03	2.500E-03	5.600E-03
Reference	CRM 1.0 B	Unfiltered	Potassium	1.310E+00	1.420E+00	1.700E+00
Reference	CRM 1.0 B	Unfiltered	Sodium	2.630E+00	5.950E+00	6.700E+00
Reference	CRM 1.0 B	Unfiltered	Vanadium	<0.001	1.400E-03	1.200E-03

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
Reference	CRM 1.0 B	Unfiltered	Zinc	3.900E-03	2.620E-02	2.310E-02
Reference	CRM 1.0 B	Filtered	Aluminum	2.690E-02	2.770E-02	3.380E-02
Reference	CRM 1.0 B	Filtered	Antimony	<0.001	3.600E-03	4.400E-03
Reference	CRM 1.0 B	Filtered	Arsenic	1.700E-03	<0.001	2.300E-03
Reference	CRM 1.0 B	Filtered	Barium	2.330E-02	2.240E-02	2.810E-02
Reference	CRM 1.0 B	Filtered	Boron	5.140E-02	8.040E-02	7.790E-02
Reference	CRM 1.0 B	Filtered	Cadmium	<0.001	<0.001	<0.001
Reference	CRM 1.0 B	Filtered	Chromium	<0.002	1.400E-03	4.700E-03
Reference	CRM 1.0 B	Filtered	Copper	1.800E-03	3.400E-03	1.120E-02
Reference	CRM 1.0 B	Filtered	Iron	2.120E-01	<0.0018	3.330E-02
Reference	CRM 1.0 B	Filtered	Lead	<0.001	<0.001	1.600E-03
Reference	CRM 1.0 B	Filtered	Manganese	1.800E-02	1.400E-03	4.700E-03
Reference	CRM 1.0 B	Filtered	Nickel	3.400E-03	1.600E-03	3.400E-03
Reference	CRM 1.0 B	Filtered	Selenium	<0.005	<0.001	1.600E-03
Reference	CRM 1.0 B	Filtered	Zinc	5.700E-03	4.600E-03	2.400E-02
White Oak	WOCM 0.0B	Unfiltered	Aluminum	4.350E-01	1.360E-01	1.550E-01
White Oak	WOCM 0.0B	Unfiltered	Arsenic	<0.001	<0.001	1.100E-03
White Oak	WOCM 0.0B	Unfiltered	Barium	2.740E-02	2.820E-02	3.630E-02
White Oak	WOCM 0.0B	Unfiltered	Boron	2.600E-02	0.000E+00	4.080E-02
White Oak	WOCM 0.0B	Unfiltered	Chromium	<0.002	<0.001	1.700E-03
White Oak	WOCM 0.0B	Unfiltered	Copper	4.100E-03	1.400E-03	5.900E-03
White Oak	WOCM 0.0B	Unfiltered	Iron	6.080E-01	1.660E-01	1.950E-01
White Oak	WOCM 0.0B	Unfiltered	Lead	1.600E-03	<0.001	1.000E-03
White Oak	WOCM 0.0B	Unfiltered	Manganese	6.310E-02	6.210E-02	7.550E-02
White Oak	WOCM 0.0B	Unfiltered	Nickel	3.200E-03	1.300E-03	1.900E-03
White Oak	WOCM 0.0B	Unfiltered	Vanadium	1.300E-03	<0.001	<0.001
White Oak	WOCM 0.0B	Unfiltered	Zinc	1.620E-02	4.100E-03	1.810E-02
White Oak	WOCM 0.0B	Filtered	Aluminum	2.190E-02	<0.006	1.000E-02
White Oak	WOCM 0.0B	Filtered	Antimony	3.500E-03	5.300E-03	6.800E-03
White Oak	WOCM 0.0B	Filtered	Barium	2.200E-02	2.570E-02	2.740E-02
White Oak	WOCM 0.0B	Filtered	Boron	3.670E-02	0.000E+00	6.290E-02
White Oak	WOCM 0.0B	Filtered	Chromium	<0.002	<0.001	1.200E-03
White Oak	WOCM 0.0B	Filtered	Copper	2.300E-03	2.500E-03	5.900E-03
White Oak	WOCM 0.0B	Filtered	Iron	2.600E-02	<0.0018	<0.0018
White Oak	WOCM 0.0B	Filtered	Manganese	2.480E-02	7.400E-03	8.100E-03
White Oak	WOCM 0.0B	Filtered	Nickel	2.300E-03	2.200E-03	1.200E-03
White Oak	WOCM 0.0B	Filtered	Zinc	4.900E-03	4.000E-03	4.700E-03

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
White Oak	CRM 20.2A	Unfiltered	Aluminum	5.050E-01	9.100E-02	6.530E-02
White Oak	CRM 20.2A	Unfiltered	Barium	2.770E-02	2.850E-02	2.620E-02
White Oak	CRM 20.2A	Unfiltered	Boron	2.780E-02	0.000E+00	4.310E-02
White Oak	CRM 20.2A	Unfiltered	Chromium	<0.002	1.100E-03	1.900E-03
White Oak	CRM 20.2A	Unfiltered	Copper	5.000E-03	4.700E-03	2.700E-03
White Oak	CRM 20.2A	Unfiltered	Iron	7.050E-01	1.420E-01	8.180E-02
White Oak	CRM 20.2A	Unfiltered	Lead	1.600E-03	<0.001	<0.001
White Oak	CRM 20.2A	Unfiltered	Manganese	5.850E-02	5.850E-02	4.020E-02
White Oak	CRM 20.2A	Unfiltered	Nickel	2.600E-03	2.900E-03	<0.001
White Oak	CRM 20.2A	Unfiltered	Vanadium	1.200E-03	<0.001	<0.001
White Oak	CRM 20.2A	Unfiltered	Zinc	1.780E-02	2.640E-02	4.200E-03
White Oak	CRM 20.2A	Filtered	Aluminum	1.120E-02	<0.006	7.300E-03
White Oak	CRM 20.2A	Filtered	Antimony	1.130E-02	5.400E-03	7.400E-03
White Oak	CRM 20.2A	Filtered	Barium	2.020E-02	2.690E-02	2.380E-02
White Oak	CRM 20.2A	Filtered	Boron	2.530E-02	0.000E+00	4.220E-02
White Oak	CRM 20.2A	Filtered	Chromium	<0.002	2.200E-03	1.100E-03
White Oak	CRM 20.2A	Filtered	Copper	1.700E-03	3.600E-03	5.300E-03
White Oak	CRM 20.2A	Filtered	Iron	1.760E-02	4.080E-01	1.800E-02
White Oak	CRM 20.2A	Filtered	Manganese	4.200E-03	3.400E-03	1.800E-03
White Oak	CRM 20.2A	Filtered	Nickel	2.200E-03	5.700E-03	1.200E-03
White Oak	CRM 20.2A	Filtered	Uranium	3.100E-03	0.000E+00	<0.001
White Oak	CRM 20.2A	Filtered	Zinc	2.800E-03	4.800E-03	3.000E-03
White Oak	CRM 20.2B	Unfiltered	Aluminum	5.530E-01	4.620E-02	5.900E-02
White Oak	CRM 20.2B	Unfiltered	Barium	2.670E-02	2.760E-02	3.000E-02
White Oak	CRM 20.2B	Unfiltered	Boron	2.590E-02	0.000E+00	6.060E-02
White Oak	CRM 20.2B	Unfiltered	Chromium	<0.002	1.500E-03	1.700E-03
White Oak	CRM 20.2B	Unfiltered	Copper	4.500E-03	4.800E-03	2.010E-02
White Oak	CRM 20.2B	Unfiltered	Iron	6.180E-01	7.080E-02	8.580E-02
White Oak	CRM 20.2B	Unfiltered	Lead	1.700E-03	<0.001	1.000E-03
White Oak	CRM 20.2B	Unfiltered	Manganese	5.850E-02	4.470E-02	4.080E-02
White Oak	CRM 20.2B	Unfiltered	Nickel	3.000E-03	3.400E-03	4.900E-03
White Oak	CRM 20.2B	Unfiltered	Vanadium	1.200E-03	<0.001	<0.001
White Oak	CRM 20.2B	Unfiltered	Zinc	1.100E-02	1.670E-02	1.810E-02
White Oak	CRM 20.2B	Filtered	Aluminum	1.930E-02	<0.006	2.040E-02
White Oak	CRM 20.2B	Filtered	Antimony	1.190E-02	5.300E-03	6.300E-03
White Oak	CRM 20.2B	Filtered	Barium	1.980E-02	2.520E-02	2.610E-02
White Oak	CRM 20.2B	Filtered	Boron	2.480E-02	0.000E+00	1.500E-01

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
White Oak	CRM 20.2B	Filtered	Chromium	<0.002	<0.001	2.600E-03
White Oak	CRM 20.2B	Filtered	Copper	2.600E-03	2.500E-03	4.400E-03
White Oak	CRM 20.2B	Filtered	Iron	2.470E-02	<0.0018	<0.0018
White Oak	CRM 20.2B	Filtered	Manganese	5.300E-03	1.100E-03	2.100E-03
White Oak	CRM 20.2B	Filtered	Nickel	2.400E-03	4.900E-03	<0.001
White Oak	CRM 20.2B	Filtered	Zinc	4.000E-03	3.500E-03	<0.002
White Oak	CRM 20.2C	Unfiltered	Aluminum	4.920E-01	4.680E-02	4.550E-02
White Oak	CRM 20.2C	Unfiltered	Barium	2.630E-02	2.790E-02	2.560E-02
White Oak	CRM 20.2C	Unfiltered	Boron	3.350E-02	0.000E+00	5.280E-02
White Oak	CRM 20.2C	Unfiltered	Chromium	<0.002	<0.001	2.300E-03
White Oak	CRM 20.2C	Unfiltered	Copper	1.050E-02	5.300E-03	2.000E-03
White Oak	CRM 20.2C	Unfiltered	Iron	6.670E-01	7.980E-02	4.860E-02
White Oak	CRM 20.2C	Unfiltered	Lead	1.500E-03	1.400E-03	<0.001
White Oak	CRM 20.2C	Unfiltered	Manganese	5.990E-02	4.280E-02	3.220E-02
White Oak	CRM 20.2C	Unfiltered	Nickel	3.200E-03	5.300E-03	<0.001
White Oak	CRM 20.2C	Unfiltered	Vanadium	1.200E-03	<0.001	<0.001
White Oak	CRM 20.2C	Unfiltered	Zinc	1.500E-02	3.710E-02	4.500E-03
White Oak	CRM 20.2C	Filtered	Aluminum	1.860E-02	<0.006	1.330E-02
White Oak	CRM 20.2C	Filtered	Antimony	7.200E-03	4.200E-03	5.100E-03
White Oak	CRM 20.2C	Filtered	Arsenic	<0.001	<0.001	1.100E-03
White Oak	CRM 20.2C	Filtered	Barium	2.000E-02	2.580E-02	2.580E-02
White Oak	CRM 20.2C	Filtered	Boron	4.100E-02	0.000E+00	4.940E-02
White Oak	CRM 20.2C	Filtered	Chromium	<0.002	<0.001	1.700E-03
White Oak	CRM 20.2C	Filtered	Copper	2.500E-03	1.600E-03	3.000E-03
White Oak	CRM 20.2C	Filtered	Iron	2.030E-02	<0.0018	1.800E-02
White Oak	CRM 20.2C	Filtered	Manganese	5.100E-03	<0.001	1.400E-03
White Oak	CRM 20.2C	Filtered	Nickel	2.600E-03	1.800E-03	<0.001
White Oak	CRM 20.2C	Filtered	Zinc	5.000E-03	5.200E-03	3.300E-03
White Oak	CRM 19.0 B	Unfiltered	Aluminum	5.100E-01	4.560E-02	6.420E-02
White Oak	CRM 19.0 B	Unfiltered	Barium	2.920E-02	2.840E-02	3.140E-02
White Oak	CRM 19.0 B	Unfiltered	Boron	4.190E-02	0.000E+00	5.970E-02
White Oak	CRM 19.0 B	Unfiltered	Chromium	<0.002	<0.001	2.300E-03
White Oak	CRM 19.0 B	Unfiltered	Copper	6.200E-03	3.900E-03	2.210E-02
White Oak	CRM 19.0 B	Unfiltered	Iron	7.230E-01	7.870E-02	9.700E-02
White Oak	CRM 19.0 B	Unfiltered	Lead	1.900E-03	<0.001	1.700E-03
White Oak	CRM 19.0 B	Unfiltered	Manganese	6.040E-02	4.590E-02	4.020E-02
White Oak	CRM 19.0 B	Unfiltered	Nickel	2.900E-03	3.200E-03	7.300E-03

Table L5 (continued)

Source	Site	Process	Analyte	Spring Rain mg/L	Summer Rain mg/L	Summer Dry mg/L
White Oak	CRM 19.0 B	Unfiltered	Zinc	2.020E-02	2.040E-02	1.330E-02
White Oak	CRM 19.0 B	Filtered	Aluminum	1.270E-02	<0.006	6.190E-03
White Oak	CRM 19.0 B	Filtered	Antimony	8.600E-03	6.380E-03	9.670E-03
White Oak	CRM 19.0 B	Filtered	Barium	2.050E-02	2.437E-02	2.516E-02
White Oak	CRM 19.0 B	Filtered	Boron	3.480E-02	0.000E+00	4.137E-02
White Oak		Filtered	Chromium	<0.002	1.280E-03	1.510E-03
White Oak	CRM 19.0 B	Filtered	Copper	1.700E-03	1.950E-03	6.100E-03
White Oak	CRM 19.0 B	Filtered	Iron	2.270E-02	<0.0018	1.800E-02
White Oak	CRM 19.0 B	Filtered	Manganese	3.900E-03	1.120E-03	2.690E-03
White Oak	CRM 19.0 B	Filtered	Nickel	2.100E-03	4.170E-03	1.110E-03
White Oak	CRM 19.0 B	Filtered	Zinc	5.600E-03	5.460E-03	3.340E-03

Table L6. Organic analytes detected (mg/L) in association with the water biased event study

Reach	River Mile		Season	Analyte	Process	Result
1	CRM	41.5	summer	Bis(2-ethylhexyl)phthalate	Filtered	2.70E-02
4.02	CRM	6	spring	Bis(2-ethylhexyl)phthalate	Filtered	1.00E-03
4.04	CRM	1	summer	Bis(2-ethylhexyl)phthalate	Filtered	3.00E-02
7.02	MBM	0.2	summer	Bis(2-ethylhexyl)phthalate	Total	6.00E-03
1	CRM	41.5	spring	Di-n-butylphthalate	Filtered	1.00E-03
4.02	CRM	6	summer	Di-n-butylphthalate	Filtered	1.00E-03
7.02	MBM	0.2	spring	Di-n-butylphthalate	Filtered	1.00E-03
1	CRM	41.5	spring	Di-n-butylphthalate	Total	1.00E-03
7.02	MBM	0.2	summer	Di-n-butylphthalate	Total	4.00E-03
7.02	MBM	0.2	spring	alpha-BHC	Filtered	1.80E-05
7.02	MBM	0.2	spring	alpha-BHC	Total	1.30E-05

Table L7. Radionuclide concentrations for the water biased event study

Subreach	Site	Analyte	Total or Dissolved	Spring Rain	Spring Det. Limit	Summer Rain	Summer Det. Limit	Summer Dry	Summer Det. Limit	Units
Source: MCoy Branch										
1	CRM 36.9B	Particle associated Co-60		-5.57E+00	3.53E+01	-6.33E+01	1.60E+02	7.97E+00	2.56E+02	pCi/G
1	CRM 36.9B	Particle associated Cs-137		1.22E+01	3.77E+01	7.39E+01	1.62E+02	-4.50E+00	2.39E+02	pCi/G
1	CRM 36.9B	Cesium-137	Dissolved	1.18E+01	1.25E+01	7.30E-01	4.95E+00	-4.03E+00	5.16E+00	pCi/L
1	CRM 36.9B	Cobalt-60	Dissolved	-7.10E-01	9.05E+00	1.41E+00	4.34E+00	2.38E+00	4.69E+00	pCi/L
1	CRM 36.9B	Cesium-137	Residue	2.20E-01	6.80E-01	3.70E-01	8.10E-01	-1.00E-02	7.20E-01	pCi/L
1	CRM 36.9B	Cobalt-60	Residue	-1.00E-01	6.30E-01	-3.20E-01	8.00E-01	2.00E-02	7.70E-01	pCi/L
1	CRM 36.9B	Gross alpha activity	Total	1.15E+00	5.70E-01	-6.56E+00	2.36E+00	-4.26E+00	3.06E+00	pCi/L
1	CRM 36.9B	Gross beta activity	Total	7.12E+00	1.37E+00	5.88E+00	2.98E+00	4.32E+00	4.66E+00	pCi/L
1	CRM 36.9B	Strontium-90	Total	9.50E-01	1.93E+00	2.40E+00	1.30E+00	2.10E-01	2.31E+00	pCi/L
1	CRM 36.9B	Tritium	Total	0.00E+00	2.20E+02	4.30E+01	2.56E+02	-7.19E+01	2.43E+02	pCi/L
7.01	MBM 0.4B	Particle associated Co-60		2.44E+01	6.25E+01	-2.72E+01	9.67E+01	-2.47E+01	1.22E+02	pCi/G
7.01	MBM 0.4B	Particle associated Cs-137		1.81E+00	5.85E+01	-2.39E+01	8.64E+01	-1.57E+01	1.06E+02	pCi/G
7.01	MBM 0.4B	Cesium-137	Dissolved	-3.63E+00	1.07E+01	6.26E+00	1.12E+01	-2.00E+00	1.08E+01	pCi/L
7.01	MBM 0.4B	Cobalt-60	Dissolved	4.14E+00	1.01E+01	8.90E-01	1.00E+01	5.75E+00	1.05E+01	pCi/L
7.01	MBM 0.4B	Cesium-137	Residue	2.00E-02	6.80E-01	-1.70E-01	6.20E-01	-9.00E-02	6.30E-01	pCi/L
7.01	MBM 0.4B	Cobalt-60	Residue	2.80E-01	7.20E-01	-2.00E-01	7.00E-01	-1.50E-01	7.30E-01	pCi/L
7.01	MBM 0.4B	Gross alpha activity	Total	1.27E+00	7.40E-01	-7.34E+00	2.47E+00	-6.50E-01	3.16E+00	pCi/L
7.01	MBM 0.4B	Gross beta activity	Total	1.56E+00	1.39E+00	6.63E+00	2.86E+00	3.57E+00	4.51E+00	pCi/L
7.01	MBM 0.4B	Strontium-90	Total	6.90E-01	2.65E+00	1.42E+00	1.49E+00	1.30E+00	1.75E+00	pCi/L
7.01	MBM 0.4B	Tritium	Total	1.13E+02	2.19E+02	2.04E+02	2.56E+02	-1.53E+01	2.43E+02	pCi/L
7.02	MBM 0.2A	Particle associated Co-60		9.12E+00	2.35E+01	-6.00E+01	1.44E+02	-3.43E+01	1.91E+02	pCi/G
7.02	MBM 0.2A	Particle associated Cs-137								pCi/G
7.02	MBM 0.2A	Cesium-137	Dissolved	6.30E-01	1.03E+01	7.00E-01	5.92E+00	-1.12E+00	5.61E+00	pCi/L

Table L7 (continued)

Subreach	Site	Analyte	Total or Dissolved	Spring Rain	Spring Det. Limit	Summer Rain	Summer Det. Limit	Summer Dry	Summer Det. Limit	Units
7.02	MBM 0.2A	Cobalt-60	Dissolved	4.19E+00	8.72E+00	2.08E+00	5.15E+00	-1.41E+00	4.94E+00	pCi/L
7.02	MBM 0.2A	Cesium-137	Residue	0.00E+00	2.90E-01	-3.10E-01	7.50E-01	1.00E-01	7.70E-01	pCi/L
7.02	MBM 0.2A	Cobalt-60	Residue	1.10E-01	3.00E-01	-2.80E-01	6.60E-01	-1.60E-01	8.80E-01	pCi/L
7.02	MBM 0.2A	Gross alpha activity	Total	3.40E-01	9.20E-01	-5.60E+00	2.46E+00	-3.29E+00	3.15E+00	pCi/L
7.02	MBM 0.2A	Gross beta activity	Total	9.90E-01	1.33E+00	1.00E+01	2.87E+00	4.54E+00	4.51E+00	pCi/L
7.02	MBM 0.2A	Strontium-90	Total	4.20E-01	2.63E+00	1.43E+00	1.32E+00	-2.11E+00	1.96E+00	pCi/L
7.02	MBM 0.2A	Tritium	Total	0.00E+00	2.19E+02	1.77E+02	2.56E+02	9.16E+01	2.43E+02	pCi/L
7.02	MBM 0.2B	Particle associated Co-60		-7.58E+00	3.97E+01	5.70E+01	8.83E+01	-1.48E+01	6.44E+01	pCi/G
7.02	MBM 0.2B	Particle associated Cs-137		-1.32E+01	3.64E+01	-4.09E+00	7.97E+01	3.04E+01	6.19E+01	pCi/G
7.02	MBM 0.2B	Cesium-137	Dissolved	-2.68E+00	5.00E+00	9.34E+00	1.16E+01	7.63E+00	1.22E+01	pCi/L
7.02	MBM 0.2B	Cobalt-60	Dissolved	-1.91E+00	4.66E+00	3.93E+00	1.07E+01	-2.60E+00	1.07E+01	pCi/L
7.02	MBM 0.2B	Cesium-137	Residue	-2.30E-01	6.30E-01	-2.00E-02	3.00E-01	1.50E-01	3.10E-01	pCi/L
7.02	MBM 0.2B	Cobalt-60	Residue	-1.30E-01	6.80E-01	2.20E-01	3.40E-01	-7.00E-02	3.20E-01	pCi/L
7.02	MBM 0.2B	Gross alpha activity	Total	4.70E-01	6.60E-01	-1.47E+01	4.65E+00	-3.42E+00	3.13E+00	pCi/L
7.02	MBM 0.2B	Gross beta activity	Total	1.45E+00	1.65E+00	7.83E+00	3.01E+00	1.70E+00	4.55E+00	pCi/L
7.02	MBM 0.2B	Strontium-90	Total	4.55E+00	2.62E+00	1.45E+00	1.19E+00	1.44E+00	1.93E+00	pCi/L
7.02	MBM 0.2B	Tritium	Total	0.00E+00	2.19E+02	1.43E+02	2.56E+02	-1.09E+02	2.43E+02	pCi/L
7.02	MBM 0.2C	Particle associated Co-60		-1.82E+00	2.15E+01	1.77E+02	2.28E+02	4.02E+01	2.23E+02	pCi/G
7.02	MBM 0.2C	Particle associated Cs-137		-1.10E+01	1.97E+01	-6.32E+01	2.15E+02	-2.18E+01	1.76E+02	pCi/G
7.02	MBM 0.2C	Cesium-137	Dissolved	1.22E+01	1.33E+01	2.36E+00	1.22E+01	8.32E+00	1.31E+01	pCi/L
7.02	MBM 0.2C	Cobalt-60	Dissolved	2.53E+00	9.48E+00	1.42E+00	9.83E+00	-2.66E+00	1.03E+01	pCi/L
7.02	MBM 0.2C	Cesium-137	Residue	-1.50E-01	2.80E-01	-2.10E-01	7.30E-01	-7.00E-02	6.00E-01	pCi/L
7.02	MBM 0.2C	Cobalt-60	Residue	-3.00E-02	3.00E-01	6.00E-01	7.80E-01	1.40E-01	7.60E-01	pCi/L
7.02	MBM 0.2C	Gross alpha activity	Total	6.60E-01	9.00E-01	-7.68E+00	2.35E+00	-4.85E+00	3.16E+00	pCi/L
7.02	MBM 0.2C	Gross beta activity	Total	1.94E+00	1.20E+00	6.10E+00	2.98E+00	2.13E+00	4.50E+00	pCi/L

Table L7 (continued)

Subreach	Site	Analyte	Total or Dissolved	Spring Rain	Spring Det. Limit	Summer Rain	Summer Det. Limit	Summer Dry	Summer Det. Limit	Units
7.02	MBM 0.2C	Strontium-90	Total	5.57E+00	2.28E+00	1.69E+00	1.40E+00	1.46E+00	2.57E+00	pCi/L
7.02	MBM 0.2C	Tritium	Total	0.00E+00	2.15E+02	1.44E+02	2.56E+02	-2.12E+02	2.43E+02	pCi/L
Source: Poplar Creek										
3.04	PCM 0.1B	Particle associated Co-60		4.46E+00	6.68E+01	-5.15E+00	6.60E+01	2.51E+00	6.78E+01	pCi/G
3.04	PCM 0.1B	Particle associated Cs-137		3.93E+00	6.06E+01	-2.07E+01	5.97E+01	1.93E+01	6.16E+01	pCi/G
3.04	PCM 0.1B	Cesium-137	Dissolved	-2.48E+00	1.15E+01	9.42E+00	1.20E+01	1.18E+01	1.24E+01	pCi/L
3.04	PCM 0.1B	Cobalt-60	Dissolved	-3.26E+00	8.82E+00	-5.00E-02	1.13E+01	7.94E+00	1.19E+01	pCi/L
3.04	PCM 0.1B	Cesium-137	Residue	4.00E-02	5.80E-01	-2.10E-01	6.20E-01	2.10E-01	6.60E-01	pCi/L
3.04	PCM 0.1B	Cobalt-60	Residue	4.00E-02	6.40E-01	-5.00E-02	6.90E-01	3.00E-02	7.30E-01	pCi/L
3.04	PCM 0.1B	Gross alpha activity	Total	-5.60E+00	3.01E+00	-8.40E+00	2.41E+00	1.18E+00	2.93E+00	pCi/L
3.04	PCM 0.1B	Gross beta activity	Total	-1.66E+00	3.07E+00	1.26E+01	3.01E+00	-2.67E+00	4.60E+00	pCi/L
3.04	PCM 0.1B	Strontium-90	Total	8.53E+01	1.29E+00	1.31E+00	7.90E-01	8.00E-01	1.53E+00	pCi/L
3.04	PCM 0.1B	Tritium	Total	0.00E+00	2.15E+02	9.19E+02	2.56E+02	8.06E+01	2.53E+02	pCi/L
4.01	CRM 11.8A	Particle associated Co-60		3.32E+01	7.64E+01	2.13E+00	1.55E+01	-1.26E+01	5.60E+01	pCi/G
4.01	CRM 11.8A	Particle associated Cs-137								pCi/G
4.01	CRM 11.8A	Cesium-137	Dissolved	1.08E+01	1.26E+01	-1.07E+00	5.58E+00	1.47E+00	1.05E+01	pCi/L
4.01	CRM 11.8A	Cobalt-60	Dissolved	-2.49E+00	1.02E+01	-3.70E-01	4.71E+00	1.76E+00	1.09E+01	pCi/L
4.01	CRM 11.8A	Cesium-137	Residue	2.20E-01	6.50E-01	2.30E-01	3.40E-01	-1.10E-01	6.60E-01	pCi/L
4.01	CRM 11.8A	Cobalt-60	Residue	2.50E-01	5.80E-01	4.00E-02	3.20E-01	-1.70E-01	7.50E-01	pCi/L
4.01	CRM 11.8A	Gross alpha activity	Total	1.00E+00	6.70E-01	-9.47E+00	2.53E+00	1.20E-01	3.00E+00	pCi/L
4.01	CRM 11.8A	Gross beta activity	Total	-1.90E+00	1.49E+00	1.27E+01	2.89E+00	9.70E-01	4.49E+00	pCi/L
4.01	CRM 11.8A	Strontium-90	Total	8.90E-01	1.26E+00	8.90E-01	7.90E-01	2.07E+00	1.51E+00	pCi/L
4.01	CRM 11.8A	Tritium	Total	1.05E+02	2.12E+02	4.36E+02	2.56E+02	-6.76E+01	2.53E+02	pCi/L
4.01	CRM 11.8B	Particle associated Co-60		-6.40E-01	3.18E+01	6.29E+00	3.77E+01	-9.15E+01	6.32E+01	pCi/G

Table L7 (continued)

Subreach	Site	Analyte	Total or Dissolved	Spring Rain	Spring Det. Limit	Summer Rain	Summer Det. Limit	Summer Dry	Summer Det. Limit	Units
4.01	CRM 11.8B	Particle associated Cs-137		2.81E+01	3.37E+01	-1.28E+01	3.38E+01	1.76E+01	6.41E+01	pCi/G
4.01	CRM 11.8B	Cesium-137	Dissolved	1.33E+01	1.24E+01	9.83E+00	1.28E+01	1.06E+01	1.17E+01	pCi/L
4.01	CRM 11.8B	Cobalt-60	Dissolved	5.54E+00	9.85E+00	1.00E+00	9.64E+00	5.76E+00	1.05E+01	pCi/L
4.01	CRM 11.8B	Cesium-137	Residue	2.60E-01	3.10E-01	-2.30E-01	6.10E-01	2.00E-01	7.40E-01	pCi/L
4.01	CRM 11.8B	Cobalt-60	Residue	-1.00E-02	2.90E-01	1.10E-01	6.90E-01	-1.06E+00	7.30E-01	pCi/L
4.01	CRM 11.8B	Gross alpha activity	Total	2.20E-01	9.70E-01	-1.68E+01	4.93E+00	1.20E+00	4.17E+00	pCi/L
4.01	CRM 11.8B	Gross beta activity	Total	2.95E+00	1.57E+00	1.87E+01	5.91E+00	1.63E+00	3.52E+00	pCi/L
4.01	CRM 11.8B	Strontium-90	Total	0.00E+00	1.79E+00	1.74E+00	9.20E-01	1.80E+00	1.78E+00	pCi/L
4.01	CRM 11.8B	Tritium	Total	2.36E+02	2.14E+02	3.14E+02	2.56E+02	9.81E+01	2.53E+02	pCi/L
4.01	CRM 11.8C	Particle associated Co-60		4.62E+01	9.33E+01	2.52E+01	3.08E+01	-1.33E+01	6.86E+01	pCi/G
4.01	CRM 11.8C	Particle associated Cs-137		-2.52E+01	9.08E+01	4.87E+00	2.81E+01	3.19E+01	6.50E+01	pCi/G
4.01	CRM 11.8C	Cesium-137	Dissolved	6.12E+00	1.13E+01	-8.70E-01	4.64E+00	1.04E+01	1.15E+01	pCi/L
4.01	CRM 11.8C	Cobalt-60	Dissolved	-2.43E+00	9.58E+00	2.74E+00	5.04E+00	-1.22E+00	8.34E+00	pCi/L
4.01	CRM 11.8C	Cesium-137	Residue	-2.00E-01	7.10E-01	1.10E-01	6.50E-01	4.10E-01	8.30E-01	pCi/L
4.01	CRM 11.8C	Cobalt-60	Residue	3.60E-01	7.30E-01	5.80E-01	7.10E-01	-1.70E-01	8.80E-01	pCi/L
4.01	CRM 11.8C	Gross alpha activity	Total	4.60E-01	1.30E+00	-1.03E+01	2.49E+00	2.74E+00	2.94E+00	pCi/L
4.01	CRM 11.8C	Gross beta activity	Total	4.94E+00	2.68E+00	1.86E+01	2.93E+00	-5.13E+00	4.57E+00	pCi/L
4.01	CRM 11.8C	Strontium-90	Total	0.00E+00	1.51E+00	5.60E-01	1.01E+00	1.42E+00	1.49E+00	pCi/L
4.01	CRM 11.8C	Tritium	Total	1.50E+02	2.13E+02	9.05E+01	2.56E+02	5.67E+01	2.53E+02	pCi/L
4.01	CRM 9.0B	Particle associated Co-60		-4.92E+01	6.66E+01	1.72E+01	6.95E+01	2.46E+01	1.75E+02	pCi/G
4.01	CRM 9.0B	Particle associated Cs-137		1.63E+01	6.38E+01	3.85E+00	6.63E+01	1.22E+02	1.71E+02	pCi/G
4.01	CRM 9.0B	Cesium-137	Dissolved	-2.16E+00	4.76E+00	-1.29E+00	9.78E+00	-6.80E-01	1.08E+01	pCi/L
4.01	CRM 9.0B	Cobalt-60	Dissolved	1.60E-01	4.51E+00	-5.00E-02	9.04E+00	7.94E+00	9.95E+00	pCi/L
4.01	CRM 9.0B	Cesium-137	Residue	1.70E-01	6.60E-01	2.00E-02	3.00E-01	5.40E-01	7.50E-01	pCi/L
4.01	CRM 9.0B	Cobalt-60	Residue	-5.10E-01	6.90E-01	8.00E-02	3.20E-01	1.10E-01	7.70E-01	pCi/L

Table L7 (continued)

Subreach	Site	Analyte	Total or Dissolved	Spring Rain	Spring Det. Limit	Summer Rain	Summer Det. Limit	Summer Dry	Summer Det. Limit	Units
4.01	CRM 9.0B	Gross alpha activity	Total	7.00E-01	7.40E-01	-7.90E+00	2.35E+00	7.60E-01	2.84E+00	pCi/L
4.01	CRM 9.0B	Gross beta activity	Total	1.38E+00	1.39E+00	7.53E+00	3.09E+00	-3.28E+00	4.75E+00	pCi/L
4.01	CRM 9.0B	Strontium-90	Total	.	.	-3.70E-01	7.50E-01	1.87E+00	1.70E+00	pCi/L
4.01	CRM 9.0B	Tritium	Total	7.67E+01	2.14E+02	4.10E+02	2.56E+02	3.44E+02	2.43E+02	pCi/L
Reference Site										
1	CRM 41.5B	Particle associated Co-60		1.75E+01	5.61E+01	9.67E+00	1.49E+02	-4.67E+01	1.69E+02	pCi/G
1	CRM 41.5B	Particle associated Cs-137		.	.	.	.	.	.	pCi/G
1	CRM 41.5B	Cesium-137	Dissolved	-1.38E+00	1.18E+01	6.23E+00	1.18E+01	8.00E-01	1.16E+01	pCi/L
1	CRM 41.5B	Cobalt-60	Dissolved	-7.60E-01	9.76E+00	-1.37E+00	8.67E+00	-1.00E+01	8.79E+00	pCi/L
1	CRM 41.5B	Cesium-137	Residue	7.00E-02	2.90E-01	1.10E-01	6.10E-01	-1.10E-01	6.70E-01	pCi/L
1	CRM 41.5B	Cobalt-60	Residue	7.00E-02	2.20E-01	5.00E-02	7.70E-01	-2.00E-01	7.10E-01	pCi/L
1	CRM 41.5B	Gross alpha activity	Total	4.20E-01	9.20E-01	-8.15E+00	2.43E+00	4.79E+00	3.08E+00	pCi/L
1	CRM 41.5B	Gross beta activity	Total	1.00E+00	1.33E+00	8.32E+00	2.99E+00	-3.60E+00	4.37E+00	pCi/L
1	CRM 41.5B	Strontium-90	Total	1.40E-01	1.09E+00	8.20E-01	8.90E-01	2.08E+00	1.70E+00	pCi/L
1	CRM 41.5B	Tritium	Total	0.00E+00	2.14E+02	1.31E+02	2.56E+02	-6.10E+01	2.53E+02	pCi/L
1	CRM 43.0B	Particle associated Co-60		5.89E+01	1.04E+02	3.91E+00	4.55E+01	3.62E+01	2.86E+02	pCi/G
1	CRM 43.0B	Particle associated Cs-137		-6.11E+00	8.64E+01	-2.03E+01	4.36E+01	1.44E+01	2.22E+02	pCi/G
1	CRM 43.0B	Cesium-137	Dissolved	2.23E+00	5.17E+00	-1.50E+00	5.24E+00	7.63E+00	1.22E+01	pCi/L
1	CRM 43.0B	Cobalt-60	Dissolved	5.82E+00	4.83E+00	-3.54E+00	4.67E+00	-1.10E-01	9.56E+00	pCi/L
1	CRM 43.0B	Cesium-137	Residue	-4.00E-02	6.20E-01	-1.50E-01	3.20E-01	4.00E-02	6.20E-01	pCi/L
1	CRM 43.0B	Cobalt-60	Residue	4.20E-01	7.50E-01	3.00E-02	3.40E-01	1.00E-01	8.00E-01	pCi/L
1	CRM 43.0B	Gross alpha activity	Total	1.23E+00	8.70E-01	-6.13E+00	2.26E+00	8.00E-02	2.95E+00	pCi/L
1	CRM 43.0B	Gross beta activity	Total	1.62E+00	1.43E+00	7.57E+00	3.20E+00	-3.83E+00	4.56E+00	pCi/L

Table L7 (continued)

Subreach	Site	Analyte	Total or Dissolved	Spring Rain	Spring Det. Limit	Summer Rain	Summer Det. Limit	Summer Dry	Summer Det. Limit	Units
1	CRM 43.0B	Strontium-90	Total	3.29E+00	2.49E+00	6.70E-01	7.40E-01	-7.40E-01	1.50E+00	pCi/L
1	CRM 43.0B	Tritium	Total	1.30E+02	2.12E+02	-1.13E+01	2.68E+02	-3.92E+01	2.53E+02	pCi/L
1	CRM 46.0B	Particle associated Co-60		8.29E+01	1.25E+02	-2.42E+01	1.36E+02	6.58E+01	2.21E+02	pCi/G
1	CRM 46.0B	Particle associated Cs-137		5.05E+01	1.22E+02	5.63E+01	1.26E+02	2.64E+01	2.12E+02	pCi/G
1	CRM 46.0B	Cesium-137	Dissolved	-5.30E-01	5.00E+00	7.59E+00	8.78E+00	2.60E-01	1.12E+01	pCi/L
1	CRM 46.0B	Cobalt-60	Dissolved	1.61E+00	4.63E+00	6.87E+00	7.77E+00	7.00E-01	1.05E+01	pCi/L
1	CRM 46.0B	Cesium-137	Residue	2.70E-01	6.60E-01	3.00E-01	6.80E-01	9.00E-02	7.20E-01	pCi/L
1	CRM 46.0B	Cobalt-60	Residue	4.50E-01	6.80E-01	-1.30E-01	7.30E-01	2.20E-01	7.50E-01	pCi/L
1	CRM 46.0B	Gross alpha activity	Total	7.10E-01	6.60E-01	-6.01E+00	2.24E+00	0.00E+00	3.00E+00	pCi/L
1	CRM 46.0B	Gross beta activity	Total	1.89E+00	1.65E+00	1.92E+01	3.23E+00	-1.62E+00	4.54E+00	pCi/L
1	CRM 46.0B	Strontium-90	Total	2.99E+00	2.67E+00	1.18E+00	8.20E-01	1.90E+00	1.65E+00	pCi/L
1	CRM 46.0B	Tritium	Total	.	.	7.47E+01	2.68E+02	3.92E+01	2.53E+02	pCi/L
4.04	CRM 1.0B	Particle associated Co-60		4.21E+00	3.77E+01	1.99E+00	1.38E+02	3.97E+00	1.14E+02	pCi/G
4.04	CRM 1.0B	Particle associated Cs-137		1.34E+01	3.91E+01	5.07E+01	1.37E+02	2.96E+01	1.14E+02	pCi/G
4.04	CRM 1.0B	Cesium-137	Dissolved	3.43E+00	1.09E+01	5.05E+00	1.26E+01	-5.30E-01	6.06E+00	pCi/L
4.04	CRM 1.0B	Cobalt-60	Dissolved	-2.89E+00	9.94E+00	3.11E+00	1.08E+01	4.42E+00	5.08E+00	pCi/L
4.04	CRM 1.0B	Cesium-137	Residue	1.10E-01	3.10E-01	2.90E-01	7.90E-01	1.80E-01	6.80E-01	pCi/L
4.04	CRM 1.0B	Cobalt-60	Residue	3.00E-02	3.00E-01	1.00E-02	8.00E-01	2.00E-02	6.80E-01	pCi/L
4.04	CRM 1.0B	Gross alpha activity	Total	1.40E-01	8.90E-01	-7.07E+00	3.37E+00	-2.20E+00	3.08E+00	pCi/L
4.04	CRM 1.0B	Gross beta activity	Total	2.55E+00	1.20E+00	6.86E+00	4.25E+00	2.75E+00	4.38E+00	pCi/L
4.04	CRM 1.0B	Strontium-90	Total	0.00E+00	2.28E+00	1.56E+00	1.27E+00	1.75E+00	1.79E+00	pCi/L
4.04	CRM 1.0B	Tritium	Total	2.17E+02	2.13E+02	1.38E+02	2.68E+02	1.22E+02	2.53E+02	pCi/L
Source: White Oak Creek										
2.02	CRM 20.2A	Particle associated Co-60		8.16E+00	2.62E+01	-5.62E+01	2.08E+02	7.96E+00	2.15E+02	pCi/G

Table L7 (continued)

Subreach	Site	Analyte	Total or Dissolved	Spring Rain	Spring Det. Limit	Summer Rain	Summer Det. Limit	Summer Dry	Summer Det. Limit	Units
2.02	CRM 20.2A	Particle associated Cs-137								pCi/G
2.02	CRM 20.2A	Cesium-137	Dissolved	-2.69E+00	4.69E+00	-2.05E+00	1.19E+01	-3.63E+00	9.79E+00	pCi/L
2.02	CRM 20.2A	Cobalt-60	Dissolved	4.60E-01	4.70E+00	-6.41E+00	8.22E+00	-4.15E+00	8.56E+00	pCi/L
2.02	CRM 20.2A	Cesium-137	Residue	1.10E-01	7.30E-01	4.00E-02	7.30E-01	4.00E-01	7.40E-01	pCi/L
2.02	CRM 20.2A	Cobalt-60	Residue	2.20E-01	7.00E-01	-2.00E-01	7.50E-01	3.00E-02	7.30E-01	pCi/L
2.02	CRM 20.2A	Gross alpha activity	Total	2.92E+00	6.70E-01	-8.34E+00	3.79E+00	-4.14E+00	3.18E+00	pCi/L
2.02	CRM 20.2A	Gross beta activity	Total	1.86E+00	1.49E+00	1.11E+01	3.81E+00	8.68E+00	4.48E+00	pCi/L
2.02	CRM 20.2A	Strontium-90	Total	2.87E+00	2.45E+00	5.28E+00	1.29E+00	3.29E+00	2.42E+00	pCi/L
2.02	CRM 20.2A	Tritium	Total	1.27E+03	2.17E+02	5.76E+03	2.56E+02	1.25E+03	2.43E+02	pCi/L
2.02	CRM 20.2B	Particle associated Co-60		-3.60E-01	1.18E+01	-2.26E+01	9.92E+01	-3.07E+02	2.87E+02	pCi/g
2.02	CRM 20.2B	Particle associated Cs-137		-3.87E+00	1.14E+01	6.58E+01	9.70E+01	5.50E+01	3.01E+02	pCi/g
2.02	CRM 20.2B	Cesium-137	Dissolved	7.57E+00	1.21E+01	3.56E+00	1.08E+01	-2.00E-01	1.05E+01	pCi/L
2.02	CRM 20.2B	Cobalt-60	Dissolved	-3.29E+00	9.75E+00	-3.88E+00	1.00E+01	4.52E+00	1.12E+01	pCi/L
2.02	CRM 20.2B	Cesium-137	Residue	-9.00E-02	2.80E-01	2.20E-01	3.30E-01	1.30E-01	7.20E-01	pCi/L
2.02	CRM 20.2B	Cobalt-60	Residue	-1.00E-02	2.90E-01	-8.00E-02	3.40E-01	-7.40E-01	6.90E-01	pCi/L
2.02	CRM 20.2B	Gross alpha activity	Total	2.00E-02	9.60E-01	-6.90E+00	3.23E+00	-4.97E+00	3.18E+00	pCi/L
2.02	CRM 20.2B	Gross beta activity	Total	2.36E+00	1.56E+00	8.52E+00	4.36E+00	7.15E+00	4.48E+00	pCi/L
2.02	CRM 20.2B	Strontium-90	Total	3.00E-02	2.24E+00	2.68E+00	1.36E+00	3.38E+00	1.60E+00	pCi/L
2.02	CRM 20.2B	Tritium	Total	0.00E+00	2.19E+02	1.89E+03	2.56E+02	9.81E+02	2.43E+02	pCi/L
2.02	CRM 20.2C	Particle associated Co-60		-1.45E+01	3.37E+01	2.56E+01	1.72E+02	6.25E+01	2.85E+02	pCi/g
2.02	CRM 20.2C	Particle associated Cs-137		1.90E-01	3.09E+01	-3.36E+01	1.82E+02	3.36E+01	2.92E+02	pCi/g
2.02	CRM 20.2C	Cesium-137	Dissolved	1.18E+01	1.22E+01	7.70E-01	4.76E+00	-2.58E+00	5.75E+00	pCi/L
2.02	CRM 20.2C	Cobalt-60	Dissolved	-8.10E-01	1.04E+01	3.98E+00	5.11E+00	7.40E-01	4.78E+00	pCi/L
2.02	CRM 20.2C	Cesium-137	Residue	0.00E+00	6.70E-01	-1.30E-01	6.90E-01	9.00E-02	7.60E-01	pCi/L
2.02	CRM 20.2C	Cobalt-60	Residue	-3.20E-01	7.30E-01	1.00E-01	6.50E-01	1.60E-01	7.40E-01	pCi/L

Table L7 (continued)

Subreach	Site	Analyte	Total or Dissolved	Spring Rain	Spring Det. Limit	Summer Rain	Summer Det. Limit	Summer Dry	Summer Det. Limit	Units
2.02	CRM 20.2C	Gross alpha activity	Total	6.70E-01	8.40E-01	-5.80E+00	2.23E+00	-5.00E-01	3.25E+00	pCi/L
2.02	CRM 20.2C	Gross beta activity	Total	1.80E+00	1.42E+00	2.32E+01	6.29E+00	3.71E+00	4.37E+00	pCi/L
2.02	CRM 20.2C	Strontium-90	Total	1.93E+00	2.13E+00	3.29E+00	1.35E+00	1.52E+00	1.73E+00	pCi/L
2.02	CRM 20.2C	Tritium	Total	0.00E+00	2.18E+02	2.94E+03	2.56E+02	9.38E+01	2.43E+02	pCi/L
2.02	WOCM 0.0B	Particle associated Co-60		1.76E+01	3.69E+01	4.37E+01	1.09E+02	-2.15E+01	9.37E+01	pCi/g
2.02	WOCM 0.0B	Particle associated Cs-137		4.11E+02	3.30E+01	1.24E+02	8.94E+01	2.38E+02	6.82E+01	pCi/g
2.02	WOCM 0.0B	Cesium-137	Dissolved	6.40E-01	4.95E+00	5.60E+00	1.12E+01	-2.59E+00	5.24E+00	pCi/L
2.02	WOCM 0.0B	Cobalt-60	Dissolved	-2.70E-01	4.67E+00	4.84E+00	1.10E+01	6.25E+00	4.99E+00	pCi/L
2.02	WOCM 0.0B	Cesium-137	Residue	7.80E+00	6.30E-01	8.00E-01	5.70E-01	1.90E+00	5.50E-01	pCi/L
2.02	WOCM 0.0B	Cobalt-60	Residue	3.30E-01	7.00E-01	2.80E-01	7.00E-01	-1.70E-01	7.50E-01	pCi/L
2.02	WOCM 0.0B	Gross alpha activity	Total	2.67E+01	7.90E-01	-2.70E-01	2.39E+00	8.20E+00	3.24E+00	pCi/L
2.02	WOCM 0.0B	Gross beta activity	Total	1.72E+02	1.40E+00	1.12E+02	2.88E+00	1.44E+02	4.39E+00	pCi/L
2.02	WOCM 0.0B	Strontium-90	Total	6.56E+01	2.28E+00	2.66E+01	8.90E-01	5.10E+01	1.56E+00	pCi/L
2.02	WOCM 0.0B	Tritium	Total	5.20E+04	2.15E+02	6.27E+04	2.56E+02	3.44E+04	2.43E+02	pCi/L
2.03	CRM 19.0B	Particle associated Co-60		5.92E+00	9.03E+00	2.02E+01	6.44E+01	1.09E+02	1.28E+02	pCi/g
2.03	CRM 19.0B	Particle associated Cs-137		3.42E+00	8.68E+00	-6.64E+00	8.21E+01	-1.92E+01	1.20E+02	pCi/g
2.03	CRM 19.0B	Cesium-137	Dissolved	3.00E-02	5.35E+00	6.40E+00	1.20E+01	9.85E+00	1.28E+01	pCi/L
2.03	CRM 19.0B	Cobalt-60	Dissolved	-9.60E-01	4.49E+00	1.52E+00	8.37E+00	1.70E+00	1.03E+01	pCi/L
2.03	CRM 19.0B	Cesium-137	Residue	1.10E-01	2.80E-01	-3.00E-02	3.10E-01	-5.00E-02	3.10E-01	pCi/L
2.03	CRM 19.0B	Cobalt-60	Residue	1.90E-01	2.90E-01	8.00E-02	2.40E-01	2.80E-01	3.30E-01	pCi/L
2.03	CRM 19.0B	Gross alpha activity	Total	4.90E-01	7.40E-01	-7.42E+00	2.25E+00	-3.44E+00	3.18E+00	pCi/L
2.03	CRM 19.0B	Gross beta activity	Total	7.91E+00	1.90E+00	8.40E+00	3.11E+00	3.16E+00	4.47E+00	pCi/L
2.03	CRM 19.0B	Strontium-90	Total	3.10E-01	1.93E+00	2.48E+00	1.52E+00	2.00E+00	1.58E+00	pCi/L
2.03	CRM 19.0B	Tritium	Total	1.56E+02	2.18E+02	3.44E+02	2.56E+02	8.06E+01	2.43E+02	pCi/L

Table L8. Filtered and total methyl mercury and mercury concentrations (ng/L) of sources from biased event sampling

Location	Sampling Date	Filtered Methyl Mercury (ng/L)	Unfiltered Methyl Mercury (ng/L)	Filtered Inorganic Mercury (ng/L)	Unfiltered Inorganic Mercury (ng/L)
POPLAR CREEK SOURCE					
REACH 3 PCM 0.1B	20APR1994	9.00E-02	1.84E-01	2.84E+00	1.02E+02
	29JUL1994	9.00E-02	1.71E-01	1.40E+00	9.04E+01
	30AUG1994	6.00E-02	9.00E-02	1.72E+00	6.12E+01
REACH 4.01 CRM 11.8A	20APR1994	3.50E-02	4.20E-02	1.79E+00	1.48E+01
	29JUL1994	1.24E-01	1.47E-01	2.71E+00	6.68E+01
	30AUG1994	4.90E-02	6.30E-02	1.72E+00	2.55E+01
CRM 11.8B	20APR1994	2.80E-02	3.40E-02	2.15E+00	3.80E+00
	29JUL1994	1.56E-01	2.38E-01	5.68E+00	1.82E+02
	30AUG1994	7.90E-02	8.00E-02	1.88E+00	2.59E+01
CRM 11.8C	20APR1994	3.50E-02	3.50E-02	4.83E+00	2.03E+00
	29JUL1994	1.84E-01	3.01E-01	9.32E+00	2.47E+02
	30AUG1994	5.40E-02	1.40E-01	4.24E+00	9.28E+01
CRM 9.0B	20APR1994	9.90E-02	9.90E-02	8.47E+00	2.30E+00
	29JUL1994	1.35E-01	1.15E-01	1.84E+00	1.23E+01
	30AUG1994	9.80E-02	1.48E-01	1.72E+00	3.13E+00
MCCOY BRANCH SOURCE					
REACH 7.01 MBM 0.4B	19APR1994	4.80E-02	1.00E-01	1.92E+00	6.84E+00
	28JUL1994	1.01E-01	1.04E-01	2.74E+00	4.30E+00
	29AUG1994	1.05E-01	1.16E-01	1.39E+00	2.82E+00
REACH 7.02 MBM 0.2A	19APR1994	4.50E-02	3.10E-02	2.55E+00	4.32E+00
	28JUL1994	7.40E-02	8.60E-02	2.24E+00	2.25E+00
	29AUG1994	1.17E-01	1.05E-01	2.10E+00	1.21E+00

Table L8 (continued)

Location	Sampling Date	Filtered Methyl Mercury (ng/L)	Unfiltered Methyl Mercury (ng/L)	Filtered Inorganic Mercury (ng/L)	Unfiltered Inorganic Mercury (ng/L)
MBM 0.2B	19APR1994	5.10E-02	3.90E-02	2.54E+00	7.63E+00
	28JUL1994	1.33E-01	7.90E-02	1.93E+00	2.18E+00
	29AUG1994	1.16E-01	5.80E-02	7.38E-01	1.97E+00
MBM 0.2C	19APR1994	2.90E-02	3.50E-02	3.29E+00	7.17E+00
	28JUL1994	7.00E-02	9.10E-02	1.78E+00	2.28E+00
	29AUG1994	1.38E-01	1.04E-01	7.43E-01	2.44E+00
REACH 1					
CRM 36.9B	19APR1994	2.80E-02	4.70E-02	2.91E+00	4.49E+00
	28JUL1994	5.33E-01	8.50E-02	1.70E+00	1.37E+00
	29AUG1994	1.03E-01	8.10E-02	2.35E+00	2.10E+00
REFERENCE SOURCES					
REACH 1					
CRM 46.0B	20APR1994	3.50E-02	4.40E-02	1.80E+00	4.45E+00
	29JUL1994	1.19E-01	9.20E-02	1.16E+00	3.03E+00
	30AUG1994	5.00E-02	6.80E-02	1.73E+00	1.49E+00
	30AUG1994	6.00E-02	6.00E-02	1.32E+00	2.17E+00
CRM 43.0B	20APR1994	3.70E-02	3.60E-02	2.20E+00	4.35E+00
	29JUL1994	1.82E-01	1.06E-01	1.24E+00	2.33E+00
	30AUG1994	5.90E-02	8.00E-02	1.60E+00	1.73E+00
CRM 41.5B	20APR1994	2.40E-02	4.30E-02	1.94E+00	2.65E+00
	29JUL1994	7.70E-02	1.07E-01	1.75E+00	2.41E+00
	30AUG1994	4.50E-02	5.40E-02	1.17E+00	1.24E+00
REACH 4.04					
CRM 1.0B	20APR1994	3.40E-02	4.60E-02	2.61E+00	1.35E+01
	29JUL1994	1.08E-01	1.19E-01	1.86E+00	7.47E+00
	29JUL1994	1.32E-01	1.47E-01	2.82E+00	9.17E+00
	30AUG1994	1.08E-01	4.00E-02	9.83E+00	1.67E+00

Table L9. Summary statistics for dissolved and total metal concentrations (mg/L) for the contaminant remobilization from sediments study by season

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Standard Error	95% UCB	Median
Spring/Dissolved								
Aluminum	12	10	7.0E-03	2.9E-02	1.5E-02	1.4E-03	1.8E-02	1.5E-02
Ammonium nitrogen	12	6	5.0E-02	1.9E-01	7.5E-02	1.3E-02	9.8E-02	5.3E-02
Antimony	12	10	1.0E-03	1.2E-02	5.1E-03	1.1E-03	7.1E-03	4.5E-03
Arsenic	12	3	1.0E-03	3.0E-03	1.8E-03	8.1E-05	2.0E-03	1.7E-03
Barium	12	12	2.2E-02	2.5E-02	2.3E-02	3.1E-04	2.4E-02	2.3E-02
Boron	12	8	1.8E-02	1.1E-01	5.1E-02	5.5E-03	6.1E-02	4.5E-02
Calcium	12	12	1.8E+01	2.9E+01	2.6E+01	9.3E-01	2.8E+01	2.7E+01
Chloride	12	12	2.3E+00	1.4E+01	3.9E+00	9.3E-01	5.6E+00	2.9E+00
Chromium	12	6	1.0E-03	4.7E-03	1.8E-03	3.9E-04	2.5E-03	1.0E-03
Copper	12	12	1.2E-03	3.6E-03	2.3E-03	2.0E-04	2.7E-03	2.3E-03
Fluoride	12	4	5.0E-02	1.5E-01	7.0E-02	8.2E-03	8.5E-02	7.0E-02
Iron	12	9	1.3E-02	7.1E-02	4.4E-02	5.8E-03	5.4E-02	4.7E-02
Lead	12	3	1.0E-03	1.7E-03	1.1E-03	9.1E-05	1.3E-03	1.0E-03
Magnesium	12	12	5.4E+00	9.0E+00	7.9E+00	2.9E-01	8.4E+00	8.1E+00
Manganese	12	11	1.0E-03	1.5E-02	5.6E-03	1.2E-03	7.8E-03	4.3E-03
Mercury (BR)	12	1	1.4E-06	8.3E-06	8.3E-06	.	.	8.3E-06
Nickel	12	12	1.3E-03	1.4E-02	4.8E-03	1.2E-03	7.0E-03	3.2E-03
Nitrate/nitrite	12	12	3.6E-01	7.5E-01	5.7E-01	3.5E-02	6.3E-01	5.7E-01
Potassium	12	12	1.2E+00	1.5E+00	1.4E+00	2.5E-02	1.4E+00	1.4E+00
Sodium	12	12	2.6E+00	3.9E+00	3.5E+00	1.0E-01	3.7E+00	3.6E+00
Sulfate	12	12	1.3E+01	1.8E+01	1.7E+01	4.6E-01	1.8E+01	1.8E+01
Zinc	12	12	3.7E-03	7.2E-03	5.5E-03	3.4E-04	6.1E-03	5.5E-03
Spring/Total								
Aluminum	12	12	4.5E-02	5.8E-01	2.3E-01	4.6E-02	3.1E-01	2.3E-01

Table L9 (continued)

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Standard Error	95% UCB	Median
Arsenic	12	4	1.0E-03	3.0E-03	1.5E-03	1.2E-04	1.7E-03	1.3E-03
Barium	12	12	2.4E-02	2.9E-02	2.7E-02	4.7E-04	2.8E-02	2.6E-02
Boron	12	11	1.8E-02	7.6E-02	4.5E-02	4.8E-03	5.4E-02	4.7E-02
Calcium	12	12	1.9E+01	3.5E+01	2.7E+01	1.3E+00	2.9E+01	2.8E+01
Chromium	12	7	1.0E-03	3.1E-03	1.5E-03	1.9E-04	1.9E-03	1.2E-03
Copper	12	12	1.2E-03	6.0E-03	3.1E-03	5.1E-04	4.1E-03	2.5E-03
Iron	12	12	8.2E-02	7.8E-01	3.4E-01	6.2E-02	4.6E-01	3.4E-01
Lead	12	4	1.0E-03	3.0E-03	1.8E-03	1.8E-04	2.1E-03	1.5E-03
Magnesium	12	12	5.5E+00	9.1E+00	7.9E+00	3.0E-01	8.4E+00	8.2E+00
Manganese	12	12	2.5E-02	9.2E-02	6.4E-02	5.8E-03	7.5E-02	6.4E-02
Mercury (BR)	12	8	2.0E-06	6.6E-05	1.9E-05	6.0E-06	3.0E-05	1.1E-05
Nickel	12	12	1.1E-03	4.0E-03	2.5E-03	2.8E-04	3.0E-03	2.6E-03
Potassium	12	12	1.3E+00	1.5E+00	1.4E+00	2.3E-02	1.5E+00	1.4E+00
Sodium	12	12	3.4E+00	5.8E+00	4.3E+00	2.6E-01	4.7E+00	3.9E+00
Vanadium	12	7	1.0E-03	1.6E-03	1.2E-03	4.9E-05	1.2E-03	1.1E-03
Zinc	12	12	3.0E-03	2.2E-02	9.8E-03	2.0E-03	1.3E-02	8.0E-03
Summer/Dissolved								
Aluminum	11	7	6.0E-03	1.7E-02	1.1E-02	1.0E-03	1.3E-02	9.4E-03
Ammonium nitrogen	12	2	5.0E-02	8.1E-02	5.8E-02	2.8E-03	6.3E-02	5.6E-02
Antimony	11	10	1.0E-03	1.1E-02	5.8E-03	7.1E-04	7.1E-03	5.4E-03
Barium	11	10	1.0E-03	2.8E-02	2.5E-02	6.4E-04	2.6E-02	2.5E-02
Boron	11	6	1.1E-02	7.1E-02	2.5E-02	5.3E-03	3.5E-02	1.6E-02
Calcium	11	10	2.7E-02	2.9E+01	2.7E+01	4.0E-01	2.8E+01	2.8E+01
Chloride	12	12	2.5E+00	3.2E+01	5.3E+00	2.4E+00	9.7E+00	2.9E+00
Chromium	11	8	1.0E-03	8.1E-03	2.4E-03	6.1E-04	3.5E-03	2.0E-03
Copper	11	10	1.0E-03	1.1E-02	4.3E-03	8.0E-04	5.7E-03	3.4E-03

Table L9 (continued)

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Standard Error	95% UCB	Median
Fluoride	12	11	5.0E-02	1.1E-01	7.3E-02	4.7E-03	8.2E-02	6.9E-02
Iron	11	5	1.8E-02	2.7E+00	4.1E-01	2.5E-01	8.7E-01	4.0E-02
Magnesium	11	10	9.0E-03	8.1E+00	7.2E+00	2.7E-01	7.7E+00	7.6E+00
Manganese	11	10	1.0E-03	5.7E-02	1.4E-02	5.5E-03	2.4E-02	3.7E-03
Nickel	11	5	1.0E-03	1.3E-02	2.6E-03	1.1E-03	4.5E-03	1.2E-03
Nitrate/nitrite	12	12	3.0E-01	6.4E-01	4.9E-01	3.0E-02	5.4E-01	4.9E-01
Potassium	11	10	1.3E-02	1.4E+00	1.3E+00	2.6E-02	1.4E+00	1.3E+00
Selenium	11	3	1.0E-03	7.5E-03	3.6E-03	4.6E-04	4.4E-03	3.2E-03
Sodium	11	11	2.4E-02	3.4E+00	2.9E+00	2.9E-01	3.4E+00	3.2E+00
Sulfate	12	12	1.3E+01	1.7E+01	1.6E+01	3.4E-01	1.7E+01	1.7E+01
Vanadium	11	1	1.0E-03	1.2E-03	1.2E-03			1.2E-03
Zinc	11	10	2.0E-03	1.1E-02	5.7E-03	1.0E-03	7.6E-03	4.2E-03
Summer/Total								
Aluminum	12	11	6.0E-03	2.2E-01	1.2E-01	2.1E-02	1.6E-01	1.1E-01
Antimony	12	3	1.0E-03	1.7E-03	1.3E-03	6.0E-05	1.4E-03	1.2E-03
Barium	12	12	2.4E-02	3.0E-02	2.7E-02	6.3E-04	2.8E-02	2.7E-02
Boron	12	4	1.1E-02	3.2E-02	2.2E-02	1.5E-03	2.5E-02	2.0E-02
Calcium	12	12	2.5E+01	3.0E+01	2.8E+01	5.0E-01	2.8E+01	2.8E+01
Chromium	12	9	1.0E-03	2.4E-03	1.7E-03	1.2E-04	1.9E-03	1.6E-03
Copper	12	12	1.4E-03	3.4E-03	2.4E-03	2.1E-04	2.8E-03	2.4E-03
Iron	12	11	1.8E-02	7.9E-01	3.4E-01	8.9E-02	5.0E-01	1.7E-01
Magnesium	12	12	6.2E+00	8.4E+00	7.5E+00	2.6E-01	8.0E+00	7.9E+00
Manganese	12	11	1.0E-03	2.2E-01	8.7E-02	1.4E-02	1.1E-01	7.9E-02
Mercury (BR)	12	5	1.9E-06	3.6E-05	1.0E-05	3.4E-06	1.6E-05	3.6E-06
Nickel	12	4	1.0E-03	1.9E-03	1.3E-03	6.8E-05	1.4E-03	1.2E-03
Potassium	12	12	1.2E+00	1.5E+00	1.3E+00	2.6E-02	1.4E+00	1.4E+00

Table L9 (continued)

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Standard Error	95% UCB	Median
Sodium	12	12	2.9E+00	3.4E+00	3.2E+00	3.5E-02	3.3E+00	3.2E+00
Vanadium	12	3	1.0E-03	1.3E-03	1.0E-03	3.4E-05	1.1E-03	1.0E-03
Zinc	12	12	2.0E-03	8.7E-03	4.9E-03	6.8E-04	6.1E-03	4.7E-03

Table L10. Summary statistics for dissolved and total metal concentrations (mg/L) for the contaminant remobilization from sediments study for each site

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Std. Error	95% UCB	Median
CRM 1.0/Dissolved								
Aluminum	6	4	6.0E-03	2.9E-02	1.4E-02	3.5E-03	2.1E-02	9.4E-03
Ammonium nitrogen	6	2	5.0E-02	7.5E-02	5.9E-02	4.1E-03	6.7E-02	5.6E-02
Antimony	6	6	1.1E-03	7.5E-03	4.6E-03	8.9E-04	6.4E-03	5.2E-03
Arsenic	6	1	1.0E-03	3.0E-03	2.1E-03	.	.	2.1E-03
Barium	6	6	2.2E-02	2.7E-02	2.5E-02	8.9E-04	2.6E-02	2.4E-02
Boron	6	4	1.1E-02	7.1E-02	4.3E-02	7.2E-03	5.7E-02	3.7E-02
Calcium	6	6	1.8E+01	2.8E+01	2.5E+01	1.7E+00	2.8E+01	2.7E+01
Chloride	6	6	2.3E+00	4.1E+00	3.1E+00	2.5E-01	3.6E+00	2.9E+00
Chromium	6	4	1.0E-03	4.7E-03	2.9E-03	3.8E-04	3.7E-03	2.6E-03
Copper	6	6	1.8E-03	4.5E-03	3.0E-03	3.6E-04	3.8E-03	3.1E-03
Fluoride	6	4	6.0E-02	1.5E-01	7.1E-02	4.9E-03	8.1E-02	7.0E-02
Iron	6	3	1.3E-02	5.7E-01	1.5E-01	9.3E-02	3.4E-01	6.7E-02
Magnesium	6	6	5.4E+00	8.5E+00	7.1E+00	4.6E-01	8.0E+00	7.2E+00
Manganese	6	6	1.8E-03	1.5E-02	4.7E-03	2.1E-03	8.9E-03	2.5E-03
Nickel	6	4	1.0E-03	1.4E-02	3.7E-03	2.1E-03	7.9E-03	1.5E-03
Nitrate/nitrite	6	6	3.0E-01	4.9E-01	4.1E-01	3.3E-02	4.8E-01	4.3E-01
Potassium	6	6	1.2E+00	1.4E+00	1.3E+00	2.6E-02	1.4E+00	1.4E+00
Sodium	6	6	2.6E+00	3.8E+00	3.3E+00	1.6E-01	3.6E+00	3.3E+00
Sulfate	6	6	1.3E+01	1.7E+01	1.5E+01	6.8E-01	1.6E+01	1.6E+01
Zinc	6	6	2.7E-03	1.1E-02	5.5E-03	1.3E-03	8.0E-03	4.3E-03
CRM 1.0/Total								
Aluminum	6	6	3.4E-02	5.8E-01	2.3E-01	7.9E-02	3.9E-01	2.1E-01
Arsenic	6	1	1.0E-03	3.0E-03	1.5E-03	.	.	1.5E-03
Barium	6	6	2.4E-02	2.9E-02	2.8E-02	8.2E-04	3.0E-02	2.9E-02

Table L10 (continued)

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Std. Error	95% UCB	Median
Boron	6	4	1.1E-02	5.6E-02	3.1E-02	6.9E-03	4.5E-02	2.3E-02
Calcium	6	6	1.9E+01	2.9E+01	2.5E+01	1.7E+00	2.8E+01	2.6E+01
Chromium	6	4	1.0E-03	2.4E-03	1.6E-03	2.3E-04	2.1E-03	1.4E-03
Copper	6	6	1.4E-03	5.2E-03	3.2E-03	5.0E-04	4.2E-03	3.2E-03
Iron	6	6	7.5E-02	7.9E-01	4.2E-01	1.3E-01	6.7E-01	3.7E-01
Lead	6	1	1.0E-03	1.5E-03	1.5E-03	.	.	1.5E-03
Magnesium	6	6	5.5E+00	8.3E+00	7.0E+00	4.8E-01	8.0E+00	7.1E+00
Manganese	6	6	4.2E-02	8.6E-02	6.7E-02	6.8E-03	8.1E-02	6.8E-02
Mercury (BR)	6	6	1.7E-05	3.6E-05	2.8E-05	3.7E-06	3.5E-05	2.8E-05
Nickel	6	4	1.0E-03	3.2E-03	2.1E-03	3.2E-04	2.7E-03	1.7E-03
Potassium	6	6	1.3E+00	1.5E+00	1.4E+00	2.3E-02	1.4E+00	1.4E+00
Sodium	6	6	3.2E+00	4.9E+00	3.7E+00	2.7E-01	4.2E+00	3.4E+00
Vanadium	6	4	1.0E-03	1.6E-03	1.2E-03	9.5E-05	1.4E-03	1.2E-03
Zinc	6	6	2.7E-03	2.0E-02	8.5E-03	2.5E-03	1.4E-02	7.3E-03
CRM 41.5/Dissolved								
Aluminum	5	4	7.0E-03	1.6E-02	1.5E-02	3.0E-04	1.6E-02	1.5E-02
Ammonium nitrogen	6	3	5.0E-02	1.3E-01	6.7E-02	1.4E-02	9.5E-02	5.3E-02
Antimony	5	4	1.0E-03	1.1E-02	6.9E-03	1.9E-03	1.1E-02	6.6E-03
Barium	5	5	2.1E-02	2.5E-02	2.3E-02	6.8E-04	2.5E-02	2.4E-02
Boron	5	2	1.1E-02	6.3E-02	4.6E-02	5.5E-03	5.8E-02	4.2E-02
Calcium	5	5	2.5E+01	2.8E+01	2.7E+01	5.9E-01	2.8E+01	2.7E+01
Chloride	6	6	2.7E+00	3.2E+01	9.7E+00	4.8E+00	1.9E+01	3.4E+00
Chromium	5	4	1.0E-03	3.8E-03	1.9E-03	5.6E-04	3.1E-03	1.3E-03
Copper	5	5	1.9E-03	1.1E-02	4.2E-03	1.7E-03	7.8E-03	3.0E-03
Fluoride	6	3	5.0E-02	1.5E-01	6.0E-02	7.5E-03	7.5E-02	5.5E-02
Iron	5	4	1.8E-02	5.1E-01	1.3E-01	9.8E-02	3.4E-01	5.1E-02
Lead	5	2	1.0E-03	1.7E-03	1.1E-03	1.7E-04	1.5E-03	1.0E-03

Table L10 (continued)

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Std. Error	95% UCB	Median
Magnesium	5	5	6.4E+00	8.8E+00	7.8E+00	4.2E-01	8.7E+00	8.1E+00
Manganese	5	5	7.7E-03	2.7E-02	1.4E-02	3.7E-03	2.1E-02	8.9E-03
Mercury (BR)	6	1	1.4E-06	8.3E-06	8.3E-06	.	.	8.3E-06
Nickel	5	4	1.0E-03	9.3E-03	3.5E-03	1.5E-03	6.8E-03	2.7E-03
Nitrate/nitrite	6	6	5.9E-01	7.4E-01	6.3E-01	2.4E-02	6.8E-01	6.1E-01
Potassium	5	5	1.2E+00	1.5E+00	1.3E+00	5.4E-02	1.5E+00	1.4E+00
Selenium	5	1	1.0E-03	3.2E-03	3.2E-03	.	.	3.2E-03
Sodium	5	5	3.0E+00	3.7E+00	3.4E+00	1.3E-01	3.7E+00	3.5E+00
Sulfate	6	6	1.7E+01	1.8E+01	1.7E+01	2.1E-01	1.8E+01	1.7E+01
Zinc	5	5	4.2E-03	7.2E-03	6.0E-03	6.2E-04	7.3E-03	6.6E-03
CRM 41.5/Total								
Aluminum	6	6	7.1E-02	3.3E-01	1.8E-01	4.0E-02	2.6E-01	1.6E-01
Arsenic	6	1	1.0E-03	3.0E-03	1.6E-03	.	.	1.6E-03
Barium	6	6	2.4E-02	2.7E-02	2.5E-02	4.5E-04	2.6E-02	2.6E-02
Boron	6	4	1.1E-02	7.6E-02	4.3E-02	9.8E-03	6.3E-02	3.0E-02
Calcium	6	6	2.5E+01	2.9E+01	2.7E+01	7.2E-01	2.9E+01	2.8E+01
Chromium	6	5	1.0E-03	3.1E-03	1.9E-03	3.1E-04	2.5E-03	1.6E-03
Copper	6	6	1.5E-03	6.0E-03	2.8E-03	6.7E-04	4.2E-03	2.6E-03
Iron	6	6	1.3E-01	7.4E-01	3.5E-01	9.8E-02	5.5E-01	2.9E-01
Lead	6	1	1.0E-03	3.0E-03	3.0E-03	.	.	3.0E-03
Magnesium	6	6	6.4E+00	8.5E+00	7.7E+00	3.2E-01	8.4E+00	7.9E+00
Manganese	6	6	6.4E-02	1.2E-01	8.8E-02	7.9E-03	1.0E-01	8.6E-02
Mercury (BR)	6	2	1.9E-06	3.6E-06	3.0E-06	1.5E-07	3.3E-06	2.9E-06
Nickel	6	4	1.0E-03	3.2E-03	2.0E-03	3.0E-04	2.6E-03	1.7E-03
Potassium	6	6	1.2E+00	1.5E+00	1.4E+00	5.5E-02	1.5E+00	1.3E+00
Sodium	6	6	2.9E+00	5.8E+00	3.6E+00	4.3E-01	4.5E+00	3.2E+00
Vanadium	6	1	1.0E-03	1.2E-03	1.2E-03	.	.	1.2E-03

Table L10 (continued)

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Std. Error	95% UCB	Median
Zinc	6	6	2.2E-03	2.2E-02	8.3E-03	3.1E-03	1.4E-02	6.1E-03
CRM 6.0/Dissolved								
Aluminum	6	4	6.0E-03	1.7E-02	1.2E-02	1.5E-03	1.5E-02	1.0E-02
Antimony	6	6	3.9E-03	9.5E-03	5.7E-03	9.3E-04	7.6E-03	4.7E-03
Arsenic	6	1	1.0E-03	3.0E-03	1.7E-03	.	.	1.7E-03
Barium	6	6	2.2E-02	2.6E-02	2.4E-02	7.2E-04	2.6E-02	2.4E-02
Boron	6	5	1.6E-02	5.0E-02	2.9E-02	6.5E-03	4.2E-02	2.3E-02
Calcium	6	6	2.6E+01	2.9E+01	2.7E+01	5.4E-01	2.8E+01	2.7E+01
Chloride	6	6	2.7E+00	3.2E+00	2.9E+00	7.3E-02	3.0E+00	2.9E+00
Chromium	6	3	1.0E-03	2.6E-03	1.4E-03	2.7E-04	1.9E-03	1.1E-03
Copper	6	6	1.2E-03	3.6E-03	2.4E-03	4.0E-04	3.2E-03	2.2E-03
Fluoride	6	4	5.9E-02	1.5E-01	7.5E-02	1.2E-02	9.9E-02	6.5E-02
Iron	6	4	1.3E-02	5.3E-01	1.3E-01	8.6E-02	3.0E-01	4.0E-02
Magnesium	6	6	6.3E+00	8.6E+00	7.8E+00	3.1E-01	8.4E+00	8.0E+00
Manganese	6	6	1.6E-03	5.8E-03	3.5E-03	6.5E-04	4.8E-03	3.2E-03
Nickel	6	4	1.0E-03	4.5E-03	2.8E-03	5.8E-04	3.9E-03	2.1E-03
Nitrate/nitrite	6	6	4.0E-01	6.9E-01	5.1E-01	4.4E-02	6.0E-01	5.0E-01
Potassium	6	6	1.3E+00	1.4E+00	1.4E+00	2.0E-02	1.4E+00	1.4E+00
Selenium	6	1	1.0E-03	3.3E-03	3.3E-03	.	.	3.3E-03
Sodium	6	6	3.2E+00	3.8E+00	3.4E+00	1.1E-01	3.6E+00	3.3E+00
Sulfate	6	6	1.6E+01	1.8E+01	1.7E+01	3.7E-01	1.8E+01	1.7E+01
Zinc	6	6	2.9E-03	9.4E-03	5.1E-03	9.8E-04	7.1E-03	4.7E-03
CRM 6.0/Total								
Aluminum	6	6	4.2E-02	4.1E-01	1.5E-01	5.9E-02	2.7E-01	9.3E-02
Antimony	6	2	1.0E-03	1.7E-03	1.6E-03	2.2E-05	1.7E-03	1.6E-03
Arsenic	6	1	1.0E-03	3.0E-03	1.3E-03	.	.	1.3E-03
Barium	6	6	2.5E-02	3.0E-02	2.8E-02	6.3E-04	2.9E-02	2.8E-02

Table L10 (continued)

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Std. Error	95% UCB	Median
Boron	6	4	1.1E-02	4.7E-02	3.4E-02	3.3E-03	4.1E-02	3.0E-02
Calcium	6	6	2.6E+01	3.0E+01	2.8E+01	8.1E-01	3.0E+01	2.8E+01
Chromium	6	4	1.0E-03	2.1E-03	1.5E-03	2.0E-04	1.9E-03	1.4E-03
Copper	6	6	1.2E-03	5.4E-03	2.4E-03	6.3E-04	3.7E-03	1.9E-03
Iron	6	6	7.1E-02	6.7E-01	3.0E-01	1.1E-01	5.3E-01	1.9E-01
Lead	6	1	1.0E-03	2.8E-03	2.8E-03	.	.	2.8E-03
Magnesium	6	6	6.3E+00	8.6E+00	8.0E+00	3.5E-01	8.7E+00	8.4E+00
Manganese	6	6	2.5E-02	8.0E-02	5.4E-02	7.7E-03	6.9E-02	5.7E-02
Mercury (BR)	6	4	1.3E-05	6.6E-05	3.0E-05	8.0E-06	4.6E-05	2.0E-05
Nickel	6	4	1.0E-03	4.0E-03	1.9E-03	5.3E-04	2.9E-03	1.2E-03
Potassium	6	6	1.3E+00	1.5E+00	1.4E+00	2.6E-02	1.5E+00	1.4E+00
Sodium	6	6	3.2E+00	5.4E+00	3.9E+00	3.5E-01	4.6E+00	3.5E+00
Vanadium	6	3	1.0E-03	1.2E-03	1.2E-03	0.0E+00	1.2E-03	1.2E-03
Zinc	6	6	3.3E-03	1.2E-02	5.8E-03	1.3E-03	8.4E-03	5.0E-03
MBM 0.2/Dissolved								
Aluminum	6	5	6.0E-03	1.6E-02	1.3E-02	8.0E-04	1.5E-02	1.3E-02
Ammonium nitrogen	6	3	5.0E-02	1.9E-01	9.7E-02	2.1E-02	1.4E-01	7.8E-02
Antimony	6	4	1.0E-03	1.2E-02	5.7E-03	1.3E-03	8.4E-03	4.0E-03
Arsenic	6	1	1.0E-03	3.0E-03	2.2E-03	.	.	2.2E-03
Barium	6	5	1.0E-03	2.8E-02	2.4E-02	9.3E-04	2.6E-02	2.3E-02
Boron	6	3	1.1E-02	1.1E-01	5.0E-02	1.3E-02	7.6E-02	3.7E-02
Calcium	6	5	2.7E-02	2.9E+01	2.7E+01	4.7E-01	2.8E+01	2.7E+01
Chloride	6	6	2.5E+00	3.0E+00	2.8E+00	8.3E-02	2.9E+00	2.9E+00
Chromium	6	3	1.0E-03	8.1E-03	3.1E-03	1.1E-03	5.3E-03	2.0E-03
Copper	6	5	1.0E-03	6.8E-03	3.4E-03	9.0E-04	5.3E-03	2.8E-03
Fluoride	6	4	6.7E-02	1.5E-01	8.2E-02	5.5E-03	9.3E-02	8.5E-02
Iron	6	3	1.3E-02	2.7E+00	4.8E-01	4.9E-01	1.5E+00	4.6E-02

Table L10 (continued)

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Std. Error	95% UCB	Median
Lead	6	1	1.0E-03	1.7E-03	1.7E-03	.	.	1.7E-03
Magnesium	6	5	9.0E-03	9.0E+00	7.6E+00	4.8E-01	8.6E+00	8.0E+00
Manganese	6	4	1.0E-03	5.7E-02	1.7E-02	9.8E-03	3.7E-02	4.7E-03
Nickel	6	5	1.0E-03	1.3E-02	5.3E-03	2.1E-03	9.5E-03	2.8E-03
Nitrate/nitrite	6	6	4.2E-01	7.5E-01	5.6E-01	4.5E-02	6.5E-01	5.5E-01
Potassium	6	5	1.3E-02	1.4E+00	1.3E+00	4.2E-02	1.4E+00	1.3E+00
Selenium	6	1	1.0E-03	7.5E-03	7.5E-03	.	.	7.5E-03
Sodium	6	6	2.4E-02	3.9E+00	2.9E+00	5.9E-01	4.1E+00	3.3E+00
Sulfate	6	6	1.6E+01	1.8E+01	1.7E+01	3.1E-01	1.8E+01	1.7E+01
Vanadium	6	1	1.0E-03	1.2E-03	1.2E-03	.	.	1.2E-03
Zinc	6	5	2.0E-03	1.1E-02	6.1E-03	1.1E-03	8.3E-03	5.5E-03
MBM 0.2/Total								
Aluminum	6	5	6.0E-03	2.5E-01	1.4E-01	3.8E-02	2.2E-01	1.5E-01
Antimony	6	1	1.0E-03	1.2E-03	1.2E-03	.	.	1.2E-03
Arsenic	6	1	1.0E-03	3.0E-03	2.2E-03	.	.	2.2E-03
Barium	6	6	2.4E-02	3.0E-02	2.6E-02	8.3E-04	2.8E-02	2.6E-02
Boron	6	3	1.1E-02	5.3E-02	3.6E-02	4.9E-03	4.6E-02	2.9E-02
Calcium	6	6	2.6E+01	3.5E+01	3.0E+01	1.3E+00	3.2E+01	2.9E+01
Chromium	6	3	1.0E-03	2.1E-03	1.6E-03	1.1E-04	1.8E-03	1.5E-03
Copper	6	6	1.7E-03	5.0E-03	2.8E-03	5.0E-04	3.8E-03	2.3E-03
Iron	6	5	1.8E-02	7.6E-01	2.9E-01	1.1E-01	5.1E-01	2.2E-01
Lead	6	1	1.0E-03	2.2E-03	2.2E-03	.	.	2.2E-03
Magnesium	6	6	6.4E+00	9.1E+00	8.0E+00	3.7E-01	8.8E+00	8.2E+00
Manganese	6	5	1.0E-03	2.2E-01	9.4E-02	2.7E-02	1.5E-01	7.3E-02
Mercury (BR)	6	1	2.0E-06	7.1E-06	2.0E-06	.	.	2.0E-06
Nickel	6	4	1.0E-03	3.9E-03	1.9E-03	4.8E-04	2.9E-03	1.3E-03
Potassium	6	6	1.3E+00	1.5E+00	1.4E+00	3.7E-02	1.5E+00	1.4E+00

Table L10 (continued)

Analyte	Observations.	Detects	Minimum	Maximum	Mean	Std. Error	95% UCB	Median
Sodium	6	6	3.1E+00	5.6E+00	3.8E+00	3.8E-01	4.5E+00	3.5E+00
Vanadium	6	2	1.0E-03	1.1E-03	1.0E-03	2.2E-05	1.1E-03	1.0E-03
Zinc	6	6	2.0E-03	1.7E-02	6.9E-03	2.3E-03	1.2E-02	5.0E-03

Table L11. Summary statistics for dissolved and total metal concentrations (mg/L) for the contaminant remobilization from sediments study for each site by season

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
CRM 1.0/Spring/Dissolved								
Aluminum	3	2	7.0E-03	2.9E-02	2.1E-02	4.5E-03	3.4E-02	1.7E-02
Ammonium nitrogen	3	1	5.0E-02	7.5E-02	7.5E-02	.	.	7.5E-02
Antimony	3	3	1.1E-03	5.2E-03	3.8E-03	1.4E-03	7.7E-03	5.1E-03
Arsenic	3	1	1.0E-03	3.0E-03	2.1E-03	.	.	2.1E-03
Barium	3	3	2.2E-02	2.4E-02	2.3E-02	6.3E-04	2.5E-02	2.3E-02
Boron	3	2	1.8E-02	5.2E-02	4.7E-02	2.7E-03	5.5E-02	4.5E-02
Calcium	3	3	1.8E+01	2.8E+01	2.3E+01	3.0E+00	3.1E+01	2.1E+01
Chloride	3	3	2.3E+00	4.1E+00	3.1E+00	5.3E-01	4.6E+00	2.9E+00
Chromium	3	2	1.0E-03	4.7E-03	3.4E-03	7.3E-04	5.6E-03	2.8E-03
Copper	3	3	1.8E-03	2.9E-03	2.5E-03	3.3E-04	3.4E-03	2.7E-03
Fluoride	3	1	7.0E-02	1.5E-01	7.0E-02	.	.	7.0E-02
Iron	3	2	1.3E-02	6.9E-02	6.7E-02	6.4E-04	6.9E-02	6.7E-02
Magnesium	3	3	5.4E+00	8.5E+00	6.9E+00	8.9E-01	9.5E+00	6.9E+00
Manganese	3	3	2.5E-03	1.5E-02	6.7E-03	4.2E-03	1.9E-02	2.5E-03
Nickel	3	3	1.8E-03	1.4E-02	6.1E-03	3.8E-03	1.7E-02	2.9E-03
Nitrate/nitrite	3	3	3.6E-01	4.9E-01	4.4E-01	4.2E-02	5.7E-01	4.8E-01
Potassium	3	3	1.2E+00	1.4E+00	1.3E+00	4.6E-02	1.4E+00	1.3E+00
Sodium	3	3	2.6E+00	3.8E+00	3.3E+00	3.6E-01	4.3E+00	3.4E+00
Sulfate	3	3	1.3E+01	1.6E+01	1.5E+01	8.8E-01	1.7E+01	1.5E+01
Zinc	3	3	3.7E-03	6.4E-03	4.9E-03	8.0E-04	7.2E-03	4.5E-03
CRM 1.0/Spring/Total								
Aluminum	3	3	7.8E-02	5.8E-01	3.1E-01	1.4E-01	7.4E-01	2.9E-01
Arsenic	3	1	1.0E-03	3.0E-03	1.5E-03	.	.	1.5E-03

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Barium	3	3	2.4E-02	2.9E-02	2.7E-02	1.7E-03	3.2E-02	2.9E-02
Boron	3	3	2.5E-02	5.6E-02	4.3E-02	9.1E-03	6.9E-02	4.7E-02
Calcium	3	3	1.9E+01	2.7E+01	2.2E+01	2.5E+00	2.9E+01	2.0E+01
Chromium	3	2	1.0E-03	2.4E-03	1.6E-03	4.6E-04	2.9E-03	1.2E-03
Copper	3	3	2.7E-03	5.2E-03	3.6E-03	7.9E-04	5.9E-03	3.0E-03
Iron	3	3	1.4E-01	7.8E-01	4.4E-01	1.8E-01	9.8E-01	4.1E-01
Lead	3	1	1.0E-03	1.5E-03	1.5E-03	.	.	1.5E-03
Magnesium	3	3	5.5E+00	8.3E+00	6.7E+00	8.3E-01	9.1E+00	6.3E+00
Manganese	3	3	4.2E-02	7.1E-02	5.9E-02	8.9E-03	8.5E-02	6.4E-02
Mercury	3	3	2.1E-05	3.6E-05	3.0E-05	4.9E-06	4.5E-05	3.5E-05
Nickel	3	3	1.5E-03	3.2E-03	2.5E-03	5.1E-04	4.0E-03	2.8E-03
Potassium	3	3	1.3E+00	1.4E+00	1.3E+00	2.5E-02	1.4E+00	1.4E+00
Sodium	3	3	3.5E+00	4.9E+00	4.1E+00	4.2E-01	5.3E+00	3.9E+00
Vanadium	3	3	1.1E-03	1.6E-03	1.3E-03	1.6E-04	1.8E-03	1.3E-03
Zinc	3	3	7.3E-03	2.0E-02	1.2E-02	4.1E-03	2.4E-02	8.8E-03
CRM 1.0/Summer/Dissolved								
Aluminum	3	2	6.0E-03	1.0E-02	9.1E-03	7.5E-04	1.1E-02	8.4E-03
Ammonium nitrogen	3	1	5.0E-02	5.6E-02	5.6E-02	.	.	5.6E-02
Antimony	3	3	3.2E-03	7.5E-03	5.4E-03	1.2E-03	8.9E-03	5.4E-03
Barium	3	3	2.5E-02	2.7E-02	2.6E-02	7.2E-04	2.8E-02	2.7E-02
Boron	3	2	1.1E-02	7.1E-02	4.3E-02	1.6E-02	9.0E-02	3.0E-02
Calcium	3	3	2.6E+01	2.8E+01	2.7E+01	7.0E-01	2.9E+01	2.8E+01
Chloride	3	3	2.8E+00	3.4E+00	3.1E+00	1.8E-01	3.6E+00	3.0E+00
Chromium	3	2	1.0E-03	2.6E-03	2.5E-03	3.8E-05	2.6E-03	2.5E-03
Copper	3	3	3.2E-03	4.5E-03	3.6E-03	4.4E-04	4.9E-03	3.2E-03

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Fluoride	3	3	6.0E-02	8.4E-02	7.1E-02	7.0E-03	9.2E-02	7.0E-02
Iron	3	1	1.8E-02	5.7E-01	5.7E-01	.	.	5.7E-01
Magnesium	3	3	6.3E+00	8.0E+00	7.3E+00	5.0E-01	8.8E+00	7.6E+00
Manganese	3	3	1.8E-03	3.5E-03	2.6E-03	5.0E-04	4.0E-03	2.5E-03
Nickel	3	1	1.0E-03	1.2E-03	1.2E-03	.	.	1.2E-03
Nitrate/nitrite	3	3	3.0E-01	4.8E-01	3.8E-01	5.2E-02	5.4E-01	3.7E-01
Potassium	3	3	1.3E+00	1.4E+00	1.4E+00	1.8E-02	1.4E+00	1.4E+00
Sodium	3	3	3.3E+00	3.4E+00	3.3E+00	2.9E-02	3.4E+00	3.3E+00
Sulfate	3	3	1.3E+01	1.7E+01	1.5E+01	1.2E+00	1.9E+01	1.6E+01
Zinc	3	3	2.7E-03	1.1E-02	6.1E-03	2.7E-03	1.4E-02	4.1E-03
CRM 1.0/Summer/Total								
Aluminum	3	3	3.4E-02	2.2E-01	1.5E-01	6.0E-02	3.3E-01	2.0E-01
Barium	3	3	2.8E-02	2.9E-02	2.9E-02	2.4E-04	2.9E-02	2.8E-02
Boron	3	1	1.1E-02	2.0E-02	2.0E-02	.	.	2.0E-02
Calcium	3	3	2.5E+01	2.9E+01	2.7E+01	1.3E+00	3.1E+01	2.8E+01
Chromium	3	2	1.0E-03	2.2E-03	1.8E-03	2.3E-04	2.5E-03	1.6E-03
Copper	3	3	1.4E-03	3.4E-03	2.7E-03	6.5E-04	4.6E-03	3.3E-03
Iron	3	3	7.5E-02	7.9E-01	4.0E-01	2.1E-01	1.0E+00	3.2E-01
Magnesium	3	3	6.2E+00	8.1E+00	7.4E+00	6.0E-01	9.1E+00	7.9E+00
Manganese	3	3	5.7E-02	8.6E-02	7.6E-02	9.2E-03	1.0E-01	8.4E-02
Mercury	3	3	1.7E-05	3.6E-05	2.5E-05	6.0E-06	4.2E-05	2.1E-05
Nickel	3	1	1.0E-03	1.9E-03	1.9E-03	.	.	1.9E-03
Potassium	3	3	1.4E+00	1.5E+00	1.4E+00	2.6E-02	1.5E+00	1.4E+00
Sodium	3	3	3.2E+00	3.3E+00	3.3E+00	2.5E-02	3.3E+00	3.3E+00
Vanadium	3	1	1.0E-03	1.3E-03	1.3E-03	.	.	1.3E-03

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Zinc	3	3	2.7E-03	7.3E-03	4.9E-03	1.3E-03	8.8E-03	4.8E-03
CRM 41.5/Spring/Dissolved								
Aluminum	3	3	1.5E-02	1.6E-02	1.6E-02	2.9E-04	1.7E-02	1.6E-02
Ammonium nitrogen	3	3	5.3E-02	1.3E-01	8.0E-02	2.5E-02	1.5E-01	5.8E-02
Antimony	3	2	1.0E-03	1.1E-02	5.7E-03	3.3E-03	1.5E-02	2.9E-03
Barium	3	3	2.2E-02	2.5E-02	2.4E-02	9.3E-04	2.6E-02	2.4E-02
Boron	3	2	1.8E-02	6.3E-02	4.9E-02	8.4E-03	7.3E-02	4.2E-02
Calcium	3	3	2.6E+01	2.8E+01	2.7E+01	5.6E-01	2.9E+01	2.7E+01
Chloride	3	3	2.7E+00	1.4E+01	6.6E+00	3.7E+00	1.7E+01	3.2E+00
Chromium	3	2	1.0E-03	3.8E-03	1.9E-03	1.1E-03	5.0E-03	1.0E-03
Copper	3	3	1.9E-03	3.0E-03	2.3E-03	3.5E-04	3.3E-03	2.0E-03
Fluoride	3	1	5.0E-02	1.5E-01	5.0E-02	.	.	5.0E-02
Iron	3	3	2.0E-02	5.4E-02	4.2E-02	1.1E-02	7.3E-02	5.1E-02
Lead	3	2	1.0E-03	1.7E-03	1.2E-03	2.7E-04	2.0E-03	1.0E-03
Magnesium	3	3	7.4E+00	8.8E+00	8.1E+00	4.1E-01	9.3E+00	8.2E+00
Manganese	3	3	7.7E-03	8.9E-03	8.5E-03	3.8E-04	9.6E-03	8.8E-03
Nickel	3	3	1.3E-03	9.3E-03	4.4E-03	2.5E-03	1.2E-02	2.7E-03
Nitrate/nitrite	3	3	5.9E-01	7.4E-01	6.5E-01	4.7E-02	7.8E-01	6.1E-01
Potassium	3	3	1.4E+00	1.5E+00	1.4E+00	3.7E-02	1.5E+00	1.4E+00
Sodium	3	3	3.5E+00	3.7E+00	3.6E+00	8.1E-02	3.8E+00	3.6E+00
Sulfate	3	3	1.7E+01	1.8E+01	1.8E+01	3.3E-01	1.9E+01	1.8E+01
Zinc	3	3	4.2E-03	7.2E-03	6.2E-03	9.8E-04	9.0E-03	7.1E-03
CRM 41.5/Spring/Total								
Aluminum	3	3	7.1E-02	3.3E-01	2.2E-01	7.7E-02	4.4E-01	2.4E-01
Arsenic	3	1	1.0E-03	3.0E-03	1.6E-03	.	.	1.6E-03

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Barium	3	3	2.6E-02	2.7E-02	2.6E-02	3.2E-04	2.7E-02	2.6E-02
Boron	3	3	2.8E-02	7.6E-02	5.8E-02	1.5E-02	1.0E-01	6.9E-02
Calcium	3	3	2.5E+01	2.9E+01	2.8E+01	1.2E+00	3.1E+01	2.9E+01
Chromium	3	2	1.0E-03	3.1E-03	2.2E-03	5.4E-04	3.7E-03	1.7E-03
Copper	3	3	1.5E-03	6.0E-03	3.3E-03	1.4E-03	7.3E-03	2.3E-03
Iron	3	3	1.3E-01	5.1E-01	3.4E-01	1.1E-01	6.7E-01	3.9E-01
Lead	3	1	1.0E-03	3.0E-03	3.0E-03	.	.	3.0E-03
Magnesium	3	3	7.4E+00	8.5E+00	8.1E+00	3.5E-01	9.1E+00	8.4E+00
Manganese	3	3	6.4E-02	9.2E-02	7.9E-02	8.1E-03	1.0E-01	8.1E-02
Mercury	3	1	2.9E-06	3.4E-06	2.9E-06	.	.	2.9E-06
Nickel	3	3	1.8E-03	3.2E-03	2.5E-03	4.1E-04	3.7E-03	2.4E-03
Potassium	3	3	1.3E+00	1.5E+00	1.4E+00	6.2E-02	1.6E+00	1.5E+00
Sodium	3	3	3.4E+00	5.8E+00	4.2E+00	7.8E-01	6.5E+00	3.4E+00
Vanadium	3	1	1.0E-03	1.2E-03	1.2E-03	.	.	1.2E-03
Zinc	3	3	3.4E-03	2.2E-02	1.2E-02	5.6E-03	2.8E-02	9.7E-03
CRM 41.5/Summer/Dissolved								
Aluminum	2	1	7.0E-03	1.5E-02	1.5E-02	.	.	1.5E-02
Antimony	2	2	6.6E-03	1.1E-02	8.7E-03	2.1E-03	2.2E-02	8.7E-03
Barium	2	2	2.1E-02	2.4E-02	2.3E-02	1.2E-03	3.0E-02	2.3E-02
Calcium	2	2	2.5E+01	2.8E+01	2.7E+01	1.6E+00	3.7E+01	2.7E+01
Chloride	3	3	2.7E+00	3.2E+01	1.3E+01	9.6E+00	4.1E+01	3.6E+00
Chromium	2	2	1.3E-03	2.6E-03	2.0E-03	6.5E-04	6.1E-03	2.0E-03
Copper	2	2	3.4E-03	1.1E-02	7.2E-03	3.8E-03	3.1E-02	7.2E-03
Fluoride	3	2	5.0E-02	8.0E-02	6.6E-02	8.1E-03	9.0E-02	5.9E-02
Iron	2	1	1.8E-02	5.1E-01	5.1E-01	.	.	5.1E-01

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Magnesium	2	2	6.4E+00	8.1E+00	7.3E+00	8.7E-01	1.3E+01	7.3E+00
Manganese	2	2	1.6E-02	2.7E-02	2.1E-02	5.7E-03	5.7E-02	2.1E-02
Nickel	2	1	1.0E-03	2.8E-03	2.8E-03	.	.	2.8E-03
Nitrate/nitrite	3	3	5.9E-01	6.4E-01	6.1E-01	1.5E-02	6.5E-01	6.0E-01
Potassium	2	2	1.2E+00	1.3E+00	1.2E+00	8.0E-02	1.7E+00	1.2E+00
Selenium	2	1	1.0E-03	3.2E-03	3.2E-03	.	.	3.2E-03
Sodium	2	2	3.0E+00	3.2E+00	3.1E+00	7.0E-02	3.5E+00	3.1E+00
Sulfate	3	3	1.7E+01	1.7E+01	1.7E+01	0.0E+00	1.7E+01	1.7E+01
Zinc	2	2	4.8E-03	6.6E-03	5.7E-03	9.0E-04	1.1E-02	5.7E-03
CRM 41.5/Summer/Total								
Aluminum	3	3	1.0E-01	1.9E-01	1.4E-01	2.7E-02	2.2E-01	1.3E-01
Barium	3	3	2.4E-02	2.5E-02	2.5E-02	6.2E-04	2.7E-02	2.5E-02
Boron	3	1	1.1E-02	3.2E-02	3.2E-02	.	.	3.2E-02
Calcium	3	3	2.5E+01	2.9E+01	2.7E+01	1.1E+00	3.0E+01	2.8E+01
Chromium	3	3	1.3E-03	2.4E-03	1.7E-03	3.5E-04	2.7E-03	1.4E-03
Copper	3	3	1.6E-03	2.8E-03	2.4E-03	3.9E-04	3.6E-03	2.8E-03
Iron	3	3	1.5E-01	7.4E-01	3.6E-01	1.9E-01	9.1E-01	2.0E-01
Magnesium	3	3	6.4E+00	8.2E+00	7.4E+00	5.3E-01	8.9E+00	7.7E+00
Manganese	3	3	7.5E-02	1.2E-01	9.8E-02	1.2E-02	1.3E-01	1.0E-01
Mercury	3	1	1.9E-06	3.6E-06	3.6E-06	.	.	3.6E-06
Nickel	3	1	1.0E-03	1.5E-03	1.5E-03	.	.	1.5E-03
Potassium	3	3	1.2E+00	1.3E+00	1.3E+00	4.7E-02	1.4E+00	1.2E+00
Sodium	3	3	2.9E+00	3.1E+00	3.0E+00	5.6E-02	3.2E+00	3.1E+00
Zinc	3	3	2.2E-03	8.7E-03	4.8E-03	2.0E-03	1.1E-02	3.4E-03
CRM 6.0/Spring/Dissolved								

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Aluminum	3	2	7.0E-03	1.5E-02	1.2E-02	1.5E-03	1.7E-02	1.1E-02
Antimony	3	3	3.9E-03	9.5E-03	6.1E-03	1.7E-03	1.1E-02	4.9E-03
Arsenic	3	1	1.0E-03	3.0E-03	1.7E-03	.	.	1.7E-03
Barium	3	3	2.2E-02	2.3E-02	2.3E-02	4.5E-04	2.4E-02	2.3E-02
Boron	3	2	1.8E-02	5.0E-02	4.9E-02	5.0E-04	5.0E-02	4.8E-02
Calcium	3	3	2.6E+01	2.8E+01	2.7E+01	7.8E-01	2.9E+01	2.6E+01
Chloride	3	3	2.7E+00	3.2E+00	2.9E+00	1.5E-01	3.4E+00	2.9E+00
Chromium	3	1	1.0E-03	1.1E-03	1.1E-03	.	.	1.1E-03
Copper	3	3	1.2E-03	3.6E-03	2.3E-03	7.1E-04	4.3E-03	2.0E-03
Fluoride	3	1	7.0E-02	1.5E-01	7.0E-02	.	.	7.0E-02
Iron	3	2	1.3E-02	7.1E-02	5.0E-02	1.2E-02	8.5E-02	4.0E-02
Magnesium	3	3	7.7E+00	8.6E+00	8.1E+00	2.6E-01	8.8E+00	8.0E+00
Manganese	3	3	2.2E-03	5.8E-03	3.6E-03	1.1E-03	6.9E-03	2.8E-03
Nickel	3	3	1.7E-03	4.5E-03	3.5E-03	9.2E-04	6.2E-03	4.4E-03
Nitrate/nitrite	3	3	4.2E-01	6.9E-01	5.6E-01	7.8E-02	7.8E-01	5.6E-01
Potassium	3	3	1.3E+00	1.4E+00	1.3E+00	4.2E-02	1.5E+00	1.4E+00
Sodium	3	3	3.3E+00	3.8E+00	3.6E+00	1.5E-01	4.0E+00	3.7E+00
Sulfate	3	3	1.6E+01	1.8E+01	1.7E+01	6.7E-01	1.9E+01	1.8E+01
Zinc	3	3	4.5E-03	6.0E-03	5.1E-03	4.6E-04	6.4E-03	4.8E-03
CRM 6.0/Spring/Total								
Aluminum	3	3	4.9E-02	4.1E-01	2.2E-01	1.0E-01	5.3E-01	2.1E-01
Arsenic	3	1	1.0E-03	3.0E-03	1.3E-03	.	.	1.3E-03
Barium	3	3	2.5E-02	2.8E-02	2.7E-02	9.7E-04	3.0E-02	2.8E-02
Boron	3	3	3.0E-02	4.7E-02	3.9E-02	4.9E-03	5.3E-02	4.1E-02
Calcium	3	3	2.6E+01	2.9E+01	2.7E+01	1.1E+00	3.1E+01	2.7E+01

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Chromium	3	2	1.0E-03	1.9E-03	1.4E-03	3.1E-04	2.3E-03	1.1E-03
Copper	3	3	1.2E-03	5.4E-03	2.8E-03	1.3E-03	6.6E-03	1.7E-03
Iron	3	3	8.2E-02	6.2E-01	3.4E-01	1.6E-01	7.9E-01	3.1E-01
Lead	3	1	1.0E-03	2.8E-03	2.8E-03			2.8E-03
Magnesium	3	3	7.9E+00	8.6E+00	8.3E+00	2.1E-01	8.9E+00	8.4E+00
Manganese	3	3	2.5E-02	8.0E-02	5.4E-02	1.6E-02	1.0E-01	5.8E-02
Mercury	3	3	2.0E-05	6.6E-05	4.0E-05	1.4E-05	8.0E-05	3.3E-05
Nickel	3	3	1.1E-03	4.0E-03	2.6E-03	8.4E-04	5.0E-03	2.7E-03
Potassium	3	3	1.3E+00	1.5E+00	1.4E+00	4.7E-02	1.6E+00	1.5E+00
Sodium	3	3	3.6E+00	5.4E+00	4.4E+00	5.4E-01	6.0E+00	4.3E+00
Vanadium	3	2	1.0E-03	1.2E-03	1.2E-03	0.0E+00	1.2E-03	1.2E-03
Zinc	3	3	3.3E-03	1.2E-02	6.8E-03	2.7E-03	1.5E-02	4.9E-03
CRM 6.0/Summer/Dissolved								
Aluminum	3	2	6.0E-03	1.7E-02	1.2E-02	3.1E-03	2.1E-02	9.4E-03
Antimony	3	3	4.1E-03	7.5E-03	5.3E-03	1.1E-03	8.5E-03	4.4E-03
Barium	3	3	2.5E-02	2.6E-02	2.6E-02	4.8E-04	2.7E-02	2.6E-02
Boron	3	3	1.6E-02	2.7E-02	2.1E-02	3.3E-03	3.0E-02	1.9E-02
Calcium	3	3	2.6E+01	2.9E+01	2.8E+01	7.3E-01	3.0E+01	2.8E+01
Chloride	3	3	2.8E+00	3.0E+00	2.9E+00	6.7E-02	3.1E+00	2.8E+00
Chromium	3	2	1.0E-03	2.6E-03	1.7E-03	4.9E-04	3.2E-03	1.3E-03
Copper	3	3	1.8E-03	3.6E-03	2.6E-03	5.3E-04	4.1E-03	2.4E-03
Fluoride	3	3	5.9E-02	1.1E-01	7.6E-02	1.7E-02	1.3E-01	6.0E-02
Iron	3	2	1.8E-02	5.3E-01	2.0E-01	1.9E-01	7.6E-01	4.0E-02
Magnesium	3	3	6.3E+00	8.0E+00	7.5E+00	5.7E-01	9.1E+00	8.0E+00
Manganese	3	3	1.6E-03	4.8E-03	3.4E-03	9.4E-04	6.1E-03	3.7E-03

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Nickel	3	1	1.0E-03	2.6E-03	2.6E-03	.	.	2.6E-03
Nitrate/nitrite	3	3	4.0E-01	5.2E-01	4.6E-01	3.5E-02	5.6E-01	4.7E-01
Potassium	3	3	1.3E+00	1.4E+00	1.4E+00	1.5E-02	1.4E+00	1.4E+00
Selenium	3	1	1.0E-03	3.3E-03	3.3E-03	.	.	3.3E-03
Sodium	3	3	3.2E+00	3.4E+00	3.2E+00	6.1E-02	3.4E+00	3.2E+00
Sulfate	3	3	1.6E+01	1.7E+01	1.7E+01	3.3E-01	1.8E+01	1.7E+01
Zinc	3	3	2.9E-03	9.4E-03	5.1E-03	2.1E-03	1.1E-02	3.0E-03
CRM 6.0/Summer/Total								
Aluminum	3	3	4.2E-02	1.4E-01	7.5E-02	3.1E-02	1.7E-01	4.5E-02
Antimony	3	2	1.0E-03	1.7E-03	1.6E-03	3.8E-05	1.7E-03	1.6E-03
Barium	3	3	2.7E-02	3.0E-02	2.8E-02	8.7E-04	3.1E-02	2.8E-02
Boron	3	1	1.1E-02	2.9E-02	2.9E-02	.	.	2.9E-02
Calcium	3	3	2.6E+01	3.0E+01	2.9E+01	1.3E+00	3.2E+01	2.9E+01
Chromium	3	2	1.0E-03	2.1E-03	1.8E-03	1.5E-04	2.3E-03	1.7E-03
Copper	3	3	1.4E-03	2.5E-03	2.0E-03	3.2E-04	2.9E-03	2.1E-03
Iron	3	3	7.1E-02	6.7E-01	2.7E-01	2.0E-01	8.5E-01	7.6E-02
Magnesium	3	3	6.3E+00	8.4E+00	7.7E+00	6.9E-01	9.7E+00	8.3E+00
Manganese	3	3	4.1E-02	6.4E-02	5.4E-02	6.8E-03	7.3E-02	5.6E-02
Mercury	3	1	1.3E-05	2.0E-05	2.0E-05	.	.	2.0E-05
Nickel	3	1	1.0E-03	1.2E-03	1.2E-03	.	.	1.2E-03
Potassium	3	3	1.4E+00	1.5E+00	1.4E+00	3.3E-02	1.5E+00	1.4E+00
Sodium	3	3	3.2E+00	3.4E+00	3.3E+00	4.0E-02	3.4E+00	3.3E+00
Vanadium	3	1	1.0E-03	1.2E-03	1.2E-03	.	.	1.2E-03
Zinc	3	3	3.6E-03	5.8E-03	4.8E-03	6.4E-04	6.7E-03	5.0E-03

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
MBM 0.2/Spring/Dissolved								
Aluminum	3	3	1.1E-02	1.5E-02	1.3E-02	1.2E-03	1.7E-02	1.3E-02
Ammonium nitrogen	3	2	5.0E-02	1.9E-01	1.2E-01	4.3E-02	2.4E-01	7.8E-02
Antimony	3	2	1.0E-03	1.2E-02	6.5E-03	2.9E-03	1.5E-02	4.0E-03
Arsenic	3	1	1.0E-03	3.0E-03	2.2E-03	.	.	2.2E-03
Barium	3	3	2.2E-02	2.4E-02	2.3E-02	5.6E-04	2.4E-02	2.3E-02
Boron	3	2	1.8E-02	1.1E-01	6.6E-02	2.4E-02	1.4E-01	4.6E-02
Calcium	3	3	2.6E+01	2.9E+01	2.8E+01	7.7E-01	3.0E+01	2.8E+01
Chloride	3	3	2.8E+00	3.0E+00	2.9E+00	5.8E-02	3.1E+00	2.9E+00
Chromium	3	1	1.0E-03	2.2E-03	2.2E-03	.	.	2.2E-03
Copper	3	3	1.5E-03	2.9E-03	2.3E-03	4.3E-04	3.6E-03	2.6E-03
Fluoride	3	1	9.0E-02	1.5E-01	9.0E-02	.	.	9.0E-02
Iron	3	2	1.3E-02	4.9E-02	4.7E-02	1.0E-03	5.0E-02	4.6E-02
Lead	3	1	1.0E-03	1.7E-03	1.7E-03	.	.	1.7E-03
Magnesium	3	3	8.1E+00	9.0E+00	8.5E+00	3.0E-01	9.3E+00	8.3E+00
Manganese	3	2	1.0E-03	7.7E-03	3.6E-03	2.3E-03	1.0E-02	1.6E-03
Nickel	3	3	1.3E-03	1.1E-02	5.2E-03	2.9E-03	1.4E-02	3.5E-03
Nitrate/nitrite	3	3	5.3E-01	7.5E-01	6.2E-01	6.7E-02	8.1E-01	5.8E-01
Potassium	3	3	1.2E+00	1.4E+00	1.3E+00	7.2E-02	1.6E+00	1.4E+00
Sodium	3	3	3.5E+00	3.9E+00	3.7E+00	1.4E-01	4.1E+00	3.6E+00
Sulfate	3	3	1.7E+01	1.8E+01	1.8E+01	3.3E-01	1.9E+01	1.8E+01
Zinc	3	3	4.9E-03	6.5E-03	5.8E-03	4.7E-04	7.2E-03	6.0E-03
MBM 0.2/Spring/Total								
Aluminum	3	3	4.5E-02	2.5E-01	1.6E-01	6.1E-02	3.4E-01	2.0E-01
Arsenic	3	1	1.0E-03	3.0E-03	2.2E-03	.	.	2.2E-03

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Barium	3	3	2.6E-02	2.8E-02	2.7E-02	6.5E-04	2.8E-02	2.6E-02
Boron	3	2	1.8E-02	5.3E-02	4.9E-02	2.2E-03	5.5E-02	4.7E-02
Calcium	3	3	2.9E+01	3.5E+01	3.2E+01	1.8E+00	3.7E+01	3.0E+01
Chromium	3	1	1.0E-03	1.6E-03	1.6E-03	.	.	1.6E-03
Copper	3	3	1.7E-03	5.0E-03	2.9E-03	1.1E-03	6.0E-03	2.0E-03
Iron	3	3	9.7E-02	3.6E-01	2.5E-01	8.1E-02	4.9E-01	3.0E-01
Lead	3	1	1.0E-03	2.2E-03	2.2E-03	.	.	2.2E-03
Magnesium	3	3	8.1E+00	9.1E+00	8.5E+00	3.2E-01	9.4E+00	8.2E+00
Manganese	3	3	4.9E-02	9.0E-02	6.5E-02	1.3E-02	1.0E-01	5.5E-02
Mercury	3	1	2.0E-06	5.8E-06	2.0E-06	.	.	2.0E-06
Nickel	3	3	1.2E-03	3.9E-03	2.5E-03	7.8E-04	4.8E-03	2.5E-03
Potassium	3	3	1.4E+00	1.5E+00	1.4E+00	2.2E-02	1.5E+00	1.4E+00
Sodium	3	3	3.7E+00	5.6E+00	4.4E+00	6.1E-01	6.1E+00	3.8E+00
Vanadium	3	1	1.0E-03	1.1E-03	1.1E-03	.	.	1.1E-03
Zinc	3	3	3.0E-03	1.7E-02	8.6E-03	4.5E-03	2.2E-02	5.4E-03
MBM 0.2/Summer/Dissolved								
Aluminum	3	2	6.0E-03	1.6E-02	1.3E-02	1.2E-03	1.7E-02	1.2E-02
Ammonium nitrogen	3	1	5.0E-02	8.1E-02	8.1E-02	.	.	8.1E-02
Antimony	3	2	1.0E-03	7.0E-03	4.9E-03	1.2E-03	8.3E-03	3.9E-03
Barium	3	2	1.0E-03	2.8E-02	2.6E-02	8.9E-04	2.9E-02	2.5E-02
Boron	3	1	1.1E-02	3.7E-02	3.7E-02	.	.	3.7E-02
Calcium	3	2	2.7E-02	2.8E+01	2.7E+01	5.8E-01	2.9E+01	2.7E+01
Chloride	3	3	2.5E+00	2.9E+00	2.7E+00	1.3E-01	3.0E+00	2.6E+00
Chromium	3	2	1.0E-03	8.1E-03	4.0E-03	2.3E-03	1.1E-02	2.0E-03
Copper	3	2	1.0E-03	6.8E-03	5.9E-03	5.2E-04	7.4E-03	5.4E-03

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Fluoride	3	3	6.7E-02	9.0E-02	7.9E-02	6.7E-03	9.8E-02	8.0E-02
Iron	3	1	1.8E-02	2.7E+00	2.7E+00	.	.	2.7E+00
Magnesium	3	2	9.0E-03	8.0E+00	6.8E+00	6.8E-01	8.8E+00	6.2E+00
Manganese	3	2	1.0E-03	5.7E-02	4.1E-02	9.1E-03	6.7E-02	3.3E-02
Nickel	3	2	1.0E-03	1.3E-02	5.6E-03	4.0E-03	1.7E-02	2.1E-03
Nitrate/nitrite	3	3	4.2E-01	5.7E-01	4.9E-01	4.3E-02	6.2E-01	4.9E-01
Potassium	3	2	1.3E-02	1.3E+00	1.3E+00	2.1E-02	1.3E+00	1.2E+00
Selenium	3	1	1.0E-03	7.5E-03	7.5E-03	.	.	7.5E-03
Sodium	3	3	2.4E-02	3.1E+00	2.1E+00	1.0E+00	5.1E+00	3.1E+00
Sulfate	3	3	1.6E+01	1.7E+01	1.7E+01	3.3E-01	1.8E+01	1.7E+01
Vanadium	3	1	1.0E-03	1.2E-03	1.2E-03	.	.	1.2E-03
Zinc	3	2	2.0E-03	1.1E-02	6.4E-03	2.6E-03	1.4E-02	4.2E-03
MBM 0.2/Summer/Total								
Aluminum	3	2	6.0E-03	2.2E-01	1.3E-01	4.7E-02	2.7E-01	9.3E-02
Antimony	3	1	1.0E-03	1.2E-03	1.2E-03	.	.	1.2E-03
Barium	3	3	2.4E-02	3.0E-02	2.6E-02	1.7E-03	3.2E-02	2.6E-02
Boron	3	1	1.1E-02	2.9E-02	2.9E-02	.	.	2.9E-02
Calcium	3	3	2.6E+01	2.8E+01	2.7E+01	5.6E-01	2.9E+01	2.8E+01
Chromium	3	2	1.0E-03	2.1E-03	1.7E-03	2.3E-04	2.4E-03	1.5E-03
Copper	3	3	2.2E-03	3.3E-03	2.6E-03	3.5E-04	3.6E-03	2.3E-03
Iron	3	2	1.8E-02	7.6E-01	3.4E-01	2.4E-01	1.0E+00	1.3E-01
Magnesium	3	3	6.4E+00	8.4E+00	7.6E+00	6.2E-01	9.4E+00	8.0E+00
Manganese	3	2	1.0E-03	2.2E-01	1.4E-01	4.2E-02	2.7E-01	1.1E-01
Nickel	3	1	1.0E-03	1.4E-03	1.4E-03	.	.	1.4E-03
Potassium	3	3	1.3E+00	1.5E+00	1.3E+00	5.8E-02	1.5E+00	1.3E+00

Table L11 (continued)

Analyte	Obs.	Detects	Min.	Max.	Mean	Std. Error	95% UCB	Median
Sodium	3	3	3.1E+00	3.3E+00	3.2E+00	4.6E-02	3.3E+00	3.2E+00
Vanadium	3	1	1.0E-03	1.0E-03	1.0E-03	.	.	1.0E-03
Zinc	3	3	2.0E-03	8.7E-03	5.1E-03	1.9E-03	1.1E-02	4.7E-03

Table L12. Differences between seasons for unfiltered and filtered metals (mg/L) for the contaminant remobilization study

Analyte	Filtered or	Season	Number of		Minimum	Maximum	Mean	Standard	95%	Median
	Whole		Obs.	Det.				Error		
Aluminum	FLTR	spring	12	10	0.0070	0.0286	0.0149	0.00	0.0175	0.0150
Aluminum	FLTR	summer	11	7	0.0060	0.0174	0.0111	0.00	0.0130	0.0094
Aluminum	WHOL	spring	12	12	0.0451	0.5760	0.2290	0.05	0.3121	0.2260
Aluminum	WHOL	summer	12	11	0.0060	0.2230	0.1203	0.02	0.1584	0.1137
Antimony	FLTR	spring	12	10	0.0010	0.0115	0.0052	0.00	0.0071	0.0045
Antimony	FLTR	summer	11	10	0.0010	0.0108	0.0058	0.00	0.0071	0.0054
Antimony	WHOL	spring	12	0	0.0010	0.0010				
Antimony	WHOL	summer	12	3	0.0010	0.0017	0.0013	0.00	0.0014	0.0012
Copper	FLTR	spring	12	12	0.0012	0.0036	0.0023	0.00	0.0027	0.0023
Copper	FLTR	summer	11	10	0.0010	0.0109	0.0043	0.00	0.0057	0.0034
Copper	WHOL	spring	12	12	0.0012	0.0060	0.0031	0.00	0.0041	0.0025
Copper	WHOL	summer	12	12	0.0014	0.0034	0.0024	0.00	0.0028	0.0024
Iron	FLTR	spring	12	9	0.0130	0.0707	0.0437	0.01	0.0542	0.0472
Iron	FLTR	summer	11	5	0.0180	2.6500	0.4128	0.25	0.8651	0.0397
Iron	WHOL	spring	12	12	0.0817	0.7770	0.3436	0.06	0.4557	0.3355
Iron	WHOL	summer	12	11	0.0180	0.7940	0.3375	0.09	0.4967	0.1732
Manganese	FLTR	spring	12	11	0.0010	0.0152	0.0056	0.00	0.0078	0.0043
Manganese	FLTR	summer	11	10	0.0010	0.0566	0.0138	0.01	0.0237	0.0037
Manganese	WHOL	spring	12	12	0.0252	0.0919	0.0642	0.01	0.0746	0.0639
Manganese	WHOL	summer	12	11	0.0010	0.2150	0.0869	0.01	0.1116	0.0794
Mercury	FLTR	spring	24	13	0.0000	0.0013	0.0001	0.00	0.0002	0.0000
Mercury	FLTR	summer	23	7	0.0000	0.0002	0.0000	0.00	0.0000	0.0000
Mercury	WHOL	spring	24	12	0.0000	0.0002	0.0000	0.00	0.0000	0.0000
Mercury	WHOL	summer	24	9	0.0000	0.0002	0.0000	0.00	0.0000	0.0000

Table L12 (continued)

	Filtered or		Number of					Standard	95%	
Analyte	Whole	Season	Obs.	Det.	Minimum	Maximum	Mean	Error	UCB	Median
Methyl Mercury	FLTR	spring	12	12	0.0000	0.0000	0.0000	0.00	0.0000	0.0000
Methyl Mercury	FLTR	summer	12	12	0.0000	0.0000	0.0000	0.00	0.0000	0.0000
Methyl Mercury	WHOL	spring	12	12	0.0000	0.0000	0.0000	0.00	0.0000	0.0000
Methyl Mercury	WHOL	summer	12	12	0.0000	0.0000	0.0000	0.00	0.0000	0.0000
Nickel	FLTR	spring	12	12	0.0013	0.0136	0.0048	0.00	0.0070	0.0032
Nickel	FLTR	summer	11	5	0.0010	0.0125	0.0026	0.00	0.0045	0.0012
Nickel	WHOL	spring	12	12	0.0011	0.0040	0.0025	0.00	0.0030	0.0026
Nickel	WHOL	summer	12	4	0.0010	0.0019	0.0013	0.00	0.0014	0.0012
Zinc	FLTR	spring	12	12	0.0037	0.0072	0.0055	0.00	0.0061	0.0055
Zinc	FLTR	summer	11	10	0.0020	0.0114	0.0057	0.00	0.0076	0.0042
Zinc	WHOL	spring	12	12	0.0030	0.0223	0.0098	0.00	0.0133	0.0080
Zinc	WHOL	summer	12	12	0.0020	0.0087	0.0049	0.00	0.0061	0.0047
Hardness	WHOL	spring	12	12	75.3231	125.9622	102.3497	4.14	109.7788	104.7260
Hardness	WHOL	summer	12	12	90.1133	110.8912	101.2331	2.03	104.8712	104.1510

Table L13. Metals summary statistics (mg/L) by reach for the contaminant remobilization from sediments study

Analyte	Filtered or		No. of		Min.	Max.	Mean	S.E.	95%	
	Whole	Sub reach	Obs.	Det.					UCB	Median
Aluminum	FLTR	1	5	4	7.00E-03	1.64E-02	1.55E-02	0	1.61E-02	1.54E-02
Aluminum	FLTR	4.02	6	4	6.00E-03	1.74E-02	1.18E-02	0	1.48E-02	1.01E-02
Aluminum	FLTR	4.04	6	4	6.00E-03	2.86E-02	1.35E-02	0	2.05E-02	9.42E-03
Aluminum	FLTR	7.02	6	5	6.00E-03	1.55E-02	1.31E-02	0	1.47E-02	1.28E-02
Aluminum	WHOL	1	6	6	7.06E-02	3.31E-01	1.77E-01	0.04	2.58E-01	1.59E-01
Aluminum	WHOL	4.02	6	6	4.19E-02	4.09E-01	1.48E-01	0.06	2.67E-01	9.29E-02
Aluminum	WHOL	4.04	6	6	3.44E-02	5.76E-01	2.34E-01	0.08	3.92E-01	2.12E-01
Aluminum	WHOL	7.02	6	5	6.00E-03	2.50E-01	1.41E-01	0.04	2.18E-01	1.46E-01
Antimony	FLTR	1	5	4	1.00E-03	1.14E-02	6.93E-03	0	1.10E-02	6.60E-03
Antimony	FLTR	4.02	6	6	3.90E-03	9.50E-03	5.72E-03	0	7.59E-03	4.65E-03
Antimony	FLTR	4.04	6	6	1.10E-03	7.46E-03	4.58E-03	0	6.37E-03	5.15E-03
Antimony	FLTR	7.02	6	4	1.00E-03	1.15E-02	5.69E-03	0	8.37E-03	3.95E-03
Antimony	WHOL	1	6	0	1.00E-03	1.00E-03	.	.	.	.
Antimony	WHOL	4.02	6	2	1.00E-03	1.70E-03	1.62E-03	0	1.66E-03	1.60E-03
Antimony	WHOL	4.04	6	0	1.00E-03	1.00E-03	.	.	.	.
Antimony	WHOL	7.02	6	1	1.00E-03	1.20E-03	1.20E-03	.	.	1.20E-03
Copper	FLTR	1	5	5	1.90E-03	1.09E-02	4.24E-03	0	7.84E-03	3.00E-03
Copper	FLTR	4.02	6	6	1.20E-03	3.60E-03	2.44E-03	0	3.25E-03	2.21E-03
Copper	FLTR	4.04	6	6	1.80E-03	4.52E-03	3.05E-03	0	3.78E-03	3.05E-03
Copper	FLTR	7.02	6	5	1.00E-03	6.75E-03	3.44E-03	0	5.25E-03	2.75E-03
Copper	WHOL	1	6	6	1.50E-03	6.00E-03	2.84E-03	0	4.19E-03	2.55E-03
Copper	WHOL	4.02	6	6	1.20E-03	5.40E-03	2.38E-03	0	3.66E-03	1.90E-03
Copper	WHOL	4.04	6	6	1.40E-03	5.20E-03	3.17E-03	0	4.18E-03	3.15E-03
Copper	WHOL	7.02	6	6	1.70E-03	5.00E-03	2.75E-03	0	3.76E-03	2.25E-03
Iron	FLTR	1	5	4	1.80E-02	5.11E-01	1.31E-01	0.1	3.41E-01	5.05E-02

Table L13 (continued)

Analyte	Filtered or		No. of		Min.	Max.	Mean	S.E.	95%	
	Whole	Sub reach	Obs.	Det.					UCB	Median
Iron	FLTR	4.02	6	4	1.30E-02	5.34E-01	1.27E-01	0.09	3.00E-01	4.00E-02
Iron	FLTR	4.04	6	3	1.30E-02	5.68E-01	1.51E-01	0.09	3.38E-01	6.69E-02
Iron	FLTR	7.02	6	3	1.30E-02	2.65E+00	4.80E-01	0.49	1.46E+00	4.58E-02
Iron	WHOL	1	6	6	1.28E-01	7.36E-01	3.51E-01	0.1	5.48E-01	2.92E-01
Iron	WHOL	4.02	6	6	7.13E-02	6.66E-01	3.03E-01	0.11	5.31E-01	1.95E-01
Iron	WHOL	4.04	6	6	7.51E-02	7.94E-01	4.20E-01	0.13	6.73E-01	3.65E-01
Iron	WHOL	7.02	6	5	1.80E-02	7.59E-01	2.92E-01	0.11	5.06E-01	2.19E-01
Manganese	FLTR	1	5	5	7.70E-03	2.71E-02	1.37E-02	0	2.14E-02	8.88E-03
Manganese	FLTR	4.02	6	6	1.60E-03	5.80E-03	3.48E-03	0	4.80E-03	3.24E-03
Manganese	FLTR	4.04	6	6	1.80E-03	1.52E-02	4.66E-03	0	8.93E-03	2.50E-03
Manganese	FLTR	7.02	6	4	1.00E-03	5.66E-02	1.70E-02	0.01	3.68E-02	4.65E-03
Manganese	WHOL	1	6	6	6.39E-02	1.18E-01	8.85E-02	0.01	1.04E-01	8.64E-02
Manganese	WHOL	4.02	6	6	2.52E-02	8.00E-02	5.39E-02	0.01	6.95E-02	5.70E-02
Manganese	WHOL	4.04	6	6	4.18E-02	8.63E-02	6.74E-02	0.01	8.12E-02	6.76E-02
Manganese	WHOL	7.02	6	5	1.00E-03	2.15E-01	9.40E-02	0.03	1.47E-01	7.26E-02
Mercury	FLTR	1	6	4	1.44E-06	8.28E-06	2.85E-06	0	5.20E-06	1.56E-06
Mercury	FLTR	4.02	6	4	1.84E-06	4.34E-06	2.66E-06	0	3.75E-06	1.85E-06
Mercury	FLTR	4.04	6	5	1.54E-06	5.16E-06	3.23E-06	0	4.58E-06	3.06E-06
Mercury	FLTR	7.02	6	6	1.35E-06	5.83E-06	2.79E-06	0	4.27E-06	2.14E-06
Mercury	WHOL	1	6	4	1.91E-06	3.60E-06	2.77E-06	0	3.45E-06	2.88E-06
Mercury	WHOL	4.02	6	6	1.31E-05	6.61E-05	2.82E-05	0	4.44E-05	1.97E-05
Mercury	WHOL	4.04	6	6	1.67E-05	3.64E-05	2.75E-05	0	3.49E-05	2.79E-05
Mercury	WHOL	7.02	6	5	2.01E-06	7.09E-06	4.18E-06	0	5.88E-06	4.09E-06
Methyl Mercury	FLTR	1	6	6	1.80E-08	1.03E-07	5.78E-08	0	8.16E-08	5.50E-08
Methyl Mercury	FLTR	4.02	6	6	4.30E-08	9.60E-08	7.00E-08	0	8.82E-08	6.65E-08
Methyl Mercury	FLTR	4.04	6	6	3.20E-08	1.30E-07	6.57E-08	0	9.40E-08	5.65E-08

Table L13 (continued)

Analyte	Filtered or		No. of		Min.	Max.	Mean	S.E.	95%	
	Whole	Sub reach	Obs.	Det.					UCB	Median
Methyl Mercury	FLTR	7.02	6	6	3.00E-08	7.10E-08	4.95E-08	0	6.26E-08	4.65E-08
Methyl Mercury	WHOL	1	6	6	3.70E-08	1.43E-07	6.97E-08	0	1.01E-07	5.90E-08
Methyl Mercury	WHOL	4.02	6	6	5.60E-08	1.66E-07	1.00E-07	0	1.34E-07	9.40E-08
Methyl Mercury	WHOL	4.04	6	6	6.40E-08	1.40E-07	1.04E-07	0	1.29E-07	1.07E-07
Methyl Mercury	WHOL	7.02	6	6	3.20E-08	9.40E-08	5.66E-08	0	7.67E-08	5.28E-08
Nickel	FLTR	1	5	4	1.00E-03	9.33E-03	3.49E-03	0	6.78E-03	2.70E-03
Nickel	FLTR	4.02	6	4	1.00E-03	4.50E-03	2.77E-03	0	3.94E-03	2.15E-03
Nickel	FLTR	4.04	6	4	1.00E-03	1.36E-02	3.65E-03	0	7.92E-03	1.50E-03
Nickel	FLTR	7.02	6	5	1.00E-03	1.25E-02	5.25E-03	0	9.49E-03	2.80E-03
Nickel	WHOL	1	6	4	1.00E-03	3.20E-03	1.98E-03	0	2.58E-03	1.65E-03
Nickel	WHOL	4.02	6	4	1.00E-03	4.00E-03	1.87E-03	0	2.93E-03	1.15E-03
Nickel	WHOL	4.04	6	4	1.00E-03	3.20E-03	2.06E-03	0	2.70E-03	1.70E-03
Nickel	WHOL	7.02	6	4	1.00E-03	3.90E-03	1.89E-03	0	2.85E-03	1.28E-03
Zinc	FLTR	1	5	5	4.22E-03	7.20E-03	5.98E-03	0	7.30E-03	6.60E-03
Zinc	FLTR	4.02	6	6	2.91E-03	9.40E-03	5.10E-03	0	7.08E-03	4.65E-03
Zinc	FLTR	4.04	6	6	2.70E-03	1.14E-02	5.46E-03	0	8.04E-03	4.30E-03
Zinc	FLTR	7.02	6	5	2.00E-03	1.10E-02	6.12E-03	0	8.28E-03	5.45E-03
Zinc	WHOL	1	6	6	2.17E-03	2.23E-02	8.28E-03	0	1.45E-02	6.05E-03
Zinc	WHOL	4.02	6	6	3.30E-03	1.21E-02	5.78E-03	0	8.44E-03	4.95E-03
Zinc	WHOL	4.04	6	6	2.70E-03	2.02E-02	8.51E-03	0	1.35E-02	7.30E-03
Zinc	WHOL	7.02	6	6	2.00E-03	1.74E-02	6.86E-03	0	1.15E-02	5.03E-03

Table L14. All organic analytes detected (mg/L) for the contaminant remobilization from sediments study

Reach	River Mile		Season	Analyte	Process	Result
1	CRM	41.5	summer	Bis(2-ethylhexyl)phthalate	Filtered	2.70E-02
4.02	CRM	6	spring	Bis(2-ethylhexyl)phthalate	Filtered	1.00E-03
4.04	CRM	1	summer	Bis(2-ethylhexyl)phthalate	Filtered	3.00E-02
7.02	MBM	0.2	summer	Bis(2-ethylhexyl)phthalate	Total	6.00E-03
1	CRM	41.5	spring	Di-n-butylphthalate	Filtered	1.00E-03
4.02	CRM	6	summer	Di-n-butylphthalate	Filtered	1.00E-03
7.02	MBM	0.2	spring	Di-n-butylphthalate	Filtered	1.00E-03
1	CRM	41.5	spring	Di-n-butylphthalate	Total	1.00E-03
7.02	MBM	0.2	summer	Di-n-butylphthalate	Total	4.00E-03
7.02	MBM	0.2	spring	alpha-BHC	Filtered	1.80E-05
7.02	MBM	0.2	spring	alpha-BHC	Total	1.30E-05

Table L15. Radionuclide water data for the contaminant remobilization study by reach, site, and season

Reach	Site	Season	Analyte	Process	Obs.	Detects	Max.	Min.	Mean	Median	Std. Error	Units
1	CRM 41.5	spring	Cesium-137	Cart. Filter	3	1	4.26E+00	-1.44E+00	0.00E+00	0.00E+00	.	PCi/L
1	CRM 41.5	summer	Cesium-137	Cart. Filter	3	2	-6.00E-01	-2.71E+00	0.00E+00	0.00E+00	0.00E+00	pCi/L
4.02	CRM 6.0	spring	Cesium-137	Cart. Filter	3	2	6.13E+00	-1.22E+00	1.00E-02	8.00E-03	1.00E-02	pCi/L
4.02	CRM 6.0	summer	Cesium-137	Cart. Filter	3	2	-1.53E+00	-3.12E+00	0.00E+00	0.00E+00	0.00E+00	pCi/L
4.04	CRM 1.0	spring	Cesium-137	Cart. Filter	4	2	1.12E+01	-1.12E+00	3.80E-01	3.78E-01	3.80E-01	pCi/L
4.04	CRM 1.0	summer	Cesium-137	Cart. Filter	4	0	9.14E+00	0.00E+00	.	.	.	pCi/L
7.02	MBM 0.2	spring	Cesium-137	Cart. Filter	3	1	1.29E+01	-2.94E+00	0.00E+00	0.00E+00	.	pCi/L
7.02	MBM 0.2	summer	Cesium-137	Cart. Filter	4	1	7.56E+00	-2.00E+00	0.00E+00	0.00E+00	.	pCi/L
1	CRM 41.5	spring	Cesium-137	Cart. Filter	3	0	2.40E-01	5.00E-02	.	.	.	pCi/L
1	CRM 41.5	summer	Cesium-137	Cart. Filter	3	0	1.30E-01	-4.00E-02	.	.	.	pCi/L
4.02	CRM 6.0	spring	Cesium-137	Cart. Filter	3	0	2.10E-01	-6.00E-02	.	.	.	pCi/L
4.02	CRM 6.0	summer	Cesium-137	Cart. Filter	3	0	2.00E-01	3.00E-02	.	.	.	pCi/L
4.04	CRM 1.0	spring	Cesium-137	Cart. Filter	5	0	2.70E-01	-1.30E-01	.	.	.	pCi/L
4.04	CRM 1.0	summer	Cesium-137	Cart. Filter	4	1	2.10E-01	-9.00E-02	2.10E-01	2.12E-01	.	pCi/L
7.02	MBM 0.2	spring	Cesium-137	Cart. Filter	3	0	1.00E-01	-4.80E-01	.	.	.	pCi/L
7.02	MBM 0.2	summer	Cesium-137	Cart. Filter	4	0	-2.00E-02	-2.90E-01	.	.	.	pCi/L
1	CRM 41.5	spring	Cobalt-60	Cart. Filter	3	0	4.94E+00	7.30E-01	.	.	.	pCi/L
1	CRM 41.5	summer	Cobalt-60	Cart. Filter	3	0	7.60E-01	-6.81E+00	.	.	.	pCi/L
4.02	CRM 6.0	spring	Cobalt-60	Cart. Filter	3	0	1.12E+00	1.60E-01	.	.	.	pCi/L
4.02	CRM 6.0	summer	Cobalt-60	Cart. Filter	3	0	5.15E+00	2.00E-01	.	.	.	pCi/L
4.04	CRM 1.0	spring	Cobalt-60	Cart. Filter	4	0	1.11E+00	-3.60E+00	.	.	.	pCi/L
4.04	CRM 1.0	summer	Cobalt-60	Cart. Filter	4	0	4.80E+00	-1.08E+00	.	.	.	pCi/L
7.02	MBM 0.2	spring	Cobalt-60	Cart. Filter	3	0	5.99E+00	-4.24E+00	.	.	.	pCi/L
7.02	MBM 0.2	summer	Cobalt-60	Cart. Filter	4	0	5.44E+00	-2.05E+00	.	.	.	pCi/L
1	CRM 41.5	spring	Cobalt-60	Cart. Filter	3	0	1.50E-01	-3.30E-01	.	.	.	pCi/L
1	CRM 41.5	summer	Cobalt-60	Cart. Filter	3	0	-4.00E-02	-1.10E-01	.	.	.	pCi/L
4.02	CRM 6.0	spring	Cobalt-60	Cart. Filter	3	0	1.20E-01	-7.00E-02	.	.	.	pCi/L

Table L15 (continued)

Reach	Site	Season	Analyte	Process	Obs.	Detects	Max.	Min.	Mean	Median	Std. Error	Units
4.02	CRM 6.0	summer	Cobalt-60	Cart. Filter	3	0	-1.30E-01	-3.90E-01	.	.	.	pCi/L
4.04	CRM 1.0	spring	Cobalt-60	Cart. Filter	5	0	4.60E-01	-3.20E-01	.	.	.	pCi/L
4.04	CRM 1.0	summer	Cobalt-60	Cart. Filter	4	0	2.40E-01	-2.10E-01	.	.	.	pCi/L
7.02	MBM 0.2	spring	Cobalt-60	Cart. Filter	3	0	2.00E-02	-2.20E-01	.	.	.	pCi/L
7.02	MBM 0.2	summer	Cobalt-60	Cart. Filter	4	0	1.10E-01	-5.70E-01	.	.	.	pCi/L
1	CRM 41.5	spring	Gross alpha activity		3	1	1.97E+00	4.20E-01	1.97E+00	1.97E+00	.	pCi/L
1	CRM 41.5	summer	Gross alpha activity		3	0	6.60E-01	-8.43E+00	.	.	.	pCi/L
4.02	CRM 6.0	spring	Gross alpha activity		3	2	1.21E+00	6.80E-01	9.70E-01	8.50E-01	1.40E-01	pCi/L
4.02	CRM 6.0	summer	Gross alpha activity		3	1	1.76E+00	-1.08E+01	0.00E+00	0.00E+00	.	pCi/L
4.04	CRM 1.0	spring	Gross alpha activity		4	0	8.60E-01	1.70E-01	.	.	.	pCi/L
4.04	CRM 1.0	summer	Gross alpha activity		3	0	2.75E+00	-1.29E+01	.	.	.	pCi/L
7.02	MBM 0.2	spring	Gross alpha activity		3	1	1.08E+00	2.90E-01	1.08E+00	1.08E+00	.	pCi/L
7.02	MBM 0.2	summer	Gross alpha activity		4	0	4.20E-01	-8.22E+00	.	.	.	pCi/L
1	CRM 41.5	spring	Gross alpha activity		3	2	5.79E+00	2.08E+00	4.74E+00	4.22E+00	6.00E-01	pCi/L
1	CRM 41.5	summer	Gross alpha activity		3	3	1.34E+01	4.82E+00	8.91E+00	8.51E+00	2.48E+00	pCi/L
4.02	CRM 6.0	spring	Gross alpha activity		3	2	5.53E+00	1.84E+00	4.86E+00	4.53E+00	3.80E-01	pCi/L
4.02	CRM 6.0	summer	Gross alpha activity		3	2	7.74E+00	3.80E-01	6.91E+00	6.49E+00	4.80E-01	pCi/L
4.04	CRM 1.0	spring	Gross alpha activity		4	2	2.88E+00	1.61E+00	2.46E+00	2.32E+00	1.70E-01	pCi/L
4.04	CRM 1.0	summer	Gross alpha activity		3	2	8.95E+00	9.90E-01	6.35E+00	5.05E+00	1.50E+00	pCi/L
7.02	MBM 0.2	spring	Gross alpha activity		3	2	6.26E+00	-2.80E-01	3.57E+00	2.22E+00	1.55E+00	pCi/L
7.02	MBM 0.2	summer	Gross alpha activity		4	4	8.14E+00	3.15E+00	6.07E+00	6.50E+00	1.09E+00	pCi/L
1	CRM 41.5	spring	Particle associated Co-60	Cart. Filter	3	0	8.81E+00	-3.98E+01	.	.	.	pCi/g
1	CRM 41.5	summer	Particle associated Co-60	Cart. Filter	3	0	-3.75E+00	-2.98E+01	.	.	.	pCi/g
4.02	CRM 6.0	spring	Particle associated Co-60	Cart. Filter	3	0	1.27E+01	-1.92E+01	.	.	.	pCi/g
4.02	CRM 6.0	summer	Particle associated Co-60	Cart. Filter	3	0	-1.80E+01	-6.55E+01	.	.	.	pCi/g
4.04	CRM 1.0	spring	Particle associated Co-60	Cart. Filter	3	0	5.30E+01	9.42E+00	.	.	.	pCi/g
4.04	CRM 1.0	summer	Particle associated Co-60	Cart. Filter	3	0	3.29E+01	0.00E+00	.	.	.	pCi/g

Table L15 (continued)

Reach	Site	Season	Analyte	Process	Obs.	Detects	Max.	Min.	Mean	Median	Std. Error	Units
7.02	MBM 0.2	spring	Particle associated Co-60	Cart. Filter	3	0	4.03E+00	-2.52E+01	.	.	.	pCi/g
7.02	MBM 0.2	summer	Particle associated Co-60	Cart. Filter	3	0	3.24E+01	-2.61E+00	.	.	.	pCi/g
1	CRM 41.5	spring	Particle associated Cs-137	Cart. Filter	3	0	2.86E+01	3.06E+00	.	.	.	pCi/g
1	CRM 41.5	summer	Particle associated Cs-137	Cart. Filter	3	0	3.55E+01	-6.18E+00	.	.	.	pCi/g
4.02	CRM 6.0	spring	Particle associated Cs-137	Cart. Filter	3	0	5.59E+01	-6.27E+00	.	.	.	pCi/g
4.02	CRM 6.0	summer	Particle associated Cs-137	Cart. Filter	3	0	1.44E+01	4.78E+00	.	.	.	pCi/g
4.04	CRM 1.0	spring	Particle associated Cs-137	Cart. Filter	3	0	2.54E+01	4.43E+00	.	.	.	pCi/g
4.04	CRM 1.0	summer	Particle associated Cs-137	Cart. Filter	3	0	1.16E+01	-6.12E+00	.	.	.	pCi/g
7.02	MBM 0.2	spring	Particle associated Cs-137	Cart. Filter	3	0	1.70E+01	-5.76E+01	.	.	.	pCi/g
7.02	MBM 0.2	summer	Particle associated Cs-137	Cart. Filter	3	0	-6.59E+00	-3.98E+01	.	.	.	pCi/g
1	CRM 41.5	spring	Strontium-90		3	0	2.47E+00	4.90E-01	.	.	.	pCi/L
1	CRM 41.5	summer	Strontium-90		3	0	7.90E-01	0.00E+00	.	.	.	pCi/L
4.02	CRM 6.0	spring	Strontium-90		3	0	1.99E+00	0.00E+00	.	.	.	pCi/L
4.02	CRM 6.0	summer	Strontium-90		3	1	8.16E+00	-1.40E-01	8.16E+00	8.16E+00	.	pCi/L
4.04	CRM 1.0	spring	Strontium-90		4	1	1.22E+01	0.00E+00	1.22E+01	1.22E+01	.	pCi/L
4.04	CRM 1.0	summer	Strontium-90		3	0	1.30E-01	0.00E+00	.	.	.	pCi/L
7.02	MBM 0.2	spring	Strontium-90		3	0	1.80E+00	0.00E+00	.	.	.	pCi/L
7.02	MBM 0.2	summer	Strontium-90		3	1	1.07E+00	4.70E-01	1.07E+00	1.07E+00	.	pCi/L
1	CRM 41.5	spring	Tritium		3	0	4.87E+01	0.00E+00	.	.	.	pCi/L
1	CRM 41.5	summer	Tritium		3	0	7.24E+01	-1.48E+02	.	.	.	pCi/L
4.02	CRM 6.0	spring	Tritium		3	3	9.52E+02	2.93E+02	7.17E+02	9.06E+02	2.12E+02	pCi/L
4.02	CRM 6.0	summer	Tritium		3	1	3.44E+02	-1.03E+02	3.44E+02	3.44E+02	.	pCi/L
4.04	CRM 1.0	spring	Tritium		4	3	3.46E+02	1.57E+02	2.53E+02	2.28E+02	3.45E+01	pCi/L
4.04	CRM 1.0	summer	Tritium		3	3	2.43E+02	-1.53E+02	8.11E+01	0.00E+00	8.11E+01	pCi/L
7.02	MBM 0.2	spring	Tritium		3	0	3.52E+01	0.00E+00	.	.	.	pCi/L
7.02	MBM 0.2	summer	Tritium		4	0	2.88E+01	-1.91E+02	.	.	.	pCi/L

Table L16. Fathead minnow survival in the Clinch River and Poplar Creek

Test Date	Site ID ^a	Survival				Percent Difference			
		Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
4/22-29/93	Control	100.0	0.0	100	100	NA	NA	17.6	NA
	PCM 1.0	100.0	0.0	100	100	0.0	NA	17.6	NA
	PCM 2.9	97.5	5.0	90	100	-2.5	NA	14.7	NA
	PCM 4.3	90.0	0.0	90	90	-10.0	NA	5.9	NA
	PCM 5.1	80.0	18.3	60	100	-20.0	NA	-5.9	NA
	PCM 11.3	85.0	12.9	70	100	-15.0	NA	NA	NA
	CRM 9.0	100.0	0.0	100	100	0.0	NA	NA	NA
7/22-29/93	Control	90.0	14.1	70	100	NA	9.1	12.5	-10.0
	PCM 1.0	67.5	17.1	50	90	-25.0	-18.2	-15.6	NA
	PCM 2.9	72.5	15.0	60	90	-19.4	-12.1	-9.4	NA
	PCM 4.3	65.0	10.0	60	80	-27.8	-21.2	-18.8	NA
	PCM 5.1	80.0	0.0	80	80	-11.1	-3.0	0.0	NA
	PCM 6.0	82.5	9.6	70	90	-8.33	NA	3.1	NA
	PCM 11.3	80.0	21.6	50	100	-11.1	-3.0	NA	NA
	CRM 9.0	90.0	8.2	80	100	0.0	NA	NA	-10.0
	CRM 19.0	95.0	5.8	90	100	5.6	NA	NA	-5.0
	CRM 22.0	100.0	0.0	100	100	11.1	NA	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile

^bReference site

NA = Not Applicable

Table L16 (continued)

Test Date	Site ID ^a	Survival				Percent Difference			
		Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
10/21-28/93	Control	87.5	12.6	70	100	NA	34.6	25.0	0.0
	PCM 1.0	60.0	14.1	50	80	-31.4	-7.7	-14.3	NA
	PCM 2.9	62.5	9.6	50	70	-28.6	-3.8	-10.7	NA
	PCM 4.3	87.5	9.6	80	100	0.0	34.6	25.0	NA
	PCM 5.1	65.0	12.9	50	80	-25.7	0.0	-7.1	NA
	PCM 6.0	65.0	17.3	40	80	-25.7	NA	-7.1	NA
	PCM 11.3	70.0	24.5	50	100	-20.0	7.7	NA	NA
	CRM 9.0	82.5	5.0	80	90	-5.7	NA	NA	-5.7
	CRM 19.0	77.5	26.3	40	100	-11.4	NA	NA	-11.4
	CRM 22.0	87.5	5.0	80	90	0.0	NA	NA	NA
1/25-2/1/94	Control	100.0	0.0	100	100	NA	60.0	21.2	2.6
	PCM 1.0	75.0	28.9	50	100	-25.0	20.0	-9.1	NA
	PCM 2.9	82.5	17.1	60	100	-17.5	32.0	0.0	NA
	PCM 4.3	75.0	31.1	30	100	-25.0	20.0	-9.1	NA
	PCM 5.1	77.5	26.3	40	100	-22.5	24.0	-6.1	NA
	PCM 6.0	62.5	27.5	30	90	-37.5	NA	-24.2	NA
	PCM 11.3	82.5	28.7	40	100	-17.5	32.0	NA	NA
	CRM 9.0	95.0	5.8	90	100	-5.0	NA	NA	-2.6

^aPCM = Poplar Creek mile; CRM = Clinch River mile^bReference site

NA = Not Applicable

Table L16 (continued)

Test Date	Site ID ^a	Survival				Percent Difference			
		Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
	CRM 19.0	95.0	5.8	90	100	-5.0	NA	NA	-2.6
	CRM 22.0	97.5	5.0	90	100	-2.5	NA	NA	NA
4/14-21/94	Control	97.5	5.0	90	100	NA	69.6	25.8	18.2
	PCM 1.0	45.0	17.3	20	60	-53.8	-21.7	-41.9	NA
	PCM 2.9	52.5	17.1	30	70	-46.2	-8.7	-32.3	NA
	PCM 4.3	42.5	9.6	30	50	-56.4	-26.1	-45.2	NA
	PCM 5.1	52.5	33.0	20	90	-46.2	-8.7	-32.3	NA
	PCM 6.0	57.5	15.0	40	70	-41.0	NA	-25.8	NA
	PCM 11.3	77.5	26.3	40	100	-20.5	34.8	NA	NA
	CRM 9.0	45.0	30.0	30	90	-53.8	NA	NA	-45.5
	CRM 19.0	75.0	5.8	70	80	-23.1	NA	NA	-9.1
	CRM 22.0	82.5	12.6	70	100	-15.4	NA	NA	NA
7/21-28/94	Control	80.0	14.1	60	90	NA	-17.9	-8.6	14.3
	PCM 1.0	90.0	11.5	80	100	12.5	-7.7	2.9	NA
	PCM 2.9	92.5	5.0	90	100	15.6	-5.1	5.7	NA
	PCM 4.3	90.0	8.2	80	100	12.5	-7.7	2.9	NA
	PCM 5.1	82.5	15.0	60	90	3.1	-15.4	-5.7	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile^bReference site

NA = Not Applicable

Table L16 (continued)

Test Date	Site ID ^a	Survival				Percent Difference			
		Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
	PCM 6.0	97.5	5.0	90	100	21.9	NA	11.4	NA
	PCM 11.3	87.5	5.0	80	90	9.4	-10.3	NA	NA
	CRM 9.0	72.5	23.6	40	90	-9.4	NA	NA	3.6
	CRM 19.0	95.0	5.8	90	100	18.8	NA	NA	35.7
	CRM 22.0	70.0	24.5	50	100	-12.5	NA	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile

^bReference site

NA = Not Applicable

Table L17. Fathead minnow survival in McCoy Branch and Walker Branch

Test Date	Site ID ^a	Survival				Percent Difference	
		Mean	SD	Min.	Max.	Control	WBM 0.4 ^b
6/2-9/94	Control	92.5	5.0	90	100	NA	-2.6
	MBM 0.2	92.5	5.0	90	100	0.0	-2.6
	MBM 0.4	92.5	5.0	90	100	0.0	-2.6
	WBM 0.4	95.0	10.0	80	100	2.7	NA
8/11-18/94	Control	95.0	5.8	90	100	NA	8.6
	MBM 0.2	75.0	23.8	40	90	-21.1	-14.3
	MBM 0.4	97.5	5.0	90	100	2.6	11.4
	WBM 0.4	87.5	9.6	80	100	-7.9	NA

^aMBM = McCoy Branch Mile; WBM = Walker Branch mile

^bReference site

NA = Not Applicable

Table L18. Fathead minnow growth (per surviving larvae) in the Clinch River and Poplar Creek

Test Date	Site ID ^a	Growth (weight in mg)				Percent Difference			
		Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
4/22-29/93	Control	0.42	0.06	0.35	0.47	NA	NA	10.53	NA
	PCM 1.0	0.40	0.02	0.37	0.43	-4.76	NA	5.26	NA
	PCM 2.9	0.41	0.04	0.36	0.45	-2.38	NA	7.89	NA
	PCM 4.3	0.39	0.02	0.36	0.41	-7.14	NA	2.63	NA
	PCM 5.1	0.43	0.04	0.38	0.48	2.38	NA	13.16	NA
	PCM 11.3	0.38	0.04	0.34	0.42	-9.52	NA	NA	NA
	CRM 9.0	0.38	0.03	0.34	0.41	-9.52	NA	NA	NA
7/22-29/93	Control	0.33	0.07	0.28	0.43	NA	6.45	3.13	-8.33
	PCM 1.0	0.42	0.10	0.31	0.55	27.27	35.48	31.25	NA
	PCM 2.9	0.37	0.06	0.33	0.45	12.12	19.35	15.63	NA
	PCM 4.3	0.36	0.08	0.25	0.43	9.09	16.13	12.50	NA
	PCM 5.1	0.38	0.04	0.32	0.41	15.15	22.58	18.75	NA
	PCM 6.0	0.31	0.05	0.25	0.37	-6.06	NA	-3.12	NA
	PCM 11.3	0.32	0.09	0.19	0.41	-3.03	3.23	NA	NA
	CRM 9.0	0.30	0.06	0.21	0.36	-9.09	NA	NA	-16.67
	CRM 19.0	0.34	0.02	0.31	0.35	3.03	NA	NA	-5.56
	CRM 22.0	0.36	0.05	0.31	0.41	9.09	NA	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile.^b Reference site

NA = Not Applicable

Table L18 (continued)

Test Date	Site ID ^a	Growth (weight in mg)				Percent Difference			
		Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
10/21-28/93	Control	0.39	0.06	0.33	0.47	NA	-30.36	-27.78	-25.00
	PCM 1.0	0.39	0.08	0.33	0.51	0.00	-30.36	-27.78	NA
	PCM 2.9	0.51	0.10	0.39	0.63	30.77	-8.93	-5.56	NA
	PCM 4.3	0.46	0.05	0.39	0.51	17.95	-17.86	-14.81	NA
	PCM 5.1	0.42	0.09	0.29	0.49	7.69	-25.00	-22.22	NA
	PCM 6.0	0.56	0.12	0.41	0.66	43.59	NA	3.70	NA
	PCM 11.3	0.54	0.11	0.38	0.64	38.46	-3.57	NA	NA
	CRM 9.0	0.51	0.09	0.43	0.64	30.77	NA	NA	-1.92
	CRM 19.0	0.54	0.03	0.51	0.58	38.46	NA	NA	3.85
	CRM 22.0	0.52	0.02	0.48	0.53	33.33	NA	NA	NA
1/25-2/1/94	Control	0.41	0.05	0.35	0.46	NA	-25.45	-8.89	-10.87
	PCM 1.0	0.56	0.07	0.48	0.64	36.59	1.82	24.44	NA
	PCM 2.9	0.54	0.06	0.49	0.62	31.71	-1.82	20.00	NA
	PCM 4.3	0.56	0.09	0.46	0.67	36.59	1.82	24.44	NA
	PCM 5.1	0.48	0.12	0.38	0.65	17.07	-12.73	6.67	NA
	PCM 6.0	0.55	0.12	0.46	0.72	34.15	NA	22.22	NA
	PCM 11.3	0.45	0.04	0.40	0.50	9.76	-18.18	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile.^bReference site

NA = Not Applicable

Table L18 (continued)

Test Date	Site ID ^a	Growth (weight in mg)				Percent Difference			
		Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
	CRM 9.0	0.49	0.02	0.46	0.51	19.51	NA	NA	6.52
	CRM 19.0	0.49	0.10	0.42	0.64	19.51	NA	NA	6.52
	CRM 22.0	0.46	0.06	0.38	0.53	12.20	NA	NA	NA
4/14-21/94	Control	0.23	0.04	0.17	0.26	NA	-20.69	-14.81	-28.13
	PCM 1.0	0.28	0.05	0.20	0.32	21.74	-3.45	3.70	NA
	PCM 2.9	0.33	0.09	0.24	0.42	43.48	13.79	22.22	NA
	PCM 4.3	0.31	0.05	0.27	0.37	34.78	6.90	14.81	NA
	PCM 5.1	0.31	0.04	0.26	0.34	34.78	6.90	14.81	NA
	PCM 6.0	0.29	0.05	0.22	0.33	26.09	NA	7.41	NA
	PCM 11.3	0.27	0.09	0.19	0.39	17.39	-6.90	NA	NA
	CRM 9.0	0.39	0.04	0.34	0.44	69.57	NA	NA	21.88
	CRM 19.0	0.30	0.03	0.26	0.34	30.43	NA	NA	-6.25
	CRM 22.0	0.32	0.07	0.27	0.42	39.13	NA	NA	NA
7/21-28/94	Control	0.55	0.08	0.44	0.63	NA	-14.06	-12.70	1.85
	PCM 1.0	0.60	0.04	0.57	0.66	9.09	-6.25	-4.76	NA
	PCM 2.9	0.64	0.10	0.56	0.78	16.36	0.00	1.59	NA
	PCM 4.3	0.52	0.12	0.38	0.65	-5.45	-18.75	-17.46	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile.^bReference site

NA = Not Applicable

Table L18 (continued)

Test Date	Site ID ^a	Growth (weight in mg)				Percent Difference			
		Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
	PCM 5.1	0.60	0.06	0.53	0.66	9.09	-6.25	-4.76	NA
	PCM 6.0	0.64	0.08	0.53	0.70	16.36	NA	1.59	NA
	PCM 11.3	0.63	0.17	0.49	0.83	14.55	-1.56	NA	NA
	CRM 9.0	0.64	0.06	0.59	0.73	16.36	NA	NA	18.52
	CRM 19.0	0.57	0.05	0.52	0.62	3.64	NA	NA	5.56
	CRM 22.0	0.54	0.16	0.31	0.69	-1.82	NA	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile.

^b Reference site

NA = Not Applicable

Table L19. Fathead minnow growth (per surviving larvae) in McCoy Branch and Walker Branch

Test Date	Site ID ^a	Growth (weight in mg)				Percent Difference	
		Mean	SD	Min.	Max.	Control	WBM 0.4 ^b
6/2–9/94	Control	0.43	0.06	0.36	0.48	NA	-18.87
	MBM 0.2	0.55	0.10	0.45	0.69	27.91	3.77
	MBM 0.4	0.57	0.05	0.51	0.64	32.56	7.55
	WBM 0.4	0.53	0.05	0.47	0.59	23.26	NA
8/11–18/94	Control	0.48	0.10	0.39	0.57	NA	-15.79
	MBM 0.2	0.46	0.18	0.19	0.57	-4.17	-19.30
	MBM 0.4	0.52	0.05	0.46	0.58	8.33	-8.77
	WBM 0.4	0.57	0.04	0.52	0.61	18.75	NA

^aMBM = McCoy Branch Mile; WBM = Walker Branch Mile.

^bReference site

NA = Not Applicable

Table L20. *Ceriodaphnia dubia* reproduction per surviving female in the Clinch River and Poplar Creek

Test date	Site ID ^a	Percent survival	Reproduction				Percent difference			
			Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
4/22-29/93	Control	90	27.1	6.8	14	37	NA	NA	3.0	NA
	PCM 1.0	100	26.8	4.7	21	38	-1.1	NA	1.9	NA
	PCM 2.9	80	26.5	9.5	7	37	-2.2	NA	0.8	NA
	PCM 4.3	90	30.6	7.0	20	42	12.9	NA	16.4	NA
	PCM 5.1	100	27.7	6.7	13	38	2.2	NA	5.3	NA
	PCM 11.3	100	26.3	7.5	17	40	-3.0	NA	NA	NA
	CRM 9.0	100	30.1	3.3	27	36	11.1	NA	NA	NA
7/22-29/93	Control	80	28.4	4.9	21	34	NA	-18.9	-7.8	-12.1
	PCM 1.0	100	31.7	6.1	21	43	11.6	-9.4	2.9	NA
	PCM 2.9	90	33.8	3.9	28	40	19.0	-3.4	9.7	NA
	PCM 4.3	80	33.3	5.3	27	44	17.3	-4.9	8.1	NA
	PCM 5.1	100	31.0	11.8	0	41	9.2	-11.4	0.7	NA
	PCM 6.0	100	35.0	4.3	27	42	23.2	NA	13.6	NA
	PCM 11.3	100	30.8	6.4	14	38	8.5	-12.0	NA	NA
	CRM 9.0	100	35.3	6.7	20	44	24.3	NA	NA	9.3

^aPCM = Poplar Creek mile; CRM = Clinch River mile.

^bReference site

NA = Not Applicable

Table L20. (continued)

Test date	Site ID ^a	Percent survival	Reproduction				Percent difference			
			Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
	CRM 19.0	100	28.4	9.8	10	38	0.0	NA	NA	-12.7
	CRM 22.0	100	32.3	6.5	19	42	13.7	NA	NA	NA
10/21-28/93	Control	100	29.4	1.6	27	32	NA	-10.1	-10.4	-8.1
	PCM 1.0	100	39.0	5.9	32	52	32.7	19.3	18.9	NA
	PCM 2.9	100	35.3	6.1	30	51	20.1	8.0	7.6	NA
	PCM 4.3	100	31.6	4.8	25	42	7.5	-3.4	-3.7	NA
	PCM 5.1	100	33.0	3.3	28	38	12.2	0.9	0.6	NA
	PCM 6.0	100	32.7	2.9	29	39	11.2	NA	-0.3	NA
	PCM 11.3	100	32.8	4.8	27	41	11.6	0.3	NA	NA
	CRM 9.0	100	31.2	4.2	22	36	6.1	NA	NA	-2.5
	CRM 19.0	100	31.2	3.2	25	35	6.1	NA	NA	-2.5
	CRM 22.0	90	32.0	4.8	27	40	8.8	NA	NA	NA
1/25-2/1/94	Control	100	18.4	3.4	13	25	NA	15.0	53.3	21.1
	PCM 1.0	100	18.6	3.6	12	25	1.1	16.3	55.0	NA
	PCM 2.9	90	17.3	4.0	9	21	-6.0	8.1	44.2	NA
	PCM 4.3	90	13.3	3.8	6	18	-27.7	-16.9	10.8	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile.^bReference site

NA = Not Applicable

Table L20. (continued)

Test date	Site ID ^a	Percent survival	Reproduction				Percent difference			
			Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
	PCM 5.1	100	15.4	2.1	13	19	-16.3	-3.8	28.3	NA
	PCM 6.0	100	16.0	2.7	10	19	-13.0	NA	33.3	NA
	PCM 11.3	90	12.0	4.7	4	18	-34.8	-25.0	NA	NA
	CRM 9.0	100	18.2	1.8	16	21	-1.1	NA	NA	19.7
	CRM 19.0	100	17.3	1.4	15	20	-6.0	NA	NA	13.8
	CRM 22.0	100	15.2	4.2	5	19	-17.4	NA	NA	NA
4/14-21/94	Control	100	18.7	3.2	16	26	NA	-15.4	11.3	3.9
	PCM 1.0	100	20.8	4.8	10	26	11.2	-5.9	23.8	NA
	PCM 2.9	100	20.7	2.6	18	27	10.7	-6.3	23.2	NA
	PCM 4.3	100	20.8	4.6	11	27	11.2	-5.9	23.8	NA
	PCM 5.1	100	22.6	3.4	18	31	20.9	2.3	34.5	NA
	PCM 6.0	100	22.1	3.0	17	26	18.2	NA	31.6	NA
	PCM 11.3	100	16.8	7.5	1	25	-10.2	-24.0	NA	NA
	CRM 9.0	90	16.6	4.7	9	23	-11.2	NA	NA	-7.8
	CRM 19.0	100	18.4	5.6	9	26	-1.6	NA	NA	2.2
	CRM 22.0	100	18.0	4.9	8	23	-3.7	NA	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile.^bReference site

NA = Not Applicable

Table L20. (continued)

Test date	Site ID ^a	Percent survival	Reproduction				Percent difference			
			Mean	SD	Min.	Max.	Control	PCM 6.0 ^b	PCM 11.3 ^b	CRM 22.0 ^b
7/21-28/94	Control	90	24.4	5.8	14	36	NA	-12.9	-15.9	7.0
	PCM 1.0	100	28.1	3.4	23	33	15.2	0.4	-3.1	NA
	PCM 2.9	90	25.3	2.1	23	29	3.7	-9.6	-12.8	NA
	PCM 4.3	100	28.9	2.6	25	34	18.4	3.2	-0.3	NA
	PCM 5.1	100	28.0	6.8	13	36	14.8	0.0	-3.5	NA
	PCM 6.0	100	28.0	3.9	22	35	14.8	NA	-3.5	NA
	PCM 11.3	90	29.0	5.5	20	37	18.9	3.6	NA	NA
	CRM 9.0	100	24.2	8.4	9	39	-0.8	NA	NA	6.1
	CRM 19.0	100	21.8	6.7	4	28	-10.7	NA	NA	-4.4
	CRM 22.0	80	22.8	6.2	11	31	-6.6	NA	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile.^bReference site

NA = Not Applicable

Table L21. *Ceriodaphnia dubia* reproduction per surviving female in McCoy Branch and Walker Branch

Test date	Site ID ^a	Percent survival	Reproduction				Percent difference	
			Mean	SD	Min.	Max.	Control	WBM 0.4 ^b
6/2-8/94	Control	100	20.5	2.4	16	23	NA	-30.5
	MBM 0.2	90	26.4	5.0	19	34	28.8	-10.5
	MBM 0.4	100	24.9	2.8	20	30	21.5	-15.6
	WBM 0.4	100	29.5	3.3	26	35	43.9	NA
8/11-17/94	Control	100	20.3	4.6	13	28	NA	-13.3
	MBM 0.2	100	24.6	4.8	17	31	21.2	5.1
	MBM 0.4	100	9.7	4.0	3	16	-52.2	-58.6
	WBM 0.4	100	23.4	4.4	15	30	15.3	NA

^aMBM = McCoy Branch Mile; WBM = Walker Branch Mile.

^bReference site.

NA = Not Applicable

Table L22. Results of quarterly medaka embryo-larval tests of surface water from the Clinch River and Poplar Creek conducted for the CR-ERP between July 1993 and July 1994^{a, b}

Date	Site ^c	Survival			Hatch			Developmental abnormalities		
		Percent survival	Decrease from control (%)	Decrease from reference (%)	Percent hatch	Decrease from control (%)	Decrease from reference (%)	Percent normal ^d	Decrease from control (%)	Decrease from reference (%)
7/21/93	Control	91	-	-	91	-	-	82	-	-
	CRM 22.0	96	-5	-	96	-5	-	100	-22	-
	CRM 19.0	86	5	10	81	11	16	81	1	19*
	CRM 9.0	100	-10	-4	87	4	9	87	-6	13*
	PCM 11.3	4	96*	-	4	96*	-	79	4	-
	PCM 6.0	5	95*	-25	5	95*	-25	67	18	15
	PCM 5.1	0	100*	100	0	100*	100	83	-1	-5
	PCM 4.3	4	96*	0	4	96*	0	57	30*	28
	PCM 2.9	9	90*	-125	9	90*	-125	74	10	6
	PCM 1.0	76	16	-1800	76	16	-1800	76	7	4

^an = 21-25 individually incubated embryos per site per test

^bAsterisks signify a significant difference in % survival, hatch, or incidence of developmental abnormalities between a site and either the control or the appropriate reference site (CRM 22.0 for Clinch River sites, PCM 11.3 for Poplar Creek sites)

^cCRM = Clinch River mile; PCM = Poplar Creek mile

^dPercent of embryos that did not exhibit any obvious developmental abnormalities (other than delayed hatching) during the course of a test

Table L22 (continued)

Date	Site ^c	Survival			Hatch			Developmental abnormalities		
		Percent survival	Decrease from control (%)	Decrease from reference (%)	Percent hatch	Decrease from control (%)	Decrease from reference (%)	Percent normal ^d	Decrease from control (%)	Decrease from reference (%)
	CRM 22.0	92	-11	-	92	-24	-	100	-27	-
	CRM 19.0	88	-6	4	88	-19	4	84	-6	16*
	CRM 9.0	83	0	10	78	-5	15	91	-15	9
	PCM 11.3	40	52*	-	40	46*	-	72	9	-
	PCM 6.0	8	90*	80*	8	89*	80*	37	53*	49*
	PCM 5.1	20	76*	50	20	73*	50	52	34*	28
	PCM 4.3	8	90*	80*	13	82*	68*	46	42*	36*
	PCM 2.9	20	76*	50	24	68*	40	76	4	-6
	PCM 1.0	13	84*	68*	13	82*	68*	58	27	19
1/25/94	Control	92	-	-	92	-	-	87	-	-
	CRM 22.0	92	-1050	-	83	-538	-	96	-10	-

^an = 21-25 individually incubated embryos per site per test

^bAsterisks signify a significant difference in % survival, hatch, or incidence of developmental abnormalities between a site and either the control or the appropriate reference site (CRM 22.0 for Clinch River sites, PCM 11.3 for Poplar Creek sites)

^cCRM = Clinch River mile; PCM = Poplar Creek mile

^dPercent of embryos that did not exhibit any obvious developmental abnormalities (other than delayed hatching) during the course of a test

Table L22 (continued)

Date	Site ^c	Survival			Hatch			Developmental abnormalities		
		Percent survival	Decrease from control (%)	Decrease from reference (%)	Percent hatch	Decrease from control (%)	Decrease from reference (%)	Percent normal ^d	Decrease from control (%)	Decrease from reference (%)
	CRM 19.0	100	-1150	-9	92	-608	-11	96	-10	0
	CRM 9.0	88	-1000	4	79	-508	5	87	0	9
	PCM 11.3	100	-1150	-	92	-608	-	96	-10	-
	PCM 6.0	96	-1100	4	79	-508	14	96	-10	0
	PCM 5.1	92	-1050	8	76	-485	17	84	3	12
	PCM 4.3	83	-938	17*	83	-538	10	67	23*	30*
	PCM 2.9	63	-688	37*	63	32*	32*	58	33*	40*
	PCM 1.0	36	61*	64*	40	57*	57*	48	45*	50*
4/14/94	Control	96	-	-	64	-	-	100	-	-
	CRM 22.0	92	0	-	92	-21	-	96	4	-
	CRM 19.0	80	17*	13	80	-5	13	92	8	4

^an = 21-25 individually incubated embryos per site per test

^bAsterisks signify a significant difference in % survival, hatch, or incidence of developmental abnormalities between a site and either the control or the appropriate reference site (CRM 22.0 for Clinch River sites, PCM 11.3 for Poplar Creek sites)

^cCRM = Clinch River mile; PCM = Poplar Creek mile

^dPercent of embryos that did not exhibit any obvious developmental abnormalities (other than delayed hatching) during the course of a test

Table L22 (continued)

Date	Site ^c	Survival			Hatch			Developmental abnormalities		
		Percent survival	Decrease from control (%)	Decrease from reference (%)	Percent hatch	Decrease from control (%)	Decrease from reference (%)	Percent normal ^d	Decrease from control (%)	Decrease from reference (%)
	CRM 9.0	92	0	0	92	-21	0	100	0	-4
	PCM 11.3	92	0	-	92	-21	-	100	0	-
	PCM 6.0	84	9	9	84	-11	9	96	4	4
	PCM 5.1	92	0	0	92	-21	0	96	4	4
	PCM 4.3	84	9	9	88	-16	4	92	8	8
	PCM 2.9	92	0	0	92	-21	0	100	0	0
	PCM 1.0	84	9	9	88	-16	4	96	4	4
7/21/94	Control	96	-	-	84	-	-	92	-	-
	CRM 22.0	36	63*	-	44	48*	-	68	26*	-
	CRM 19.0	16	83*	56	24	71*	45	68	26*	0
	CRM 9.0	79	18*	-119	83	10	-89	96	-4	-41

^an = 21-25 individually incubated embryos per site per test

^bAsterisks signify a significant difference in % survival, hatch, or incidence of developmental abnormalities between a site and either the control or the appropriate reference site (CRM 22.0 for Clinch River sites, PCM 11.3 for Poplar Creek sites)

^cCRM = Clinch River mile; PCM = Poplar Creek mile

^dPercent of embryos that did not exhibit any obvious developmental abnormalities (other than delayed hatching) during the course of a test

Table L22 (continued)

Date	Site ^c	Survival			Hatch			Developmental abnormalities		
		Percent survival	Decrease from control (%)	Decrease from reference (%)	Percent hatch	Decrease from control (%)	Decrease from reference (%)	Percent normal ^d	Decrease from control (%)	Decrease from reference (%)
	PCM 11.3	71	26*	-	79	14	-	75	18	-
	PCM 6.0	84	9	-18	84	9	-6	84	9	-12
	PCM 5.1	52	46*	27	52	38*	34*	72	22*	4
	PCM 4.3	40	58*	44*	40	52*	49*	64	30*	15
	PCM 2.9	16	83*	77*	16	81*	80*	56	39*	25
	PCM 1.0	12	88*	83*	12	86*	85*	80	13	-7

^an = 21-25 individually incubated embryos per site per test

^bAsterisks signify a significant difference in % survival, hatch, or incidence of developmental abnormalities between a site and either the control or the appropriate reference site (CRM 22.0 for Clinch River sites, PCM 11.3 for Poplar Creek sites)

^cCRM = Clinch River mile; PCM = Poplar Creek mile

^dPercent of embryos that did not exhibit any obvious developmental abnormalities (other than delayed hatching) during the course of a test

Table L23. Results of medaka embryo-larval tests of surface water from the Clinch River and Poplar Creek conducted for the K-25 Site Biological Monitoring and Abatement Program (BMAP) during October 1994 and January 1995^{a,b}

Date	Site ^c	Survival			Hatch			Developmental abnormalities		
		Percent survival	Decrease from control (%)	Decrease from reference (%)	Percent hatch	Decrease from control (%)	Decrease from reference (%)	Percent normal ^d	Decrease from control (%)	Decrease from reference (%)
10/13/94	Control	96	--	--	83	--	--	96	--	--
	CRM 9.0	100	-4	--	96	??	--	100	-4	--
	PCM 11.3	32	67*	--	32	61*	--	56	42*	--
	PCM 5.1	13	86*	59	13	84*	??	21	78*	63*
	PCM 4.3	24	75*	25	24	71*	??	12	88*	79*
	PCM 2.9	24	75*	25	28	66*	??	8	92*	86*
	PCM 1.0	12	88*	63*	12	86*	63*	20	79*	64*
1/19/95	Control	85	--	--	85	--	--	85	--	--
	CRM 9.0	80	6	--	80	??	--	85	0	--
	PCM 11.3	90	-6	--	95	??	--	90	-6	--
	PCM 5.1	53	38*	41*	58	32*	39*	47	45*	48*
	PCM 4.3	50	41*	44*	50	41*	47*	35	59*	61*
	PCM 2.9	42	51*	53*	42	51*	56*	53	38*	41*
	PCM 1.0	25	71*	72*	30	65*	68*	10	88*	89*

^an=23-25 individually incubated embryos per site for 10/94 test; 19-20 embryos per site for 1/95 test

^bAsterisks signify a significant difference in percent survival, hatch, or normal development between a site and a control or appropriate reference site (PCM 11.3 for Poplar Creek sites)

^cCRM = Clinch River mile; PCM = Poplar Creek mile

Table L24. Results of medaka embryo-larval tests of surface water from McCoy Branch and Walker Branch conducted for the CR-ERP during June 1994 and August 1994^{a,b}

Date	Site ^c	Survival			Hatch			Developmental abnormalities		
		Percent survival	Decrease from control (%)	Decrease from reference (%)	Percent hatch	Decrease from control (%)	Decrease from reference (%)	Percent normal ^d	Decrease from control (%)	Decrease from reference (%)
6/2/94	Control	100	-	-	88	-	-	92	-	-
	WBM 0.4	88	12*	-	88	0	-	96	9	-
	MBM 0.4	96	4	-9	96	-9	-9	96	9	0
	MBM 0.2	96	4	-9	100	-14	-14	96	9	0
8/11/94	Control	92	-	-	56	-	-	100	-	-
	WBM 0.4	100	-9	-	100	-79	-	100	0	-
	MBM 0.4	92	0	8	92	-64	8	98	4	4
	MBM 0.2	84	9	16*	88	-57	12*	96	8	8

^an = 24-25 individually incubated embryos per site per test.

^bAsterisks signify a significant difference in % survival, hatch, or normal development between a site and either the control or the reference site (WBM 0.4)

^cMBM = McCoy Branch mile; WBM = Walker Branch mile

^dPercent of embryos that did not exhibit any obvious developmental abnormalities (other than delayed hatching) during the course of a test

Table L25. Comparison of medaka and redbreast sunfish embryo-larval test of surface water from selected sites on the Clinch River and Poplar Creek.^{a, b, c}

Species	Site ^d	Survival		Hatch		Developmental abnormalities ^e	
		Percent survival	Decrease from reference (%)	Percent hatch	Decrease from reference (%)	Percent normal	Decrease from reference (%)
Medaka	CRM 22.0	80		85		90	-
	CRM 9.0	85	-6	85	0	80	11
	PCM 11.3	70		75		95	-
	PCM 6.0	45	36	50	33	70	26*
	PCM 4.3	11	84*	11	85*	50	47*
	PCM 1.0	11	84*	11	85*	42	56*
Sunfish (Pair 1)	CRM 22.0	91		91		96	-
	CRM 9.0	83	9	100	-10	92	4
	PCM 11.3	96		100		91	-
	PCM 6.0	80	17*	96	4	96	-6
	PCM 4.3	36	63*	96	4	84	8
	PCM 1.0	50	48*	100	0	92	-1
Sunfish (Pair 2)	CRM 22.0	87		96		91	-
	CRM 9.0	92	-6	100	-4	84	8
	PCM 11.3	96		100		91	-
	PCM 6.0	92	4	96	4	92	-1
	PCM 4.3	57	41*	100	0	95	-4
	PCM 1.0	88	8	100	0	100	-10
Sunfish (Pair 3)	CRM 22.0	79		96		96	-
	CRM 9.0	88	-11	96	0	100	4
	PCM 11.3	96		96		96	-
	PCM 6.0	78	19*	96	0	91	5
	PCM 4.3	63	34*	96	0	92	4
	PCM 1.0	72	25*	100	-4	96	0

^aTest initiated 7/28/94

^bn = 18-20 embryos per site per test for medaka; n = 21-25 embryos per site per redbreast sunfish pairing.

^cAsterisks signify a significant difference in % survival, hatch, or incidence of developmental abnormalities between a site and either the control or appropriate reference site (PCM 11.3 for Poplar Creek sites)

^dCRM = Clinch River Mile; PCM = Poplar Creek Mile

^ePercent of embryos not exhibiting any developmental abnormality (other than delayed hatching) during the course of

Table L26. Summary of individual survival statistics for Largemouth Bass embryo-larval tests of surface water from the Clinch River and Poplar Creek conducted for the CR-ERP during April 1994 ^{a,b}

Site ^c	Pair 1			Pair 2			Pair 3			Pair 4			Pair 5		
	%	Control	Ref	%	Control	Ref	%	Control	Ref	%	Control	Ref	%	Control	Ref
Control	90			88			80			86			94		
CRM 22.0	85	6		92	-5		94	-18		94	-9		92	2	
CRM 19.0	88	2	-4	98	-11	-7	96	-20	-2	94	-9	0	94	0	-2
CRM 9.0	76	16*	11	96	-9	-4	96	-20	-2	96	-12	-2	78	17*	15*
TRM 547	90	0	-6	94	-7	-2	90	-13	4	92	-7	2	88	6	4
PCM 11.3	90	0		94	-7		90	-13		80	7		72	23*	
PCM 6.0	88	2	2	96	-9	-2	88	-10	2	62	28*	23*	64	32*	11
PCM 5.1	74	18*	18*	98	-11	-4	84	-5	7	64	26*	20*	90	4	-25
PCM 4.3	86	4	4	96	-9	-2	92	-15	-2	66	23*	18	94	0	-31
PCM 2.9	94	-4	-4	96	-9	-2	88	-10	2	72	16*	10	82	13*	-14
PCM 1.0	94	-4	-4	98	-11	-4	96	-20	-7	76	12	5	90	4	-25

^aTest initiated 4/21/94; expressed as percent decrease from control or appropriate reference (PCM 11.3 for Poplar Creek sites, CRM 22.0 for Clinch River and Tennessee River sites) in the % survival of an initial 50 embryos per site per each of five different largemouth bass pairings; eggs were fertilized in vitro with sperm derived from testes minced in a saline solution

^bAsterisks signify a significant difference in % survival between a site and the control or appropriate reference site

^cCRM = Clinch River mile, TRM = Tennessee River mile, and PCM = Poplar Creek mile

Table L27. Summary of developmental abnormality statistics for largemouth bass embryo-larval tests of surface water from the Clinch River and Poplar Creek conducted for the CR-ERP during April 1994 ^{a,b}

Site ^c	Pair 1			Pair 2			Pair 3			Pair 4			Pair 5		
	% ^d	Control	Ref	% ^d	Control	Ref	% ^d	Control	Ref	% ^d	Control	Ref	% ^d	Control	Ref
Control	94	--	--	78	--	--	95	--	--	92	--	--	100	--	--
CRM 22.0	96	-2	--	98	-26	--	96	-1	--	90	2	--	96	4	--
CRM 19.0	92	2	4	100	-28	-2	98	-3	-2	100	-9	-11	96	4	0
CRM 9.0	96	-2	0	98	-26	0	94	1	2	94	-2	-4	89	11*	7
TRM 547	98	-4	-2	94	-20	4	96	-1	0	96	-4	-7	88	12*	8
PCM 11.3	10 0	-6	--	96	-23	--	98	-3	--	88	4	--	92	8*	--
PCM 6.0	10 0	-6	0	100	-28	-4	96	-1	0	96	-4	-9	90	10*	2
PCM 5.1	92	2	8*	96	-23	0	98	-3	-2	88	4	0	92	8*	0
PCM 4.3	98	-4	2	86	-10	10*	90	5	6	92	0	-4	90	10*	2
PCM 2.9	94	0	6*	96	-23	0	96	-1	0	96	-4	-9	86	14*	6
PCM 1.0	98	-4	2	96	-23	0	100	-5	-4	86	6	2	90	10*	2

^aTest initiated 4/21/94; expressed as percent decrease from control or appropriate reference (PCM 11.3 for Poplar Creek sites, CRM 22.0 for Clinch River and Tennessee River sites) in the % normal embryos of an initial 50 embryos per site per each of five different largemouth bass pairings; eggs were fertilized in vitro with sperm derived from testes minced in a saline solution

^bAsterisks signify a significant difference in % normal between a site and the control or appropriate reference site

^cCRM = Clinch River mile, TRM = Tennessee River mile, and PCM = Poplar Creek mile

^dPercent of embryos that did not exhibit any obvious developmental abnormality (other than delayed hatching) during the course of the test

Table L28. Concentrations of selected analytes in surface water (µg/L) and sediment (mg/kg) at areas near potential contaminant sources.^a

Sample location ^b	Possible contaminant sources ^c	Copper		Arsenic		Mercury		Manganese		Aroclor 1254	Aroclor 1260	Total Chlordane
		Water	Sedi-ment	Water	Sedi-ment	Water	Sedi-ment	Water	Sedi-ment	Sediment		
CRM 50.1 - Oak Ridge Marina	Contaminated fill material	35*	25.5*	1*	5.5*	0.2*	0.11*	39*	3900*	25	25	26
CRM 47.9 - Bull Run Steam Plant	Plant operations	40	48	1	6.3	0.2	0.10	65	4300	45	100	25
CRM 41 - Upper Scarboro Creek	Kerr Hollow (Y-12 Plant)	20	24	1	6.4	0.2	0.2	60	1900	25	51.5	16.5
CRM 41 - Lower Scarboro Creek	CARL	10	37	1	1.6	0.2	0.12	31	3300	25	25	10
CRM 37.5 - Lower McCoy Branch	Rogers Quarry (Y-12 Plant)	10	39	1	23	0.2	0.1	26	5300	25	25	10
CRM 33.2 - Walker Branch	Reference site	10	30	1	6.5	0.2	0.49	18	1900	25	25	10
CRM 31.8 - Bearden Creek	ORNL WAGs	10*	30	1*	6.8	0.2*	0.1*	11*	3400	25	25	10
CRM 27.1 - unnamed embayment	ORNL WAGs and SWMUs	10	41	1	12	0.2	0.1	6	3100	25	25	10

^aAsterisks indicate an average of two samples; otherwise, values are for single samples. The values listed for surface water are unfiltered (total) concentrations.

^bCRM = Clinch River mile.

^cCARL = Comparative Animal Research Laboratory; ORNL = Oak Ridge National Laboratory; WAG = Waste Area Grouping; SWMU = Solid Waste Management Unit.

Appendix M

SEDIMENT CHARACTERIZATION-SUPPORTING STUDIES

Table M1. *Hyalella azteca* survival in the Poplar Creek and Clinch River test sites

Test Date	Site ID ^a	Percent survival			Percent difference			
		Mean	SD	n	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
7/21 - 8/2, 1993	PCM 1.0	53.75	19.31	4	35	80	-39.44	NA
	PCM 2.9	55.00	26.77	4	25	90	-38.03	NA
	PCM 4.3	42.50	13.23	4	25	55	-52.11	NA
	PCM 5.1	92.50	5.00	4	85	95	4.23	NA
	PCM 6.0	88.75	4.79	4	85	95	NA	NA
	CRM 9.0	88.75	4.79	4	85	95	NA	7.58
	CRM 19.0	65.00	27.08	4	25	85	NA	-21.21
	CRM 22.0	82.50	9.57	4	75	95	NA	NA
8/24 - 9/5, 1993	PCM 1.0	93.75	4.79	4	90	100	0.00	NA
	PCM 2.9	93.75	4.79	4	90	100	0.00	NA
	PCM 4.3	95.00	4.08	4	90	100	1.33	NA
	PCM 5.1	100.00	0.00	4	100	100	6.67	NA
	PCM 6.0	93.75	4.79	4	90	100	NA	NA
	CRM 9.0	96.25	7.50	4	85	100	NA	2.67
	CRM 19.0	95.00	4.08	4	90	100	NA	1.33
	CRM 22.0	93.75	2.50	4	90	95	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.

NA = Not Applicable.

Table M1 (continued)

Test Date	Site ID ^a	Percent survival					Percent difference	
		Mean	SD	n	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
11/2-11/16,1993	PCM 1.0	90.00	10.80	4	75	100	-1.37	NA
	PCM 2.9	93.75	7.50	4	85	100	2.74	NA
	PCM 4.3	91.67	2.89	3	90	95	0.46	NA
	PCM 5.1	96.25	4.79	4	90	100	5.48	NA
	PCM 6.0	91.25	8.54	4	80	100	NA	NA
	CRM 9.0	75.00	18.03	3	55	90	NA	-20.00
	CRM 19.0	85.00	7.07	4	80	95	NA	-9.33
	CRM 22.0	93.75	2.50	4	90	95	NA	NA
2/22 - 3/7,1994	PCM 1.0	75.00	37.19	4	20	100	-4.76	NA
	PCM 2.9	97.50	5.00	4	90	100	23.81	NA
	PCM 4.3	70.00	20.41	4	55	100	-11.11	NA
	PCM 5.1	38.75	46.97	4	0	95	-50.79	NA
	PCM 6.0	78.75	32.76	4	30	100	NA	NA
	CRM 9.0	58.75	40.29	4	15	100	NA	-36.49
	CRM 19.0	73.75	42.70	4	10	100	NA	-20.27
	CRM 21.2	92.50	6.46	4	85	100	NA	NA

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^aPCM = Poplar Creek mile; CRM = Clinch River mile^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.

NA = Not Applicable.

Table M1 (continued)

Test Date	Site ID ^a	Percent survival			Percent difference		PCM Ref. ^b	CRM Ref. ^b
		Mean	SD	n	Min.	Max.		
5/10 - 5/23, 1994	PCM 1.0	87.50	9.57	4	80	100	-2.78	NA
	PCM 2.9	60.00	29.72	4	25	95	-33.33	NA
	PCM 4.3	87.50	8.66	4	75	95	-2.78	NA
	PCM 5.1	80.00	5.00	3	75	85	-11.11	NA
	PCM 6.0	90.00	4.08	4	85	95	NA	NA
	CRM 9.0	96.25	7.50	4	85	100	NA	6.94
	CRM 19.0	90.00	8.66	3	80	95	NA	0.00
	CRM 21.5	90.00	5.00	3	85	95	NA	NA
7/10 - 7/26, 1994	PCM 1.0	82.50	6.46	4	75	90	0.00	NA
	PCM 2.9	91.25	7.50	4	85	100	10.61	NA
	PCM 4.3	92.50	6.46	4	85	100	12.12	NA
	PCM 5.1	95.00	5.77	4	90	100	15.15	NA
	PCM 6.0	82.50	12.58	4	65	95	NA	NA
	CRM 9.0	78.75	36.14	4	25	100	NA	-10.00
	CRM 19.0	67.50	32.79	4	20	95	NA	-22.86
	CRM 20.5	87.50	15.55	4	65	100	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.

NA = Not Applicable.

Table M1 (continued)

Test Date	Site ID ^a	Percent survival				Percent difference		
		Mean	SD	n	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
9/13 - 9/23, 1994	PCM 1.0	73.75	6.29	4	65	80	-9.23	NA
	PCM 2.9	78.75	7.50	4	75	90	-3.08	NA
	PCM 4.3	83.75	4.79	4	80	90	3.08	NA
	PCM 5.1	75.00	17.80	4	55	90	-7.69	NA
	PCM 6.0	81.25	8.54	4	70	90	NA	NA
	CRM 9.0	12.50	10.41	4	0	25	NA	-44.44
	CRM 19.0	28.75	34.49	4	0	75	NA	27.78
	CRM 20.5	22.50	35.71	4	0	75	NA	NA
12/5-12/15, 1995 Confirmatory Test	PCM 0.5	70.00	34.64	4	20	100	-9.68	NA
	PCM 4.0	85.00	12.91	4	70	100	9.68	NA
	PCM 4.5	77.50	22.17	4	50	100	0.00	NA
	PCM 6.0	77.50	32.02	4	30	100	NA	NA
	Lab Control	90.00	14.14	4	70	100	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2 and 20.5 were used.

NA = Not Applicable.

^cLaboratory formulated control sediment (batch no. LFS1295). Used to evaluate test acceptability.

Table M2. *Hyaella azteca* survival in the McCoy Branch and Walker Branch embayment sites

Test date	Site ID ^a	Percent survival				Percent difference	
		Mean	SD	<i>n</i>	Min.	Max.	<u>from reference</u>
6/7 - 6/21, 1994	MBM 0.2	93.75	4.79	4	90	100	7.14
	MBM 0.4	91.25	6.29	4	85	100	4.29
	WBM 0.6 ^b	87.50	6.45	4	80	95	NA
8/15 - 8/28, 1994	MBM 0.2	82.50	19.36	4	55	100	24.53
	MBM 0.4	70.00	27.39	4	30	90	5.67
	WBM 0.4 ^b	66.25	24.28	4	30	80	NA

^aMBM = McCoy Branch embayment mile; WBM = Walker Branch embayment mile; Control = a water-only treatment.

^bThe reference site for McCoy Branch was either Walker Branch embayment site WBM 0.6 or WBM 0.4, as shown.

NA = Not Applicable.

Table M3. *Anodonta imbecillis* (freshwater mussel) survival in the Poplar Creek and Clinch River test sites

Test date	Site ID ^a	Percent survival				Percent difference		
		Mean	SD	n	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
7/21 - 8/2, 1993	PCM 1.0	87.50	15.00	4	70.00	100.00	7.69	NA
	PCM 2.9	90.00	8.17	4	80.00	100.00	10.77	NA
	PCM 4.3	91.94	9.14	4	77.78	100.00	13.23	NA
	PCM 5.1	91.94	9.14	4	77.78	100.00	13.23	NA
	PCM 6.0	81.11	9.72	4	66.67	90.00	NA	NA
	CRM 9.0	79.45	7.14	4	70.00	90.00	NA	7.07
	CRM 19.0	55.00	40.41	4	0.00	90.00	NA	-25.93
	CRM 22.0	74.17	11.64	4	60.00	90.00	NA	NA
8/24 - 9/5, 1993	PCM 1.0	85.00	17.32	4	60.00	100.00	9.68	NA
	PCM 2.9	82.50	9.57	4	70.00	90.00	6.45	NA
	PCM 4.3	55.00	12.91	4	40.00	70.00	-29.03	NA
	PCM 5.1	77.50	12.58	4	60.00	90.00	0.00	NA
	PCM 6.0	77.50	15.00	4	60.00	90.00	NA	NA
	CRM 9.0	52.50	41.13	4	0.00	90.00	NA	-8.70
	CRM 19.0	80.00	8.17	4	70.00	90.00	NA	39.13
	CRM 22.0	57.50	40.31	4	0.00	90.00	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.

NA = Not Applicable.

Table M3 (continued)

Test date	Site ID ^a	Percent survival					Percent difference	
		Mean	SD	<i>n</i>	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
9/13 - 9/23, 1994	PCM 1.0	79.72	18.57	4	50.00	100.00	-12.37	NA
	PCM 2.9	95.00	8.67	4	80.00	100.00	4.43	NA
	PCM 4.3	64.70	26.67	4	33.33	100.00	-28.88	NA
	PCM 5.1	97.50	4.33	4	90.00	100.00	7.14	NA
	PCM 6.0	90.97	10.28	4	75.00	100.00	NA	NA
	CRM 9.0	85.42	14.88	4	66.67	100.00	NA	-10.09
	CRM 19.0	51.25	28.80	4	20.00	80.00	NA	-46.05
	CRM 20.5	95.00	5.00	4	90.00	100.00	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.

NA = Not Applicable.

Table M4. *Ceriodaphnia dubia* (pore water) survival in the Poplar Creek and Clinch River test sites

Test date	Site ID ^a	Percent survival				Percent difference		
		Mean	SD	n	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
8/24 - 9/5, 1993	Control	90.00	10.00	4	80	100	-10.00	NA
	PCM 1.0	100.00	0.00	4	100	100	0.00	NA
	PCM 2.9	100.00	0.00	4	100	100	0.00	NA
	PCM 4.3	100.00	0.00	4	100	100	0.00	NA
	PCM 5.1	100.00	0.00	4	100	100	0.00	NA
	PCM 6.0	100.00	0.00	4	100	100	NA	NA
	CRM 9.0	95.00	8.66	4	80	100	NA	NA
	CRM 19.0	100.00	0.00	4	100	100	NA	NA
	CRM 22.0 ^c	NA	NA	NA	NA	NA	NA	NA
11/2 - 11/16, 1993	Control	100.00	0.00	4	100	100	4.35	0.00
	PCM 1.0	95.83	7.22	4	83.33	100.00	0.00	NA
	PCM 2.9	91.67	14.43	4	66.67	100.00	-4.35	NA
	PCM 4.3	100.00	0.00	4	100.00	100.00	4.35	NA
	PCM 5.1	95.83	7.22	4	83.33	100.00	0.00	NA
	PCM 6.0	95.83	7.22	4	83.33	100.00	NA	NA
	CRM 9.0	91.67	8.33	4	83.33	100.00	NA	8.33
	CRM 19.0	100.00	0.00	4	100.00	100.00	NA	0.00
	CRM 22.0	100.00	0.00	4	100.00	100.00	NA	NA

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^aPCM = Poplar Creek mile; CRM = Clinch River mile; Control = a water-only treatment (control treatment was not run on 11/2 - 11/16, 1993).

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.

^cThis site was not tested; insufficient volume of pore water was collected.

NA = Not Applicable.

Table M4 (continued)

Test date	Site ID ^a	Percent survival			Percent difference			
		Mean	SD	n	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
2/22 - 3/7, 1994	Control	100.00	0.00	4	100.00	100.00	4.38	9.09
	PCM 1.0	95.83	7.22	4	83.33	100.00	0.00	NA
	PCM 2.9	87.50	13.82	4	66.67	100.00	-8.70	NA
	PCM 4.3	83.33	11.79	4	66.67	100.00	-13.04	NA
	PCM 5.1	91.67	8.33	4	83.33	100.00	-4.35	NA
	PCM 6.0	95.83	7.22	4	83.33	100.00	NA	NA
	CRM 9.0	100.00	0.00	4	100.00	100.00	NA	9.09
	CRM 19.0	95.83	7.22	4	83.33	100.00	NA	4.55
	CRM 22.0	91.67	14.43	4	66.67	100.00	NA	NA
5/10 - 5/23, 1994	Control	100.00	0.00	4	100.00	100.00	0.00	0.00
	PCM 1.0	100.00	0.00	4	100.00	100.00	0.00	NA
	PCM 2.9	100.00	0.00	4	100.00	100.00	0.00	NA
	PCM 4.3	79.17	13.82	4	66.67	100.00	-20.83	NA
	PCM 5.1	95.83	7.22	4	83.33	100.00	-4.17	NA
	PCM 6.0	100.00	0.00	4	100.00	100.00	NA	NA
	CRM 9.0	91.67	8.33	4	83.33	100.00	NA	-8.33
	CRM 19.0	100.00	0.00	4	100.00	100.00	NA	0.00
	CRM 21.2	100.00	0.00	4	100.00	100.00	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile; Control = a water-only treatment (control treatment was not run on 11/2 - 11/16, 1993).

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.

^cThis site was not tested; insufficient volume of pore water was collected.

NA = Not Applicable.

Table M4 (continued)

Test date	Site ID ^a	Percent survival					Percent difference	
		Mean	SD	<i>n</i>	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
7/10 - 7/26, 1994	Control	100.00	0.00	4	100.00	100.00	0.00	0.00
	PCM 1.0	100.00	0.00	4	100.00	100.00	0.00	NA
	PCM 2.9	100.00	0.00	4	100.00	100.00	0.00	NA
	PCM 4.3	100.00	0.00	4	100.00	100.00	0.00	NA
	PCM 5.1	100.00	0.00	4	100.00	100.00	0.00	NA
	PCM 6.0	100.00	0.00	4	100.00	100.00	NA	NA
	CRM 9.0	NA	NA	0	NA	NA	NA	NA
	CRM 19.0	NA	NA	0	NA	NA	NA	NA
	CRM 21.5	100.00	0.00	4	100.00	100.00	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile; Control = a water-only treatment (control treatment was not run on 11/2 - 11/16, 1993).

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.

^cThis site was not tested; insufficient volume of pore water was collected.

NA = Not Applicable.

Table M5. *Ceriodaphnia dubia* (pore water) survival in the McCoy Branch and Walker Branch embayment sites

Test date	Site ID ^a	Percent survival				Percent difference from reference	
		Mean	SD	<i>n</i>	Min.		Max.
6/7 - 6/21, 1994	Control	100.00	0.00	4	100	100	0.00
	MBM 0.2	100.00	0.00	4	100	100	0.00
	MBM 0.4	91.67	14.43	4	66.67	100	-8.33
	WBM 0.6 ^b	100.00	0.00	4	100	100	NA
8/15 - 8/28, 1994	Control	100.00	0.00	4	100	100	4.35
	MBM 0.2	100.00	0.00	4	100	100	4.35
	MBM 0.4	87.50	13.82	4	66.67	100	-8.69
	WBM 0.4 ^b	95.83	7.22	4	83.33	100	NA

^aMBM = McCoy Branch Embayment mile; WBM = Walker Branch Embayment mile; Control = a water-only treatment.

^bThe reference site for McCoy Branch was either Walker Branch Embayment site WBM 0.6 or WBM 0.4, as shown.

NA = Not Applicable.

Table M6. *Daphnia magna* survival in the Poplar Creek and Clinch River test sites

Test date	Site ID ^a	Mean percent survival	Percent difference	
			PCM Ref. ^b	CRM Ref. ^b
7/21 - 8/2, 1993	Control	90	-10.00	-10.00
	PCM 1.0	80	-20.00	NA
	PCM 2.9	90	-10.00	NA
	PCM 4.3	90	-10.00	NA
	PCM 5.1	100	0.00	NA
	PCM 6.0	100	NA	NA
	CRM 9.0	100	NA	0.00
	CRM 19.0	70	NA	-30.00
	CRM 22.0	100	NA	NA
8/24 - 9/5, 1993	Control	100	11.11	0.00
	PCM 1.0	80	-11.11	NA
	PCM 2.9	90	0.00	NA
	PCM 4.3	100	11.11	NA
	PCM 5.1	90	0.00	NA
	PCM 6.0	90	NA	NA
	CRM 9.0	100	NA	0.00
	CRM 19.0	100	NA	0.00
	CRM 22.0	100	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile; Control = a water-only treatment.

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2 and 20.5 were used.

^cA water-only control treatment was not run during this test period.

NA = Not Applicable.

Table M6 (continued)

Test date	Site ID ^a	Mean percent survival	Percent difference	
			PCM Ref. ^b	CRM Ref. ^b
11/2 - 11/16, 1993 ^c	Control	NA	NA	NA
	PCM 1.0	100	0.00	NA
	PCM 2.9	100	0.00	NA
	PCM 4.3	100	0.00	NA
	PCM 5.1	100	0.00	NA
	PCM 6.0	100	NA	NA
	CRM 9.0	100	NA	0.00
	CRM 19.0	100	NA	0.00
	CRM 22.0	100	NA	NA
2/22 - 3/7, 1994	Control	90	-10.00	-10.00
	PCM 1.0	90	-10.00	NA
	PCM 2.9	100	0.00	NA
	PCM 4.3	90	-10.00	NA
	PCM 5.1	90	-10.00	NA
	PCM 6.0	100	NA	NA
	CRM 9.0	80	NA	-20.00
	CRM 19.0	90	NA	10.00
	CRM 21.2	100	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile; Control = a water-only treatment.

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2 and 20.5 were used.

^cA water-only control treatment was not run during this test period.

NA = Not Applicable.

Table M6 (continued)

Test date	Site ID ^a	Mean percent survival	Percent difference	
			PCM Ref. ^b	CRM Ref. ^b
5/10 - 5/23, 1994	Control	100	25.00	11.11
	PCM 1.0	70	-12.50	NA
	PCM 2.9	90	12.50	NA
	PCM 4.3	90	12.50	NA
	PCM 5.1	100	25.00	NA
	PCM 6.0	80	NA	NA
	CRM 9.0	90	NA	0.00
	CRM 19.0	60	NA	-33.33
	CRM 21.5	90	NA	NA
7/10 - 7/26, 1994	Control	100	42.86	11.11
	PCM 1.0	40	-42.86	NA
	PCM 2.9	90	28.57	NA
	PCM 4.3	100	42.86	NA
	PCM 5.1	100	42.86	NA
	PCM 6.0	70	NA	NA
	CRM 9.0	80	NA	-11.11
	CRM 19.0	100	NA	11.11
	CRM 20.5	90	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile; Control = a water-only treatment.

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2 and 20.5 were used.

^cA water-only control treatment was not run during this test period.

NA = Not Applicable.

Table M7. *Daphnia magna* survival in the McCoy Branch and Walker Branch embayment sites

Test date	Site ID ^a	Mean percent survival	Percent difference from reference
6/7 - 6/21, 1994	Control	100	12.50
	MBM 0.2	90	1.25
	MBM 0.4	100	12.50
	WBM 0.6 ^b	88.89 ^c	NA
8/15 - 8/28, 1994	Control	60	-14.29
	MBM 0.2	90	28.57
	MBM 0.4	70	0.00
	WBM 0.4 ^b	70	NA

^aMBM = McCoy Branch Embayment mile; WBM = Walker Branch Embayment mile; Control = a water-only treatment.

^bThe reference site for McCoy Branch was either Walker Branch Embayment site WBM 0.6 or WBM 0.4, as shown.

^cOne replicate was lost due to technician error. Survival was calculated as 8 of the 9 remaining replicates, or 88.89%.

NA = Not Applicable.

Table M8. *Daphnia magna* reproduction in the Poplar Creek and Clinch River test sites

Test date	Site ID ^a	Reproduction: offspring per surviving female					Percent difference	
		Mean	SD	<i>n</i>	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
7/21 - 8/2, 1993	Control	90.56	25.33	9	42	132	435.86	192.13
	PCM 1.0	33.25	4.63	8	26	42	96.75	NA
	PCM 2.9	50.67	14.17	9	31	76	199.80	NA
	PCM 4.3	34.33	11.32	9	16	53	103.16	NA
	PCM 5.1	34.10	5.36	10	24	41	101.78	NA
	PCM 6.0	16.90	5.50	10	10	30	NA	NA
	CRM 9.0	40.20	14.03	10	28	79	NA	29.68
	CRM 19.0	30.14	6.85	7	22	41	NA	-2.76
	CRM 22.0	31.00	6.56	10	21	39	NA	NA
8/24 - 9/5, 1993	Control	104.50	12.15	10	90	124	148.16	195.20
	PCM 1.0	43.25	10.92	8	21	53	2.70	NA
	PCM 2.9	45.89	10.44	9	24	60	8.97	NA
	PCM 4.3	38.50	10.74	10	21	52	-8.58	NA
	PCM 5.1	39.89	14.22	9	9	58	-5.28	NA
	PCM 6.0	42.11	11.13	9	26	56	NA	NA
	CRM 9.0	47.30	6.71	10	34	56	NA	33.62
	CRM 19.0	38.10	13.52	17	17	63	NA	7.63
	CRM 22.0	35.40	10.26	10	22	55	NA	NA

M-18

^aPCM = Poplar Creek mile; CRM = Clinch River mile; Control = a water-only treatment.^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.^cA water-only control treatment was not run during this test period.

NA = Not Applicable.

Table M8 (continued)

Test date	Site ID ^a	Reproduction: offspring per surviving female				Percent difference		
		Mean	SD	n	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
11/2 - 11/16, 1993 ^c	Control	NA	NA	NA	NA	NA	NA	NA
	PCM 1.0	24.10	5.36	10	18	36	-17.75	NA
	PCM 2.9	26.70	5.39	10	15	36	-8.87	NA
	PCM 4.3	24.00	3.63	10	19	28	-18.09	NA
	PCM 5.1	28.20	5.72	10	18	40	-3.75	NA
	PCM 6.0	29.30	4.90	10	19	37	NA	NA
	CRM 9.0	42.10	9.80	10	20	62	NA	144.77
	CRM 19.0	43.10	9.99	10	29	60	NA	150.58
	CRM 22.0	17.20	3.74	10	9	23	NA	NA
2/22 - 3/7, 1994	Control	51.89	12.34	9	35	72	90.07	74.13
	PCM 1.0	15.33	5.33	9	8	28	-43.83	NA
	PCM 2.9	22.60	9.22	10	12	45	-17.22	NA
	PCM 4.3	17.22	6.25	9	9	27	-36.91	NA
	PCM 5.1	16.00	9.82	9	9	42	-41.39	NA
	PCM 6.0	27.30	11.95	10	12	51	NA	NA
	CRM 9.0	18.50	6.84	8	9	33	NA	-37.92
	CRM 19.0	21.22	3.49	9	17	28	NA	-28.78
	CRM 21.2	29.80	8.57	10	18	49	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile; Control = a water-only treatment.

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.

^cA water-only control treatment was not run during this test period.

NA = Not Applicable.

Table M8 (continued)

Test date	Site ID ^a	Reproduction: offspring per surviving female					Percent difference	
		Mean	SD	n	Min.	Max.	PCM Ref. ^b	CRM Ref. ^b
5/10 - 5/23, 1994	Control	47.00	9.15	10	35	67	178.44	159.53
	PCM 1.0	9.57	4.27	7	4	15	-43.28	NA
	PCM 2.9	26.11	12.31	9	13	55	54.73	NA
	PCM 4.3	16.56	9.33	9	7	35	-1.89	NA
	PCM 5.1	17.60	6.30	10	13	31	4.30	NA
	PCM 6.0	16.88	7.91	8	12	37	NA	NA
	CRM 9.0	9.00	1.56	9	8	12	NA	-50.31
	CRM 19.0	16.83	11.26	6	0	34	NA	-7.06
	CRM 21.5	18.11	4.93	9	11	26	NA	NA
7/10 - 7/26, 1994	Control	44.00	12.62	10	22	62	185.16	122.45
	PCM 1.0	20.00	3.46	4	18	26	29.63	NA
	PCM 2.9	13.67	1.94	9	11	16	-11.42	NA
	PCM 4.3	18.00	2.10	10	15	23	16.67	NA
	PCM 5.1	14.30	3.98	10	5	19	-7.31	NA
	PCM 6.0	15.43	2.92	7	11	21	NA	NA
	CRM 9.0	16.00	7.07	8	6	31	NA	-19.10
	CRM 19.0	18.90	2.62	10	15	24	NA	-4.44
	CRM 20.5	19.78	3.64	9	14	25	NA	NA

^aPCM = Poplar Creek mile; CRM = Clinch River mile; Control = a water-only treatment.

^bThe reference site for Poplar Creek was PCM 6.0; the reference site for Clinch River varied: CRM 22.0, 21.5, 21.2, and 20.5 were used.

^cA water-only control treatment was not run during this test period.

NA = Not Applicable.

Table M9. *Daphnia magna* reproduction in the McCoy Branch and Walker Branch embayment sites

Test date	Site ID ^a	Reproduction: offspring per surviving female				Percent difference from reference	
		Mean	SD	<i>n</i>	Min.		Max.
6/7 - 6/21, 1994	Control	33.00	5.16	10	24	41	144.44
	MBM 0.2	12.67	2.67	9	8	19	-6.17
	MBM 0.4	14.90	2.26	10	10	18	10.37
	WBM 0.6 ^b	13.50	2.65	8	10	17	NA
8/15 - 8/28, 1994	Control	83.83	20.45	6	71	129	93.65
	MBM 0.2	42.44	26.36	9	22	115	1.94
	MBM 0.4	59.14	27.63	7	34	119	36.63
	WBM 0.4 ^b	43.29	16.76	7	22	72	NA

^aMBM = McCoy Branch Embayment mile; WBM = Walker Branch Embayment mile; Control = a water-only treatment.

^bThe reference site for McCoy Branch was either Walker Branch Embayment site WBM 0.6 or WBM 0.4, as shown.

*Indicates sites in which survival differed from reference site survival by greater than or equal to 20%.

[†]Indicates sites in which survival was significantly different from the reference site ($\alpha = 0.05$; Tukey's test).

NA = Not Applicable.

Appendix N

BIOTA CHARACTERIZATION-SUPPORTING STUDIES

Table N1. Mean $\pm$ SE (N) concentrations (ppm, wet wt) of elements and Aroclor 1260^a from homogenized fish^b collected from great blue heron colonies located on^c and off^d the Oak Ridge Reservation (ORR)

	On ORR	Off ORR	P ^e
Mercury	0.06 $\pm$ 0.02 (13)	0.02 $\pm$ 0.00 (15)	0.030
Arsenic	0.30 $\pm$ 0.05 (13)	0.23 $\pm$ 0.03 (15)	0.238
Chromium	1.52 $\pm$ 0.54 (12)	0.37 $\pm$ 0.08 (15)	0.030
Aroclor 1260	0.20 $\pm$ 0.04 (13)	0.15 $\pm$ 0.03 (15)	0.269

^aAll congener concentrations were <20 ppb.

^bVarious fish species collected from active nest or stomachs of collected great blue heron chicks.

^cIncludes the K25 and Melton Hill colonies.

^dIncludes the Long Island and Looney Island colonies.

^eT-test P value.

Table N2. Metal^a concentrations (ppm, wet wt) detected in great blue heron eggs from colonies located on^b and off^c the Oak Ridge Reservation during 1992–1994

	On ORR	Off ORR	P ^d
Mercury			
Mean	0.17	0.12	0.009
SE	0.02	0.02	
Min	0.04	0.04	
Max	0.31	0.29	
N	24	34	
Chromium			
Mean	0.18	0.11	0.046
SE	0.03	0.01	
Min	0.05	0.06	
Max	0.84	0.21	
N	25	26	

^aArsenic was quantified in one egg at a concentration below the contract required detection limit.

^bIncludes K-25 colony.

^cIncludes Long Island and Looney Island colonies.

^dT-test P value.

Table N3. Metal concentrations (Mean $\pm$ SE) detected in tissues collected from great blue heron chicks from colonies located on^a (N=38) and off^b (N=35) the Oak Ridge Reservation (ORR) during 1992–1994

	On ORR	Off ORR	P ^c
Mercury			
Feather	1.71 $\pm$ 0.21	0.91 $\pm$ 0.08	0.001
Liver	0.24 $\pm$ 0.03	0.16 $\pm$ 0.02	0.028
Muscle	0.08 $\pm$ 0.01	0.09 $\pm$ 0.02	0.655
Chromium			
Feather	0.96 $\pm$ 0.17	1.16 $\pm$ 0.19	0.429
Liver	1.49 $\pm$ 0.48	1.26 $\pm$ 0.49	0.739
Muscle	1.86 $\pm$ 0.56	2.84 $\pm$ 0.81	0.322
Arsenic			
Feather	0.10 $\pm$ 0.01	0.10 $\pm$ 0.01	0.977
Liver	0.13 $\pm$ 0.03	0.12 $\pm$ 0.02	0.771
Muscle	0.15 $\pm$ 0.05	0.15 $\pm$ 0.04	0.938

^aIncludes K25 and Melton Hill colonies.

^bIncludes Long Island and Looney Island colonies.

^cT-test P value.

Table N4. Mean $\pm$ SE (N) Aroclor 1260 and congener concentrations^a (ppm, wet wt) in great blue heron eggs collected from colonies located on^b and off^c the Oak Ridge Reservation (ORR)

	On ORR	Off ORR	P ^d
Aroclor 1260	1.68 $\pm$ 0.48 (24)	0.27 $\pm$ 0.08 (34)	0.008
CB 81	0.13 $\pm$ 0.04 (16)	0.08 $\pm$ 0.02 (26)	0.365
CB 99	0.09 $\pm$ 0.03 (16)	0.02 $\pm$ 0.01 (26)	0.030
CB 101	0.04 $\pm$ 0.02 (16)	0.00 $\pm$ 0.00 (26)	0.018
CB 118	0.17 $\pm$ 0.04 (16)	0.08 $\pm$ 0.02 (26)	0.062
CB 123	0.11 $\pm$ 0.04 (16)	0.01 $\pm$ 0.00 (26)	0.015
CB 138	0.29 $\pm$ 0.05 (16)	0.14 $\pm$ 0.03 (26)	0.025
CB 146	0.09 $\pm$ 0.03 (16)	0.03 $\pm$ 0.01 (26)	0.036
CB 149	0.09 $\pm$ 0.05 (8)	0.03 $\pm$ 0.01 (14)	0.288
CB 153	0.37 $\pm$ 0.07 (16)	0.16 $\pm$ 0.04 (26)	0.019
CB 158	0.04 $\pm$ 0.02 (16)	0.06 $\pm$ 0.02 (26)	0.128
CB 167	0.05 $\pm$ 0.01 (16)	0.01 $\pm$ 0.00 (26)	0.008
CB 170	0.09 $\pm$ 0.02 (16)	0.04 $\pm$ 0.01 (26)	0.012
CB 180	0.27 $\pm$ 0.06 (16)	0.11 $\pm$ 0.02 (26)	0.021
CB 183	0.06 $\pm$ 0.01 (16)	0.02 $\pm$ 0.00 (26)	0.020
CB 194	0.04 $\pm$ 0.01 (16)	0.02 $\pm$ 0.00 (26)	0.076
CB 196	0.07 $\pm$ 0.02 (16)	0.03 $\pm$ 0.01 (26)	0.059

^aConcentrations of CBs 66, 76, 77, 95, 105, 110, 114, 126, 128, 132, 151, 156, 171, and 201 were <30 ppb and are not included.

^bIncludes the K25 colony.

^cIncludes the Long Island and Looney Island colonies.

^dT-test P value.

Table N5. Mean $\pm$ SE (N) Aroclor 1260 and congener concentrations (ppm, wet wt) in abdominal fat from great blue heron chicks collected from colonies located on^a and off^b the Oak Ridge Reservation (ORR)

	On ORR	Off ORR	P ^c
Aroclor 1260	48.63 $\pm$ 11.71 (16)	15.70 $\pm$ 2.64 (24)	0.014
CB 66	1.21 $\pm$ 0.75 (16)	0.23 $\pm$ 0.03 (24)	0.210
CB 76	0.78 $\pm$ 0.55 (16)	0.12 $\pm$ 0.02 (24)	0.250
CB 77	0.27 $\pm$ 0.10 (16)	0.20 $\pm$ 0.04 (24)	0.556
CB 81	1.54 $\pm$ 0.44 (16)	1.28 $\pm$ 0.30 (24)	0.761
CB 95	0.84 $\pm$ 0.54 (16)	0.14 $\pm$ 0.04 (24)	0.216
CB 99	2.70 $\pm$ 1.36 (16)	0.56 $\pm$ 0.15 (24)	0.138
CB 101	2.65 $\pm$ 1.37 (16)	0.47 $\pm$ 0.15 (24)	0.134
CB 105	0.73 $\pm$ 0.36 (16)	0.13 $\pm$ 0.02 (24)	0.115
CB 110	2.40 $\pm$ 1.16 (16)	0.49 $\pm$ 0.10 (24)	0.122
CB 114	0.07 $\pm$ 0.04 (16)	0.00 $\pm$ 0.00 (24)	0.999
CB 118	1.95 $\pm$ 0.82 (16)	0.79 $\pm$ 0.11 (24)	0.182
CB 123	2.53 $\pm$ 1.09 (16)	0.63 $\pm$ 0.11 (24)	0.102
CB 126	0.54 $\pm$ 0.13 (16)	0.33 $\pm$ 0.08 (24)	0.195
CB 128	0.95 $\pm$ 0.37 (16)	0.19 $\pm$ 0.02 (24)	0.058
CB 132	0.76 $\pm$ 0.41 (16)	0.14 $\pm$ 0.02 (24)	0.146
CB 138	5.13 $\pm$ 1.44 (16)	1.70 $\pm$ 0.23 (24)	0.032
CB 146	1.70 $\pm$ 0.37 (16)	0.75 $\pm$ 0.11 (24)	0.024
CB 149	2.76 $\pm$ 0.54 (7)	1.04 $\pm$ 0.24 (12)	0.018
CB 151	0.98 $\pm$ 0.35 (16)	0.33 $\pm$ 0.06 (24)	0.084
CB 153	6.24 $\pm$ 1.35 (16)	2.47 $\pm$ 0.45 (24)	0.016
CB 156	0.31 $\pm$ 0.09 (16)	0.12 $\pm$ 0.02 (24)	0.043
CB 158	0.19 $\pm$ 0.14 (16)	0.21 $\pm$ 0.08 (24)	0.905
CB 167	0.86 $\pm$ 0.30 (16)	0.29 $\pm$ 0.04 (24)	0.078
CB 170	1.57 $\pm$ 0.34 (16)	0.54 $\pm$ 0.07 (24)	0.010
CB 171	0.22 $\pm$ 0.09 (16)	0.17 $\pm$ 0.05 (24)	0.621
CB 180	4.27 $\pm$ 0.95 (16)	1.37 $\pm$ 0.25 (24)	0.009
CB 183	0.88 $\pm$ 0.25 (16)	0.35 $\pm$ 0.05 (24)	0.054
CB 194	0.63 $\pm$ 0.12 (16)	0.38 $\pm$ 0.05 (31)	0.078
CB 196	0.93 $\pm$ 0.21 (16)	0.37 $\pm$ 0.06 (24)	0.018
CB 201	0.53 $\pm$ 0.11 (16)	0.22 $\pm$ 0.03 (24)	0.012

^aIncludes the K-25 colony.

^bIncludes the Long Island and Looney Island colonies.

^cT-test P value.

Table N6. Mean $\pm$ SE (N) Aroclor 1260 and congener concentrations^a (ppm, wet wt) in liver tissue from great blue heron chicks collected from colonies located on^b and off^c the Oak Ridge Reservation (ORR)

	On ORR	Off ORR	P ^d
Aroclor 1260	0.77 $\pm$ 0.23 (18)	0.23 $\pm$ 0.03 (22)	0.029
CB 110	0.06 $\pm$ 0.02 (18)	0.02 $\pm$ 0.00 (22)	0.050
CB 118	0.05 $\pm$ 0.02 (18)	0.01 $\pm$ 0.00 (22)	0.049
CB 138	0.07 $\pm$ 0.03 (18)	0.02 $\pm$ 0.00 (22)	0.077
CB 149	0.06 $\pm$ 0.03 (8)	0.02 $\pm$ 0.00 (10)	0.209
CB 151	0.04 $\pm$ 0.02 (18)	0.01 $\pm$ 0.00 (22)	0.048
CB 153	0.10 $\pm$ 0.03 (18)	0.03 $\pm$ 0.00 (22)	0.017
CB 180	0.07 $\pm$ 0.02 (18)	0.02 $\pm$ 0.00 (22)	0.021

^aConcentrations of CBs 66, 76, 77, 95, 99, 101, 105, 114, 123, 126, 128, 132, 146, 156, 158, 167, 170, 171, 183, 194, 196, and 201 were <30 ppb and are not included.

^bIncludes the K-25 colony.

^cIncludes the Long Island and Looney Island colonies.

^dT-test P value.

Table N7. Mean $\pm$ SE (N) Aroclor 1260 and congener concentrations^a (ppm, wet wt) in muscle tissue from great blue heron chicks collected from colonies located on^b and off^c the Oak Ridge Reservation (ORR)

	On ORR	Off ORR	p ^d
Aroclor 1260	1.05 $\pm$ 0.25 (18)	0.35 $\pm$ 0.08 (24)	0.015
CB 81	0.04 $\pm$ 0.01 (18)	0.04 $\pm$ 0.02 (24)	0.795
CB 110	0.06 $\pm$ 0.02 (18)	0.01 $\pm$ 0.00 (24)	0.027
CB 118	0.06 $\pm$ 0.01 (18)	0.02 $\pm$ 0.01 (24)	0.015
CB 138	0.09 $\pm$ 0.02 (18)	0.04 $\pm$ 0.01 (24)	0.033
CB 149	0.09 $\pm$ 0.03 (8)	0.03 $\pm$ 0.01 (12)	0.086
CB 153	0.16 $\pm$ 0.03 (18)	0.05 $\pm$ 0.01 (24)	0.009
CB 180	0.10 $\pm$ 0.02 (18)	0.03 $\pm$ 0.01 (24)	0.008

^aConcentrations of CBs 66, 76, 77, 95, 99, 101, 105, 114, 123, 126, 128, 132, 146, 151, 156, 167, 170, 171, 183, 194, 196, and 201 were <30 ppb and are not included.

^bIncludes the K-25 colony.

^cIncludes the Long Island and Looney Island colonies.

^dT-test P value, based on lipid adjusted concentrations.

Table N8. Reproductive, physiological, and biomarker measurements [Mean $\pm$ SE (N)] in great blue heron from colonies located on^a and off^b the Oak Ridge Reservation (ORR) during 1992–1994

	On ORR	Off ORR
Mean eggs/nest	3.5 $\pm$ 0.2 (26)	3.2 $\pm$ 0.2 (27)
Egg shell thickness (mm)	0.427 $\pm$ 0.01 (33)	0.410 $\pm$ 0.01 (34)
Egg weight (g) ^c	69.16 $\pm$ 0.97 (33)	66.36 $\pm$ 0.97 (34)
Mean chicks/nest	2.7 $\pm$ 0.1 (55)	2.7 $\pm$ 0.2 (30)
Chick weight/length ratio	2.06 $\pm$ 0.05 (38)	2.12 $\pm$ 0.06 (35)
Liver somatic index	4.50 $\pm$ 0.16 (38)	4.64 $\pm$ 0.23 (35)
Liver EROD activity ^d	31.9 $\pm$ 2.7 (12)	41.3 $\pm$ 3.2 (12)
DNA double-strandedness (F) ^e	73 $\pm$ 0.03 (26)	84 $\pm$ 0.02 (27)
Hematocrit	32 $\pm$ 0.8 (38)	31 $\pm$ 0.7 (26)

^aIncludes K-25 and Melton Hill colonies.

^bIncludes Long Island and Looney Island colonies.

^cMeans significantly different (T-test, P = 0.048).

^d1994 data; ethoxyresorufin-o-deethylase activity (pmole/mq protein/min); means significantly different (T-test, P=0.033).

^eMeans significantly different (T-test, P = 0.006), F = fraction of double-stranded DNA.

Table N9. Percent by weight of the most common fish species collected from the Oak Ridge Reservation (ORR) and Clinch River above Melton Hill Dam

Common name	ORR %	Weight Kg	Clinch River %	Weight Kg
Sucker	17	280	3	12
Carp	20	330	24	97
Catfish	15	248	13	53
Shad	7	116	6	24
Buffalo	17	280	42	170
Other species	24	396	12	49
Totals	100	1,650	100	405

Table N10. Mean mercury concentrations (ppm, wet wt) in homogenized fish^a collected on the Oak Ridge Reservation^b (ORR), Clinch River above ORR^c, and from the ocean^d and diets fed to mink

	N ^e	Mean ^f	SE	Min	Max
Location					
On ORR	10	0.35 ^a	0.03	0.17	0.43
Clinch River	10	0.07 ^b	0.00	0.05	0.09
Ocean	10	0.03 ^c	0.00	0.02	0.04
Diet					
A ^g	10	0.02 ^a	0.00	0.02	0.03
B ^h	10	0.05 ^b	0.00	0.04	0.06
C ⁱ	10	0.09 ^c	0.00	0.08	0.11
D ^j	10	0.15 ^d	0.01	0.12	0.18
E ^k	10	0.22 ^e	0.01	0.16	0.24

^aVarious fish species.

^bPoplar Creek between East Fork Poplar Creek and confluence with the Clinch River.

^cAbove Melton Hill Dam near Bull Run Power Plant.

^dMackerel purchased from commercial supplier.

^eNumber of aliquots analyzed.

^fMeans followed by different letters are significantly different, $P < 0.05$.

^g75% ocean fish, 25% ranch mink diet.

^h75% fish collected from the Clinch River above ORR, 25% ranch mink diet.

ⁱ25% fish collected from Poplar Creek on ORR, 50% ocean fish, 25% ranch mink diet.

^j50% fish collected from Poplar Creek on ORR, 25% ocean fish, 25% ranch mink diet.

^k75% fish collected from Poplar Creek on ORR, 25% ranch mink diet.

Table N11. Mean^a ± SE lipid adjusted Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in homogenized fish^b collected on the Oak Ridge Reservation^c (ORR), Clinch River above ORR^d, and from the ocean^e

	Ocean	Clinch River	ORR
CB 77	0.022 ^a ±0.000 (10)	0.039 ^b ±0.001 (10)	0.190 ^c ±0.004 (10)
CB 81	0.053 ^a ±0.001 (10)	0.592 ^b ±0.062 (10)	1.419 ^c ±0.262 (9)
CB 99	0.022 ^a ±0.000 (10)	0.076 ^b ±0.011 (10)	0.894 ^c ±0.015 (10)
CB 101	0.022 ^a ±0.000 (10)	0.142 ^b ±0.022 (10)	0.609 ^c ±0.010 (10)
CB 118	0.022 ^a ±0.000 (10)	0.468 ^{ab} ±0.219 (10)	1.150 ^b ±0.030 (9)
CB 123	0.022 ^a ±0.000 (10)	0.039 ^{ab} ±0.001 (10)	0.051 ^b ±0.010 (10)
CB 126	0.022 ^a ±0.000 (10)	0.039 ^b ±0.001 (10)	0.041 ^b ±0.001 (10)
CB 128	0.022 ^a ±0.000 (10)	0.178 ^b ±0.003 (10)	0.636 ^c ±0.012 (10)
CB 138	0.022 ^a ±0.000 (10)	0.706 ^b ±0.014 (10)	1.611 ^c ±0.052 (9)
CB 146	0.022 ^a ±0.000 (10)	0.388 ^b ±0.007 (10)	0.822 ^c ±0.023 (10)
CB 151	0.039 ^a ±0.002 (10)	0.496 ^b ±0.008 (10)	1.731 ^c ±0.048 (10)
CB 153	0.074 ^a ±0.002 (10)	2.813 ^b ±0.082 (10)	4.733 ^c ±0.123 (9)
CB 156	0.022 ^a ±0.000 (10)	0.039 ^b ±0.001 (10)	0.078 ^b ±0.037 (10)
CB 167	0.022 ^a ±0.000 (10)	0.044 ^b ±0.003 (10)	0.193 ^c ±0.003 (10)
CB 170	0.022 ^a ±0.000 (10)	0.455 ^b ±0.010 (10)	1.315 ^c ±0.025 (10)
CB 171	0.022 ^a ±0.000 (10)	0.039 ^b ±0.001 (10)	0.041 ^b ±0.001 (10)
CB 180	0.022 ^a ±0.000 (10)	3.021 ^b ±0.099 (10)	3.592 ^c ±0.088 (10)
CB 183	0.022 ^a ±0.000 (10)	0.690 ^b ±0.012 (10)	1.000 ^c ±0.016 (10)
CB 189	0.022 ^a ±0.000 (10)	0.039 ^b ±0.001 (10)	0.041 ^b ±0.001 (10)
CB 194	0.022 ^a ±0.000 (10)	0.376 ^b ±0.009 (10)	0.430 ^c ±0.006 (10)
CB 195	0.022 ^a ±0.000 (10)	0.042 ^b ±0.002 (10)	0.043 ^b ±0.002 (10)
CB 196	0.022 ^a ±0.000 (10)	0.570 ^b ±0.014 (10)	1.660 ^c ±0.041 (10)
CB 201	0.022 ^a ±0.000 (10)	0.486 ^b ±0.009 (10)	0.605 ^c ±0.008 (10)
Aroclor 1260	0.379 ^a ±0.008 (10)	21.917 ^b ±0.681 (10)	28.997 ^c ±0.659 (10)

^aMeans with different superscripts are significantly different, P<0.05.

^bVarious fish species.

^cPoplar Creek between East Fork Poplar Creek and confluence with the Clinch River.

^dAbove Melton Hill Dam near Bull Run Power Plant.

^eMackerel purchased from commercial supplier.

NOTE: Superscript letters within table do not correlate to the above footnotes; please refer to footnote a.

Table N12. Mean $\pm$ SE lipid adjusted Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in mink diets^a (n=10/diet)

	Diet A	Diet B	Diet C	Diet D	Diet E
CB 77	0.025 $\pm$ 0.000	0.037 $\pm$ 0.001	0.046 $\pm$ 0.003	0.102 $\pm$ 0.002	0.116 $\pm$ 0.005
CB 81	0.027 $\pm$ 0.002	0.337 $\pm$ 0.051	0.507 $\pm$ 0.011	0.873 $\pm$ 0.022	1.158 $\pm$ 0.033
CB 99	0.025 $\pm$ 0.000	0.037 $\pm$ 0.001	0.276 $\pm$ 0.011	0.531 $\pm$ 0.014	0.520 $\pm$ 0.013
CB 101	0.031 $\pm$ 0.004	0.239 $\pm$ 0.032	0.288 $\pm$ 0.009	0.585 $\pm$ 0.012	0.396 $\pm$ 0.020
CB 118	0.025 $\pm$ 0.000	0.117 $\pm$ 0.010	0.192 $\pm$ 0.007	0.405 $\pm$ 0.007	0.668 $\pm$ 0.021
CB 123	0.025 $\pm$ 0.000	0.037 $\pm$ 0.001	0.212 $\pm$ 0.008	0.446 $\pm$ 0.008	0.076 $\pm$ 0.003
CB 126	0.025 $\pm$ 0.000	0.037 $\pm$ 0.001	0.027 $\pm$ 0.001	0.038 $\pm$ 0.003	0.033 $\pm$ 0.001
CB 128	0.025 $\pm$ 0.000	0.085 $\pm$ 0.003	0.104 $\pm$ 0.004	0.228 $\pm$ 0.005	0.351 $\pm$ 0.013
CB 138	0.080 $\pm$ 0.002	0.791 $\pm$ 0.087	0.331 $\pm$ 0.011	0.690 $\pm$ 0.009	1.048 $\pm$ 0.020
CB 146	0.025 $\pm$ 0.000	0.037 $\pm$ 0.001	0.141 $\pm$ 0.006	0.335 $\pm$ 0.007	0.501 $\pm$ 0.015
CB 151	0.025 $\pm$ 0.000	0.314 $\pm$ 0.010	0.254 $\pm$ 0.009	0.555 $\pm$ 0.009	1.058 $\pm$ 0.039
CB 153	0.025 $\pm$ 0.000	1.862 $\pm$ 0.025	0.766 $\pm$ 0.029	1.772 $\pm$ 0.026	3.126 $\pm$ 0.056
CB 156	0.025 $\pm$ 0.000	0.139 $\pm$ 0.013	0.065 $\pm$ 0.002	0.094 $\pm$ 0.015	0.033 $\pm$ 0.001
CB 167	0.025 $\pm$ 0.000	0.037 $\pm$ 0.001	0.027 $\pm$ 0.001	0.061 $\pm$ 0.003	0.103 $\pm$ 0.004
CB 170	0.025 $\pm$ 0.000	1.847 $\pm$ 0.964	0.154 $\pm$ 0.007	0.346 $\pm$ 0.008	0.798 $\pm$ 0.016
CB 171	0.025 $\pm$ 0.000	0.037 $\pm$ 0.001	0.061 $\pm$ 0.002	0.127 $\pm$ 0.003	0.033 $\pm$ 0.001
CB 180	0.025 $\pm$ 0.000	1.011 $\pm$ 0.266	0.507 $\pm$ 0.019	1.091 $\pm$ 0.018	2.292 $\pm$ 0.040
CB 183	0.025 $\pm$ 0.000	0.276 $\pm$ 0.053	0.170 $\pm$ 0.006	0.355 $\pm$ 0.007	0.573 $\pm$ 0.019
CB 189	0.025 $\pm$ 0.000	0.037 $\pm$ 0.001	0.027 $\pm$ 0.001	0.031 $\pm$ 0.000	0.033 $\pm$ 0.001
CB 194	0.025 $\pm$ 0.000	0.058 $\pm$ 0.022	0.072 $\pm$ 0.008	0.149 $\pm$ 0.020	0.245 $\pm$ 0.009
CB 195	0.025 $\pm$ 0.000	0.039 $\pm$ 0.003	0.027 $\pm$ 0.001	0.033 $\pm$ 0.002	0.033 $\pm$ 0.001
CB 196	0.025 $\pm$ 0.000	1.081 $\pm$ 0.084	0.184 $\pm$ 0.008	0.415 $\pm$ 0.008	1.071 $\pm$ 0.024
CB 201	0.025 $\pm$ 0.000	0.230 $\pm$ 0.034	0.060 $\pm$ 0.002	0.131 $\pm$ 0.003	0.338 $\pm$ 0.010
Aroclor 1260	0.169 $\pm$ 0.002	11.440 $\pm$ 0.327	4.697 $\pm$ 0.174	10.405 $\pm$ 0.250	20.670 $\pm$ 0.458

^aDiet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet D = 50% fish collected on the Oak Ridge Reservation and 25% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

Table N13. Mercury concentration (ppm, wet wt) in tissues from female mink fed (n=8/diet) various diets¹ and their 6-week-old kits

		Diet A	Diet B	Diet C	Diet D	Diet E
Adult female mink						
Liver Hg	Mean ²	0.41 ^a	0.61 ^a	1.06 ^a	1.93 ^b	3.67 ^c
	SE	0.07	0.06	0.10	0.15	0.32
	Range	0.17-0.8	0.47-0.87	0.74-1.49	1.26-2.47	2.52-5.20
Kidney Hg	Mean	0.84 ^a	1.25 ^{ab}	2.22 ^{bc}	3.47 ^{cd}	4.35 ^d
	SE	0.13	0.18	0.35	0.52	0.34
	Range	0.25-1.46	0.53-1.96	1.24-4.22	2.38-7.00	3.33-6.25
Hair Hg	Mean	3.79 ^a	7.43 ^b	7.71 ^b	13.44 ^c	19.03 ^d
	SE	0.26	0.55	0.63	0.79	0.57
	Range	2.20-4.61	5.05-9.70	4.38-9.62	10.2-15.6	16.8-21.4
Kits						
Carcass	Mean	0.02 ^a	0.03 ^a	0.05 ^a		0.20 ^b
	SE	0.004	0.003	0.003		0.02
	Range	0.01-0.05	0.02-0.05	0.04-0.06		0.10-0.30
	N	9	9	8		9
Kidney Hg	Mean	0.03 ^a	0.03 ^a	0.06 ^a		0.19 ^b
	SE	0.001	0.003	0.003		0.02
	Range	0.02-0.04	0.02-0.04	0.05-0.07		0.11-0.31
	N	9	9	8		9

¹Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet D = 50% fish collected on the Oak Ridge Reservation and 25% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

²Means with different superscripts are significantly different, P<0.05.

Table N14. Mean $\pm$ SE lipid adjusted Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in liver tissue from female mink (n = 8/diet) for various diets¹

	Diet A	Diet B	Diet C	Diet D	Diet E
CB 77	0.048 $\pm$ 0.016	0.081 $\pm$ 0.010	0.033 $\pm$ 0.004	0.095 $\pm$ 0.040	0.028 $\pm$ 0.005
CB 81	0.048 $\pm$ 0.016	0.054 $\pm$ 0.010	0.033 $\pm$ 0.004	0.095 $\pm$ 0.040	0.197 $\pm$ 0.117
CB 99	0.048 $\pm$ 0.016	0.117 $\pm$ 0.014	0.420 $\pm$ 0.061	0.962 $\pm$ 0.123	0.823 $\pm$ 0.215
CB 101	0.048 $\pm$ 0.016	0.053 $\pm$ 0.011	0.033 $\pm$ 0.004	0.145 $\pm$ 0.019	0.154 $\pm$ 0.015
CB 118	0.141 $\pm$ 0.008	0.590 $\pm$ 0.040	1.066 $\pm$ 0.153	2.157 $\pm$ 0.406	1.656 $\pm$ 0.332
CB 123	0.048 $\pm$ 0.016	0.041 $\pm$ 0.006	0.033 $\pm$ 0.004	0.095 $\pm$ 0.040	1.598 $\pm$ 0.228
CB 126	0.048 $\pm$ 0.016	0.224 $\pm$ 0.023	0.033 $\pm$ 0.004	0.095 $\pm$ 0.040	1.703 $\pm$ 0.251
CB 128	0.048 $\pm$ 0.016	0.174 $\pm$ 0.023	0.151 $\pm$ 0.024	0.353 $\pm$ 0.054	0.691 $\pm$ 0.097
CB 138	0.136 $\pm$ 0.023	2.063 $\pm$ 0.479	2.083 $\pm$ 0.224	4.816 $\pm$ 0.915	5.649 $\pm$ 0.465
CB 146	0.059 $\pm$ 0.015	0.627 $\pm$ 0.051	0.545 $\pm$ 0.055	1.188 $\pm$ 0.113	0.604 $\pm$ 0.111
CB 153	0.206 $\pm$ 0.020	5.075 $\pm$ 0.445	3.858 $\pm$ 0.365	8.063 $\pm$ 1.195	7.242 $\pm$ 1.658
CB 156	0.048 $\pm$ 0.016	0.228 $\pm$ 0.074	0.193 $\pm$ 0.037	0.480 $\pm$ 0.102	0.648 $\pm$ 0.102
CB 167	0.048 $\pm$ 0.016	0.125 $\pm$ 0.013	0.166 $\pm$ 0.020	0.244 $\pm$ 0.077	0.776 $\pm$ 0.100
CB 170	0.057 $\pm$ 0.015	2.249 $\pm$ 0.219	0.774 $\pm$ 0.144	1.971 $\pm$ 0.444	1.878 $\pm$ 0.194
CB 171	0.048 $\pm$ 0.016	0.041 $\pm$ 0.006	0.093 $\pm$ 0.013	0.217 $\pm$ 0.027	0.774 $\pm$ 0.065
CB 180	0.131 $\pm$ 0.015	6.576 $\pm$ 0.772	3.117 $\pm$ 0.390	6.980 $\pm$ 1.296	7.752 $\pm$ 0.815
CB 183	0.048 $\pm$ 0.016	0.412 $\pm$ 0.032	0.229 $\pm$ 0.024	0.479 $\pm$ 0.097	0.527 $\pm$ 0.086
CB 189	0.048 $\pm$ 0.016	0.044 $\pm$ 0.007	0.042 $\pm$ 0.007	0.137 $\pm$ 0.038	0.106 $\pm$ 0.013
CB 194	0.050 $\pm$ 0.016	1.887 $\pm$ 0.208	0.803 $\pm$ 0.086	1.795 $\pm$ 0.202	1.218 $\pm$ 0.174
CB 195	0.048 $\pm$ 0.016	0.041 $\pm$ 0.006	0.192 $\pm$ 0.018	0.457 $\pm$ 0.035	0.115 $\pm$ 0.015
CB 196	0.068 $\pm$ 0.015	2.998 $\pm$ 0.302	0.033 $\pm$ 0.004	0.095 $\pm$ 0.040	1.863 $\pm$ 0.985
CB 201	0.048 $\pm$ 0.016	2.085 $\pm$ 0.261	0.245 $\pm$ 0.084	1.448 $\pm$ 0.459	2.794 $\pm$ 0.356
Aroclor 1260	0.344 $\pm$ 0.132	0.270 $\pm$ 0.039	0.230 $\pm$ 0.021	0.723 $\pm$ 0.329	79.486 $\pm$ 8.112

¹Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet D = 50% fish collected on the Oak Ridge Reservation and 25% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

Table N15. Mean $\pm$ SE Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in fat tissue from female mink (n=8/diet) fed various diets¹

	Diet A	Diet B	Diet C	Diet D	Diet E
CB 77	0.011 $\pm$ 0.005	0.035 $\pm$ 0.006	0.046 $\pm$ 0.006	0.083 $\pm$ 0.019	0.138 $\pm$ 0.011
CB 81	0.120 $\pm$ 0.042	0.339 $\pm$ 0.061	0.280 $\pm$ 0.052	0.429 $\pm$ 0.023	0.696 $\pm$ 0.078
CB 99	0.050 $\pm$ 0.018	0.169 $\pm$ 0.029	0.786 $\pm$ 0.168	1.447 $\pm$ 0.265	1.708 $\pm$ 0.272
CB 101	0.016 $\pm$ 0.006	0.098 $\pm$ 0.020	0.107 $\pm$ 0.018	0.263 $\pm$ 0.029	0.311 $\pm$ 0.037
CB 118	0.163 $\pm$ 0.066	0.464 $\pm$ 0.089	1.461 $\pm$ 0.276	2.943 $\pm$ 0.388	3.175 $\pm$ 0.299
CB 123	0.130 $\pm$ 0.036	0.458 $\pm$ 0.088	0.033 $\pm$ 0.006	0.063 $\pm$ 0.006	2.375 $\pm$ 0.330
CB 126	0.064 $\pm$ 0.029	1.171 $\pm$ 0.212	0.196 $\pm$ 0.032	0.481 $\pm$ 0.035	1.511 $\pm$ 0.160
CB 128	0.033 $\pm$ 0.020	0.299 $\pm$ 0.048	0.352 $\pm$ 0.059	0.781 $\pm$ 0.080	1.210 $\pm$ 0.097
CB 138	0.267 $\pm$ 0.135	2.800 $\pm$ 0.609	3.464 $\pm$ 0.638	9.543 $\pm$ 1.036	9.925 $\pm$ 0.833
CB 146	0.041 $\pm$ 0.015	0.500 $\pm$ 0.104	0.600 $\pm$ 0.097	1.421 $\pm$ 0.111	1.771 $\pm$ 0.179
CB 153	0.405 $\pm$ 0.230	5.538 $\pm$ 1.069	5.195 $\pm$ 0.988	15.714 $\pm$ 1.686	15.375 $\pm$ 1.349
CB 156	0.009 $\pm$ 0.003	0.469 $\pm$ 0.084	0.409 $\pm$ 0.073	0.914 $\pm$ 0.086	1.188 $\pm$ 0.077
CB 167	0.040 $\pm$ 0.019	0.350 $\pm$ 0.055	0.621 $\pm$ 0.109	1.347 $\pm$ 0.126	1.500 $\pm$ 0.125
CB 170	0.093 $\pm$ 0.051	2.278 $\pm$ 0.471	0.800 $\pm$ 0.157	2.043 $\pm$ 0.238	3.013 $\pm$ 0.168
CB 171	0.035 $\pm$ 0.017	0.521 $\pm$ 0.093	0.488 $\pm$ 0.086	1.083 $\pm$ 0.100	1.393 $\pm$ 0.084
CB 180	0.290 $\pm$ 0.188	7.175 $\pm$ 1.544	5.264 $\pm$ 1.034	14.571 $\pm$ 1.325	14.750 $\pm$ 1.161
CB 183	0.019 $\pm$ 0.012	0.559 $\pm$ 0.102	0.368 $\pm$ 0.069	0.899 $\pm$ 0.073	1.114 $\pm$ 0.143
CB 189	0.005 $\pm$ 0.001	0.090 $\pm$ 0.019	0.041 $\pm$ 0.006	0.130 $\pm$ 0.015	0.186 $\pm$ 0.018
CB 194	0.060 $\pm$ 0.035	2.103 $\pm$ 0.475	0.918 $\pm$ 0.174	2.386 $\pm$ 0.201	2.688 $\pm$ 0.351
CB 195	0.011 $\pm$ 0.007	0.419 $\pm$ 0.078	0.033 $\pm$ 0.006	0.063 $\pm$ 0.006	0.133 $\pm$ 0.021
CB 196	0.021 $\pm$ 0.014	0.778 $\pm$ 0.163	0.426 $\pm$ 0.091	1.064 $\pm$ 0.105	1.645 $\pm$ 0.295
CB 201	0.031 $\pm$ 0.019	0.889 $\pm$ 0.151	0.477 $\pm$ 0.080	1.226 $\pm$ 0.101	1.813 $\pm$ 0.178
Aroclor 1260	3.169 $\pm$ 1.849	61.250 $\pm$ 12.560	0.261 $\pm$ 0.044	105.86 $\pm$ 11.26	128.63 $\pm$ 7.73

¹Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet D = 50% fish collected on the Oak Ridge Reservation and 25% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

Table N16. Mean¹ ± SE Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in liver tissue from 6-week-old mink kits from dams fed diets of fish collected from various sources²

	Diet A	Diet B	Diet C	Diet E
CB 77	0.003±0.000 (9)	0.006±0.001 (9)	0.007±0.001 (8)	0.006±0.001 (9)
CB 81	0.004±0.000 (9)	0.006±0.001 (9)	0.007±0.001 (8)	0.007±0.001 (9)
CB 99	0.003 ^a ±0.000 (9)	0.006 ^a ±0.001 (9)	0.016 ^a ±0.005 (8)	0.049 ^b ±0.012 (9)
CB 101	0.004±0.000 (9)	0.006±0.001 (9)	0.007±0.001 (8)	0.006±0.001 (9)
CB 118	0.012 ^a ±0.001 (9)	0.012 ^a ±0.002 (9)	0.068 ^b ±0.014 (8)	0.138 ^c ±0.025 (9)
CB 123	0.008±0.001 (9)	0.007±0.000 (9)	0.007±0.001 (8)	0.006±0.001 (9)
CB 126	0.003 ^a ±0.000 (9)	0.007 ^a ±0.001 (9)	0.007 ^a ±0.001 (8)	0.014 ^b ±0.003 (9)
CB 128	0.003 ^a ±0.000 (9)	0.006 ^a ±0.001 (9)	0.020 ^a ±0.005 (8)	0.092 ^b ±0.034 (9)
CB 138	0.015 ^a ±0.002 (9)	0.058 ^a ±0.011 (9)	0.141 ^a ±0.033 (8)	0.547 ^b ±0.200 (9)
CB 146	0.004 ^a ±0.000 (9)	0.011 ^a ±0.002 (9)	0.033 ^a ±0.006 (8)	0.143 ^b ±0.042 (9)
CB 151	0.004±0.000 (9)	0.006±0.001 (9)	0.007±0.001 (8)	0.006±0.001 (9)
CB 153	0.011 ^a ±0.002 (9)	0.065 ^a ±0.010 (9)	0.157 ^a ±0.039 (8)	0.509 ^b ±0.137 (9)
CB 156	0.003±0.000 (9)	0.008±0.001 (9)	0.009±0.001 (8)	0.006±0.001 (9)
CB 167	0.004 ^a ±0.000 (9)	0.007 ^a ±0.001 (9)	0.009 ^a ±0.002 (8)	0.028 ^b ±0.007 (9)
CB 170	0.004 ^a ±0.000 (9)	0.054 ^a ±0.009 (9)	0.078 ^b ±0.014 (8)	0.294 ^b ±0.118 (9)
CB 171	0.003±0.000 (9)	0.008±0.001 (9)	0.007±0.001 (8)	0.006±0.001 (9)
CB 180	0.006 ^a ±0.001 (9)	0.109 ^a ±0.018 (9)	0.194 ^b ±0.040 (8)	0.629 ^b ±0.235 (9)
CB 183	0.004 ^a ±0.000 (9)	0.007 ^a ±0.000 (9)	0.013 ^a ±0.004 (8)	0.035 ^b ±0.009 (9)
CB 189	0.003±0.000 (9)	0.006±0.001 (9)	0.007±0.001 (8)	0.008±0.002 (9)
CB 194	0.004 ^a ±0.000 (9)	0.019 ^a ±0.003 (9)	0.041 ^b ±0.008 (8)	0.146 ^b ±0.055 (9)
CB 195	0.003±0.000 (9)	0.006±0.001 (9)	0.007±0.001 (8)	0.006±0.001 (9)
CB 196	0.004 ^a ±0.000 (9)	0.052 ^a ±0.011 (9)	0.084 ^b ±0.015 (8)	0.319 ^b ±0.128 (9)
CB 201	0.003 ^a ±0.000 (9)	0.014 ^a ±0.002 (9)	0.027 ^a ±0.005 (8)	0.142 ^b ±0.032 (9)
Aroclor 1260	0.099±0.016 (9)	0.151±0.099 (9)	0.058±0.009 (8)	0.048±0.008 (9)

¹Means with different superscripts are significantly different, $P \leq 0.05$.

²Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

Table N17. Mean¹ ± SE Aroclor 1260 and PCB congener concentrations (ppm, wet wt) in carcass² of 6-week-old mink kits from dams fed diets of fish collected from various sources³

	Diet A	Diet B	Diet C	Diet E
CB 77	0.003±0.000 (9)	0.003±0.000 (9)	0.003±0.000 (8)	0.003±0.000 (9)
CB 81	0.003±0.000 (9)	0.003±0.000 (9)	0.003±0.000 (8)	0.005±0.001 (9)
CB 99	0.003 ^a ±0.000 (9)	0.009 ^a ±0.003 (9)	0.017 ^a ±0.003 (8)	0.096 ^b ±0.023 (9)
CB 101	0.003 ^a ±0.000 (9)	0.004 ^a ±0.001 (9)	0.006 ^a ±0.001 (8)	0.017 ^b ±0.002 (9)
CB 118	0.008 ^a ±0.001 (9)	0.030 ^a ±0.009 (9)	0.071 ^a ±0.018 (7)	0.245 ^b ±0.036 (9)
CB 123	0.003±0.000 (9)	0.011±0.005 (9)	0.003±0.000 (8)	0.008±0.001 (9)
CB 126	0.003±0.000 (9)	0.011±0.001 (9)	0.005±0.001 (8)	0.003±0.000 (9)
CB 128	0.003 ^a ±0.000 (9)	0.011 ^a ±0.004 (9)	0.012 ^a ±0.002 (8)	0.054 ^b ±0.007 (9)
CB 138	0.008 ^a ±0.001 (9)	0.112 ^a ±0.016 (9)	0.106 ^a ±0.021 (7)	0.634 ^b ±0.110 (9)
CB 146	0.003 ^a ±0.000 (9)	0.013 ^a ±0.002 (9)	0.019 ^a ±0.003 (8)	0.103 ^b ±0.017 (9)
CB 151	0.003±0.000 (9)	0.003±0.000 (9)	0.003±0.000 (8)	0.005±0.001 (9)
CB 153	0.009 ^a ±0.001 (9)	0.141 ^a ±0.024 (9)	0.119 ^a ±0.025 (7)	0.619 ^b ±0.096 (9)
CB 156	0.003 ^a ±0.000 (9)	0.017 ^{ab} ±0.003 (9)	0.022 ^b ±0.003 (8)	0.058 ^c ±0.008 (9)
CB 167	0.003 ^a ±0.000 (9)	0.014 ^{bc} ±0.002 (9)	0.010 ^{ab} ±0.002 (8)	0.022 ^c ±0.003 (9)
CB 170	0.003 ^a ±0.000 (9)	0.073 ^a ±0.012 (9)	0.047 ^a ±0.007 (8)	0.238 ^b ±0.036 (9)
CB 171	0.003 ^a ±0.000 (9)	0.021 ^a ±0.003 (9)	0.008 ^a ±0.004 (8)	0.017 ^b ±0.002 (9)
CB 180	0.004 ^a ±0.000 (9)	0.203 ^a ±0.026 (9)	0.121 ^a ±0.019 (7)	0.611 ^b ±0.080 (9)
CB 183	0.003 ^a ±0.000 (9)	0.011 ^a ±0.001 (9)	0.007 ^a ±0.002 (8)	0.031 ^b ±0.005 (9)
CB 189	0.003±0.000 (9)	0.003±0.000 (9)	0.003±0.000 (8)	0.008±0.001 (9)
CB 194	0.003 ^a ±0.000 (9)	0.025 ^a ±0.003 (9)	0.019 ^a ±0.004 (8)	0.089 ^b ±0.010 (9)
CB 195	0.003 ^a ±0.000 (9)	0.003 ^a ±0.000 (9)	0.004 ^a ±0.001 (8)	0.023 ^b ±0.003 (9)
CB 196	0.003±0.000 (9)	0.014±0.002 (9)	0.005±0.002 (8)	0.005±0.001 (9)
CB 201	0.003 ^a ±0.000 (9)	0.013 ^a ±0.002 (9)	0.012 ^a ±0.002 (8)	0.050 ^b ±0.009 (9)
Aroclor 1260	0.082±0.005 (9)	1.791±0.282 (9)	0.353±0.245 (8)	0.049±0.006 (9)

¹Means with different superscripts are significantly different, P<0.05. Diet groups were separated based on lipid adjusted concentrations.

²Whole body minus liver tissue.

³Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

Table N18. Reproductive performance of female mink fed diets of 75% fish from various sources¹

	Diet A	Diet B	Diet C	Diet D	Diet E
Females whelping	6	7	4	6	8
Female weights					
December ²	1269±64 ³	1245±63	1374±64	1258±64	1230±64
June ⁴	1168±84 ^a	1016±81	1134±81	1020±81	935±81 ^b
Gestation (days)	44.6	46.4	44.3	47.5	44.9
Kit Wts (6 wks)	328±14	311±10	333±20	307±12	295±11
Females	296±38				268±37
Males	376±42 ^a				312±44 ^b
Litter size ⁵	6.9 ^a	7.3 ^a	7.8 ^a	6.0 ^{ab}	4.3 ^b
EROD ⁶	51±13 ^a	134±26 ^{ab}	124±32 ^{ab}	276±33 ^b	262.54±31 ^b

¹Diet A = 75% ocean fish, Diet B = 75% fish collected above the Oak Ridge Reservation, Diet C = 25% fish collected on the Oak Ridge Reservation and 50% ocean fish, Diet D = 50% fish collected on the Oak Ridge Reservation and 25% ocean fish, Diet E = 75% fish collected on the Oak Ridge Reservation.

²Beginning of study.

³Means followed by different superscripts are significantly different, P<0.05.

⁴End of study.

⁵Kits/female.

⁶Ethoxyresorufin-o-deethylase, pmoles/mg protein/min.

Table N19. Mean $\pm$ SE for bioindicators measured in female bluegill sunfish collected from various sites in the Clinch River, Poplar Creek, and Tennessee River

	CRM 1.0		CRM 20.0		PCM 1.0		TRM 570.0		TRM 555.0		CRM 125.0	
	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR
EROD	4.78	0.82	8.18	1.62	4.25	0.92	7.74	1.34	5.67	0.85	4.70	0.37
MPRO	19.49	1.43	22.55	1.87	21.35	2.47	17.16	2.67	17.63	3.29	20.98	1.99
CDFC	1.84	0.03	1.92	0.04	1.95	0.06	1.95	0.05	1.88	0.05	1.85	0.04
LSI	1.43 B	0.08	1.29 B	0.06	1.76	0.09	1.48	0.07	1.37 B	0.08	1.64	0.07
VSI	3.76	0.09	2.62 B	0.13	3.05	0.14	4.09 B	0.20	3.74	0.19	3.30	0.20
VEIP	4.00	0.00	3.94	0.06	3.92	0.08	4.00	0.00	4.00	0.00	4.00	0.00
SSI	0.06	0.01	0.10 B	0.01	0.08 B	0.01	0.06	0.00	0.07	0.01	0.05	0.00
PSTO	95.00 B	5.00	24.69	5.73	28.75	9.54	72.50	7.48	79.58 B	10.84	47.31	7.59
PINT	33.00	6.02	45.31	5.01	25.00	6.48	42.92	5.62	20.42 B	3.04	41.92	6.78
LMACA	0.19	0.12	1.62 B	0.40	0.16	0.05	1.13 B	0.26	0.42	0.12	0.28	0.14
LPARS	3.45	2.24	1.28	0.79	9.20	6.04	1.48	0.59	2.88	1.90	0.00	0.00
SMACA	4.18	1.59	2.13	0.50	3.23	1.46	4.70	1.36	5.58	2.18	4.35	0.45
SPARS	0.43	0.43	1.93	1.93	8.73	8.73	0.00	0.00	1.75	0.74	0.00	0.00
LNPMA	0.58	0.38	1.25	0.60	0.12	0.07	2.95	0.92	0.50	0.33	0.25	0.25

Table N20. Mean $\pm$ SE for bioindicators measured in male bluegill sunfish collected from various sites in the Clinch River, Poplar Creek, and Tennessee River

	CRM 1.0		CRM 10.0		CRM 20.0		CRM 21.5		PCM 1.0		PCM 4.6		PCM 5.3		TRM 570.0		TRM 555.0		TRM 530.0		CRM 125.0	
	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR
EROD	9.38	0.81	7.57	1.85	21.02 AB	2.95	11.34	2.80	13.20	1.57	19.53	6.21	16.19	1.78	11.77	1.95	11.72	2.64	8.11	2.96	9.44	1.79
MPRO	17.77 AB	1.21	13.46	1.13	15.70 A	0.88	15.14	0.66	14.12	1.16	16.37 A	0.65	15.69	0.83	16.02	1.66	18.49 AB	2.32	11.27	0.92	13.57	1.13
ALB	0.72 B	0.03	0.91	0.04	0.84	0.05	0.86	0.06	1.63 A	0.28	0.78	0.03	0.99	0.09	1.06 A	0.16	1.24 A	0.15	0.708 B	0.05	1.05 A	0.09
ALT	12.71	3.35	19.42	3.51	14.08	2.36	23.80	5.66	42.00 AB	5.71	8.64	1.36	10.00	2.34	31.40 A	8.05	32.46 A	5.85	11.25	1.38	23.63	4.67
AST	65.52	6.94	183.33 A	37.90	82.75	12.71	152.80	46.06	119.00	14.41	122.64	22.73	74.57	14.90	167.33	37.98	94.50	16.50	79.83	10.57	129.74	16.41
BPRO	2.34 B	0.10	2.83 B	0.12	3.03 B	0.15	3.04 B	0.09	3.74 A	0.28	2.78 B	0.10	3.37	0.11	2.72 B	0.14	3.96 A	0.21	2.90 B	0.14	3.83 A	0.25
BUN	1.24 AB	0.13	1.80 B	0.15	1.38 AB	0.14	0.89 AB	0.12	3.19	0.64	1.95 B	0.28	1.65 B	0.22	1.20 AB	0.25	2.74	0.26	2.41 B	0.19	3.47 A	0.38
CREAT	0.13	0.03	0.18	0.07	0.11	0.01	0.09	0.02	0.22 B	0.07	0.12	0.01	0.13	0.05	0.21	0.03	0.11	0.01	0.15	0.02	0.10	0.01
CDFC	1.99	0.04	1.93	0.06	2.10	0.05	2.00	0.04	2.13	0.04	1.88	0.03	1.75 B	0.02	2.05	0.03	1.95	0.04	1.96	0.06	1.97	0.05
LSI	0.98	0.06	0.80	0.06	1.12	0.08	0.99	0.09	1.06	0.08	0.89	0.06	0.88	0.03	0.86	0.04	0.91	0.07	1.08	0.08	0.99	0.05
VSI	4.23 B	0.13	3.73	0.21	3.251 A	0.15	3.22 A	0.19	3.20 A	0.09	4.29	0.22	3.68	0.10	3.92	0.16	3.45 A	0.15	4.26	0.20	3.67	0.13
VEIP	3.86	0.08	3.92	0.08	3.60	0.11	3.20 B	0.29	3.82	0.12	3.55	0.16	3.67	0.17	4.00 A	0.00	4.00 A	0.00	3.38	0.22	3.85	0.11
SSI	0.07	0.01	0.10 B	0.01	0.10 B	0.01	0.097 B	0.02	0.07	0.01	0.08	0.01	0.11 B	0.02	0.04	0.00	0.08	0.02	0.07	0.01	0.05	0.00
PSTO	45.91	9.94	18.75 A	9.05	25.21 A	5.25	4.50 AB	3.45	10.46 AB	7.02	17.73 A	6.01	10.56 AB	4.89	74.55	8.75	46.82	12.03	60.83	12.83	50.50	8.58
PINT	25.00 B	4.31	40.83	9.94	39.38	5.07	13.00 B	4.10	10.46 AB	3.72	15.91 B	6.21	40.56	11.56	40.46	7.15	31.36	5.40	42.08	8.71	52.75	6.92
BTRI	281.62 A	34.71	143.25 A	19.45	563.29 B	61.54	436.70	105.34	205.91 A	40.55	322.00	65.48	175.00 A	27.00	328.20	46.25	220.36 A	80.77	517.42	82.31	366.26	51.14
LMACA	0.20	0.09	0.69	0.19	0.28	0.11	0.27	0.09	0.46	0.22	1.92	1.67	0.90	0.60	0.26	0.11	0.58	0.27	0.35	0.20	0.35	0.08
LPARS	1.91	0.82	12.07 A	4.86	7.61	1.57	0.00	0.00	2.78	1.67	13.40 AB	4.53	10.13	2.71	0.22	0.14	1.58	1.58	0.48	0.44	3.24	1.42
SMACA	4.35	0.65	2.56	0.93	1.74	0.29	1.49	0.49	3.20	0.97	2.32	0.40	1.52	0.41	2.78	1.09	4.90	2.82	3.06	0.82	2.57	0.81
SPARS	1.32	0.74	2.51	1.43	4.02	1.64	1.11	1.03	4.16	2.97	4.46	2.01	7.26	2.87	2.82	1.74	0.00	0.00	1.26	0.86	1.72	1.11
LNPMA	0.74	0.38	2.01	1.22	0.72	0.27	0.37	0.24	1.06	0.57	1.84	1.18	2.43	2.03	7.98 AB	7.13	0.45	0.22	0.11	0.11	0.57	0.28

Table N21. Mean $\pm$ SE for bioindicators measured in female largemouth bass collected from various sites in the Clinch River, Poplar Creek, and Tennessee River

	CRM 1.0		CRM 10.0		CRM 20.0		CRM 21.5		PCM 1.0		PCM 4.6		PCM 5.3		TRM 570.0		TRM 555.0		TRM 530.0		CRM 125.0	
	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR
EROD	3.10	0.59	8.80	1.48	13.45 B	3.11	7.73	1.34	13.41 B	2.03	27.61 B	10.31	28.14 B	9.22	5.94	1.66	3.15	0.52	11.40	5.86	2.53	0.30
MPRO	34.86	2.07	23.48 B	0.94	29.27 B	1.92	24.64 B	1.34	26.73 B	1.04	24.43 B	3.24	24.21 B	2.58	32.25	1.76	38.81 A	1.70	22.29 B	3.14	36.62 A	1.75
ALB	1.43	0.05	.	.	0.83	0.03	.	.	0.49	0.03	1.05	0.15	.	.	1.23	0.13	.	.	.	.	.	.
ALT	7.00	1.83	.	.	11.67	7.17	.	.	9.44	2.26	5.50	0.50	.	.	5.33	2.33	.	.	.	.	.	.
AST	31.00	5.67	.	.	45.33	32.90	.	.	30.67	8.58	42.00	1.00	.	.	52.00	36.02	.	.	.	.	.	.
BPRO	3.88	0.20	.	.	3.33	0.13	.	.	1.79	0.06	3.65	0.55	.	.	3.93	0.35	.	.	.	.	.	.
BUN	2.62	0.35	.	.	1.10	0.18	.	.	0.87	0.13	2.03	0.71	.	.	1.76	0.19	.	.	.	.	.	.
CREAT	0.20	0.05	.	.	0.26	0.04	.	.	0.21	0.01	0.26	0.01	.	.	0.11	0.01	.	.	.	.	.	.
CDFC	1.54 B	0.04	1.61 B	0.08	1.41	0.05	1.46 B	0.07	1.48 B	0.03	1.39	0.10	1.41	0.07	1.43 B	0.03	1.49 B	0.05	1.62 B	0.06	1.27 A	0.03
LSI	1.31	0.04	1.56 B	0.11	1.27	0.14	1.24	0.04	1.34	0.06	0.97 A	0.04	0.79 A	0.10	1.44 B	0.05	1.30	0.04	1.63 B	0.17	1.16 A	0.06
VSI	5.04 B	0.22	5.77 B	0.55	5.36 B	0.38	4.63 B	0.65	4.66 B	0.18	4.16	0.26	4.08	0.33	4.56 B	0.18	3.86	0.15	5.22 B	0.15	3.31 A	0.15
VEIP	1.64 B	0.12	2.10	0.25	2.50	0.21	2.25	0.25	2.62	0.16	3.07 A	0.39	3.00	0.27	2.91 A	0.17	3.25 A	0.17	1.50	0.29	2.74	0.28
SSI	0.09	0.01	0.10	0.01	0.16 B	0.05	0.10	0.02	0.10	0.01	0.07	0.01	0.14	0.04	0.09	0.01	0.11	0.02	0.11	0.02	0.08	0.01
PSTO	2.14	1.46	1.00	1.00	21.25	8.66	0.00	0.00	26.15 B	7.74	1.43	0.92	9.00	6.60	14.05	6.85	2.08	2.08	21.67	21.67	0.00	0.00
PINT	1.43	1.43	5.00	2.74	12.92	7.14 B	0.83	0.83	6.15	2.50	5.71	2.54	12.00	6.25	7.62	3.27	0.00	0.00	5.00	5.00	0.00	0.00
BTRI	348.25	48.40	.	.	381.67	153.04	.	.	138.00	17.24	205.50	43.50	.	.	477.00	170.56	.	.	.	.	.	.
LMACA	0.85	0.25	0.90	.	0.81	0.33	0.64	0.20	0.90	0.31	0.96	0.55	1.35	1.35	0.63	0.20	0.90	0.32	0.65	0.45	1.60	0.60
LPARS	0.13	0.09	0.00	.	0.83	0.28	0.40	0.40	1.08	0.44	1.16	1.02	0.00	0.00	0.28	0.21	0.26	0.26	0.00	0.00	0.03	0.03
SMACA	3.53	0.62	4.20	.	4.33	1.16	2.08	0.37	2.82	0.42	4.48	2.15	0.70	0.70	2.00	0.74	3.60	1.35	2.55	0.85	.	.
SPARS	0.80	0.80	9.60	.	1.91	1.70	0.62	0.43	4.78	3.41	3.88	1.58	8.35	8.35	8.66	7.56	2.00	1.85	0.00	0.00	.	.
LNPMA	1.03	0.65	0.70	.	0.84	0.30	0.20	0.13	0.51	0.20	1.04	0.38	0.85	0.85	0.41	0.18	0.00	0.00	0.05	0.05	0.30	0.30

Table N22. Mean $\pm$ SE for bioindicators measured in male largemouth bass collected from various sites in the Clinch River, Poplar Creek, and Tennessee River

	CRM 1.0		CRM 10.0		CRM 20.0		CRM 21.5		PCM 1.0		PCM 4.6		PCM 5.3		TRM 570.0		TRM 555.0		TRM 530.0		CRM 125.0	
	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR	MEAN	STDERR
EROD	12.24	2.65	23.91 B	4.04	17.03	2.32	23.96	3.04	39.67 AB	5.32	43.68 AB	18.00	31.73	.	11.19	2.78	6.68	1.49	17.05	3.06	9.64	1.64
MPRO	22.00 A	1.47	14.36	1.19	24.77 A	1.84	16.59	1.43	21.08 A	1.03	15.94	4.78	25.78	.	16.55	1.80	26.37 AB	1.33	12.38 B	1.25	19.59 A	1.06
ALB	1.05	0.02	0.97	0.06	0.85 B	0.03	0.90	.	0.91	0.04	1.00	0.10	.	.	1.02	0.02	1.18 A	0.04	0.93	0.04	1.04	0.05
ALT	10.79 A	2.25	12.11	2.70	19.44	9.60	15.00	.	9.13	3.18	4.50	1.50	.	.	7.06 A	2.07	5.60 A	1.63	26.33 B	6.73	10.05 A	2.63
AST	59.58	7.89	65.33	16.09	70.44	25.57	42.00	.	36.13	11.66	46.00	23.00	.	.	65.06	18.85	30.50	4.06	89.67	24.53	37.84	10.25
BPRO	4.24	0.13	3.87	0.31	3.44 AB	0.13	4.10	.	3.83 A	0.32	3.75	0.45	.	.	4.04	0.13	4.68	0.14	4.67	0.15	4.25	0.14
BUN	1.48	0.16	1.70	0.27	1.89	0.25	0.95	.	2.29	0.43	2.61	0.67	.	.	1.66	0.21	2.69	0.31	1.67	0.13	1.90	0.16
CREAT	0.20	0.02	0.18	0.03	0.20	0.03	0.25	.	0.30 AB	0.08	0.25	0.09	.	.	0.18	0.01	0.26 AB	0.03	0.12	0.02	0.12	0.01
CDFC	1.47 B	0.03	1.40	0.03	1.34 A	0.05	1.32	0.16	1.42 B	0.03	1.44	0.03	1.34	.	1.45 B	0.04	1.35 A	0.05	1.53 B	0.04	1.27 A	0.01
LSI	0.79 A	0.04	1.42 B	0.14	0.90 A	0.08	0.80 A	0.12	0.97 A	0.09	1.07	0.23	0.49 A	.	1.25 AB	0.09	0.77 A	0.06	1.62 B	0.16	0.70 A	0.04
VSI	5.24 B	0.25	5.00 B	0.40	4.94 B	0.39	4.42	1.51	5.25 B	0.30	4.24	0.67	3.50	.	5.27 B	0.24	4.29 B	0.17	5.14 B	0.23	3.12 A	0.12
VEIP	1.66	0.14	1.85	0.17	2.12	0.22	2.75	1.25	1.75	0.15	2.00	0.50	4.00 A	.	2.21	0.18	3.10 AB	0.27	1.50	0.17	2.15	0.20
SSI	0.13	0.02	0.14	0.01	0.16 B	0.03	0.14	0.08	0.11	0.02	0.07	0.01	0.04	.	0.12	0.01	0.10	0.01	0.14	0.01	0.09	0.01
PSTO	0.00	0.00	0.50	0.50	2.69	2.69	32.50	32.50	6.50	6.50	2.50	2.50	0.00	.	18.53	8.47	20.00	13.33	10.00	9.39	0.00	0.00
PINT	0.00	0.00	2.00	1.53	1.15	1.15	17.50	17.50	2.00	1.53	2.50	2.50	0.00	.	6.47	2.87	10.00	10.00	3.33	1.67	2.75	1.87
BTRI	220.21 B	30.47	204.78	26.61	216.11 B	79.76	1210.00 AB	.	354.88 B	83.22	138.00	30.00	.	.	211.77 B	26.68	189.20	39.65	219.56 B	25.08	68.11 A	4.96
LMACA	2.02 AB	0.69	0.41	0.12	0.33	0.16	0.65	0.15	0.71	0.28	0.10	0.10	.	.	0.30	0.08	0.80	0.26	0.26	0.14	0.54	0.11
LPARS	0.64	0.38	2.49 AB	1.13	0.77	0.35	0.00	0.00	0.13	0.08	0.30	0.10	.	.	1.31	0.73	0.00	0.00	0.00	0.00	0.08	0.07
SMACA	3.82	0.87	2.38	0.44	3.43	0.59	1.10	0.50	3.43	0.90	1.40	0.30	.	.	2.60	0.65	5.08	1.83	2.68	0.84	5.03	0.88
SPARS	0.95	0.73	5.89	2.91	0.50	0.47	0.00	0.00	3.40	1.72	24.20 AB	12.70	.	.	9.18 AB	3.71	0.43	0.39	0.24	0.24	0.16	0.16
LNPMA	1.06	0.52	1.46	0.41	1.40	0.96	1.05	0.75	0.49	0.20	0.00	0.00	.	.	0.69	0.39	0.00	0.00	1.04	0.51	0.29	0.19

Table N23. Relative rankings of the severity of histopathological lesions in the liver and spleen of bluegill sunfish at collection sites in the Clinch River, Poplar Creek, and the reference site, Norris Reservoir (CRM 125). The overall rank for each site is the average of all liver and spleen lesions at that site. Lower ranks represent higher lesion rate.

	CRM 125	CRM 21.5	CRM 20.0	CRM 10.0	CRM 1.0	TRM 530	PCM 5.3	PCM 4.6
Liver								
Glycogen depletion	7	6	8	3	4	5	1.5	1.5
Vacuolated hepatocytes	2.5	4	8	2.5	5	6	1	7
Macrophage aggregates	4	1	8	2	3	6	5	7
Focal necrosis	3.5	1	5	6	7.5	7.5	3.5	2
Granulomas	0	0	1	0	0	0	0	0
Parasites	5	6	3	4	7	8	2	1
Spleen								
Macrophage aggregates	8	7	4	5	6	1	2.5	2.5
Parasites	5	7	2	6	1	8	3.5	3.5
Total	4.4	4.4	4.88	3.6	4.2	5.56	2.3	3.06
Overall rank	6	4	7	3	5	8	1	2

Table N24. Relative rankings of the severity of histopathological lesions in the liver and spleen of largemouth bass at collection sites in the Clinch River, Poplar Creek, Tennessee River, and the reference site, Norris Reservoir (CRM 125). The overall rank for each site is the average of all liver and spleen lesions at that site. Lower ranks represent higher lesion rate.

	CRM 125	CRM 21.5	CRM 20.0	CRM 10.0	CRM 1.0	TRM 570	TRM 530	PCM 5.3	PCM 4.6	PCM 1.0
Liver										
Glycogen depletion	5.5	2	5.5	10	5.5	9	7	5.5	1	8
Vacuolated hepatocytes	3	5	7.5	4	2	7.5	7.5	7.5	1	7.5
Macrophase aggregates	9	10	7.5	5	3	1	7.5	4	6	2
Focal necrosis	7.5	3	2	7.5	7.5	7.5	7.5	7.5	1	7.5
Granulomas	9.5	2	1	5	3	6	7	9.5	4	8
Parasites	8.5	6	1	5	8.5	3	2	4	7	8.5
Spleen										
Macrophase aggregates	1	9	2	3	4	8	7	10	6	5
Focal necrosis	8.5	3.5	9	2	8.5	6	10	1	3.5	7
Granulomas	6	4	1.5	5	3	8	9.5	7.5	1.5	7
Parasites	10	8	7	2.5	6	5	9	2.5	2.5	4
Total	6.85	5.30	4.40	4.90	5.10	6.10	7.40	5.1	3.35	6.45
Overall rank	9	6	2	3	4.5	7	10	4.5	1	8

Table N25. Reproductive status of male largemouth bass collected at the beginning of the 1993 breeding season from sites in Poplar Creek, Clinch River, Tennessee River, and Norris Lake

Site ^a	GSI ^b	Plasma testosterone (pg/mL)	Plasma estradiol (pg/mL)	Testes stage ^c
CRM 125	0.586±0.046 (9)	2441±662 (9)	89±39 (9)	4.1±0.1 (9)
PRM 30	0.534±0.035 (11)	2056±652 (11)	162±48 (11)	4.0±0 (11)
PCM 1	0.409±0.058 (5)	1071±476 (5)	50±0 (5)	4.0±0 (5)
CRM 20	0.439±0.050 (8)	1240±438 (8)	327±42 (8)	4.1±0.1 (8)
CRM 0.5	0.483±0.028 (13)	1971±348 (13)	292±47 (13)	3.9±0.1 (13)
TRM 570	0.463±0.023 (10)	2581±343 (10)	50±0 (10)	4.1±0 (10)
TRM 557	0.451±0.032 (10)	2015±494 (10)	170±49 (10)	4.0±0.1 (10)

^aCRM = Clinch River mile, PRM = Powell River (Norris Lake) mile, PCM = Poplar Creek mile, and TRM = Tennessee River mile

^bGSI = Gonadal-Somatic Index ([gonad wt./body wt.]*100)

^cStage 0 = no obvious germ cell tissue; stage 1 = primarily spermatogonia (may be some degenerating sperm); stage 2 = spermatogonia and spermatocytes; stage 3 = some spermatids and spermatozoa present as well; stage 4 = tubules filled with sperm, still active spermatogenesis; stage 5 = only sperm and possibly scattered spermatogenic cysts

Table N26. Reproductive status of female largemouth bass collected at the beginning of the 1993 breeding season from sites in Poplar Creek, Clinch River, Tennessee River, and Norris Lake

Site ^a	GSI ^b	Atretic ^c oocytes (oocytes/g)	Ovary parasites (cysts/g)	Vitellogenic oocytes (oocytes/g)	Batch ^d fecundity (oocytes/g)	Fecundity ^e (oocytes/g)	Plasma estradiol (pg/mL)	Plasma testosterone (pg/mL)
CRM125	4.90±0.47 (14)	1.29±0.40 (14)	0 (14)	60.2±10.7 (14)	22.3 ±2.7 (10)	58.1 ±10.6 (14)	4600±552 (14)	4635±1455 (14)
PRM 30	4.41±0.24 (12)	0.70±0.22 (12)	0 (12)	55.3±3.9 (12)	17.0 ±1.7 (12)	56.1 ±3.2 (12)	5810±1062 (12)	5454±942 (12)
PCM 1	4.20±0.62 (17)	2.20±1.39 (15)	0.01±0.01 (15)	59.2±12.1 (15)	18.1 ±2.9 (8)	44. 2±6.5 (15)	4082±1088 (15)	4103±1065 (15)
CRM 20	4.65±0.63 (5)	8.18±4.33 (5)	0 (5)	41.5 ±5.2 (5)	16.0 ±0.6 (4)	46.1 ±7.2 (5)	2041±756 (5)	3892±2648 (5)
CRM 0.5	6.34±0.70 (10)	0.98±0.53 (10)	0 (10)	54.9 ±6.9 (10)	17.2 ±2.7 (9)	57.0 ±6.1 (10)	2962±376 (10)	1063±119 (10)
TRM 570	6.42±0.34 (18)	0.84±0.22 (18)	0 (18)	60.6 ±3.6 (18)	17.0 ±1.4 (13)	60.0 ±2.3 (18)	3729±404 (18)	5479±1070 (14)
TRM 557	7.23±0.52 (8)	1.27±0.23 (8)	0 (8)	55.4 ±4.1 (8)	16.6 ±1.6 (6)	56.3 ±2.6 (8)	3704±818 (8)	3758±1297 (8)

^aCRM = Clinch River mile, PRM = Powell River (Norris Lake) mile, PCM = Poplar Creek mile, and TRM = Tennessee River mile

^bGSI = Gonadal-Somatic Index ([gonad wt./body wt.]*100)

^cAtretic oocytes are dead and/or reabsorbing oocytes

^dBatch fecundity is the enumeration of obviously maturing oocytes, mature eggs, and/or shed follicles in fish collected immediately prior to or during a spawn

^eFecundity is the enumeration of all oocytes and/or shed follicles in an ovary regardless of gamete developmental stage

Table N27. Reproductive status of male bluegill sunfish collected at the beginning of the 1993 breeding season from sites in Poplar Creek, Clinch River, Tennessee River, and Norris Lake

Site ^a	GSI ^b	Plasma testosterone (pg/mL)	Plasma estradiol (pg/mL)	Testes stage ^c	Testes composition ^d			
					Spermatagonia	Spermatocytes	Sperm	Duct
CRM 125	0.993±0.230 (10)	2399±550 (10)	71±22 (10)	3.6±0.2 (10)	0.47±0.30 (10)	8.37±1.90 (10)	3.07±0.68 (10)	0.43±0.09 (10)
CRM 0.5	0.616±0.138 (12)	1529±298 (11)	50±0 (11)	3.3±0.2 (12)	0.31±0.18 (12)	7.81±0.69 (12)	1.47±0.32 (12)	0.31±0.09 (12)
PRM 30	0.979±0.277 (10)	3777±906 (10)	50±0 (10)	3.7±0.1 (10)	0.63±0.25 (10)	7.67±1.48 (10)	3.40±0.65 (10)	0.30±0.12 (10)
TRM 570	1.000±0.131 (11)	3829±805 (10)	50±0 (10)	3.6±0.1 (11)	0.09±0.06 (11)	11.00±1.02 (11)	2.42±0.41 (11)	0.27±0.15 (11)
PCM 1	1.353±0.096 (11)	5475±5712 (10)	65±11 (10)	3.7±0.1 (11)	0.03±0.03 (11)	12.15±0.69 (11)	3.61±0.44 (11)	0.55±0.23 (11)
TRM 557	1.244±0.185 (11)	5430±928 (11)	192±52 (11)	3.7±0.1 (11)	0.15±0.15 (11)	9.39±0.53 (11)	3.55±0.48 (11)	0.06±0.06 (11)
CRM 20	0.748±0.125 (13)	3837±693 (12)	155±55 (12)	3.4±0.2 (13)	0.56±0.24 (13)	8.97±1.30 (13)	2.23±0.50 (13)	0.18±0.08 (13)

^aCRM = Clinch River mile, PRM = Powell River (Norris Lake) mile, PCM = Poplar Creek mile, and TRM = Tennessee River mile

^bGSI = Gonadal-Somatic Index ([gonad wt./body wt.]*100)

^cStage 0 = no obvious germ cell tissue; stage 1 = primarily spermatogonia (may be some degenerating sperm); stage 2 = spermatogonia and spermatocytes; stage 3 = some spermatids and spermatozoa present as well; stage 4 = tubules filled with sperm, still active spermatogenesis; stage 5 = only sperm and possibly scattered spermatogenic cysts

^dmean relative units occupied by various spermatogenic stages measured along the diameters of three cross-sections through a testis

Table N28. Reproductive status of female bluegill sunfish collected at the beginning of the 1993 breeding season from sites in Poplar Creek, Clinch River, Tennessee River, and Norris Lake

Site ^a	GSI ^b	Atretic ^c oocytes (oocytes/g)	Ovary parasites (cysts/g)	Vitellogenic oocytes (oocytes/g)	Batch ^d fecundity (oocytes/g)	Plasma estradiol (pg/mL)	Plasma testosterone (pg/mL)
CRM 125	6.36±0.77 (13)	0.36±0.12 (13)	0.06±0.05 (13)	168±17(13)	143±14 (12)	4633±987 (11)	3449±1379 (11)
CRM 0.5	7.21±0.95 (10)	3.51±1.09 (10)	0 (10)	162±15 (10)	129±8 (10)	2051±394 (10)	2221±553 (10)
PRM 30	7.48±0.50 (12)	0.52±0.35 (12)	0.12±0.09 (12)	153±10 (12)	127±10 (12)	2877±554 (12)	1958±328 (12)
TRM 570	7.94±0.81 (12)	2.33±0.97 (12)	0 (12)	172±13 (12)	126±8 (11)	3579±663 (11)	4850±1196 (11)
PCK 1.0	9.87±1.20 (12)	4.47±1.97 (12)	0.36±0.14 (12)	225±27 (12)	155±16 (12)	1682±362 (12)	1472±349 (12)
TRM 557	7.80±0.98 (12)	1.07±0.48 (12)	0.05±0.05 (12)	154±19 (12)	121±13 (12)	2958±775 (12)	918±175 (12)
CRM 20	7.64±0.89 (16)	2.71±1.41 (16)	0 (16)	163±13 (16)	135±8 (15)	3433±559 (16)	3274±684 (16)

^aCRM = Clinch River mile, PRM = Powell River (Norris Lake) mile, PCM = Poplar Creek mile, and TRM = Tennessee River mile

^bGSI = Gonadal-Somatic Index ([gonad wt./body wt.]*100)

^cAtretic oocytes are dead and/or reabsorbing oocytes

^dBatch fecundity is the enumeration of a clutch of simultaneously developing oocytes, mature eggs, and/or shed follicles

Table N29. Total number of analyses, detectable results, minimum, maximum, mean, standard error, and upper 95% confidence bound for the 44 PCB congeners analyzed from fish tissue samples

ANALYTE	N	# DETECTS	MIN	MAX	MEAN	STDERR	UCB
PCB169T	326	1	0.010	0.01	0.010000	.	.
PCB018T	326	3	0.010	0.01	0.010000	0.000000	0.010000
PCB166T	326	3	0.010	0.07	0.010337	0.000293	0.010820
PCB076T	326	9	0.010	0.01	0.010000	0.000000	0.010000
PCB070T	326	21	0.005	0.01	0.005919	0.000292	0.006402
PCB167T	326	22	0.010	0.05	0.010337	0.000156	0.010594
PCB157T	326	38	0.005	0.20	0.007745	0.000816	0.009092
PCB126T	326	54	0.006	0.07	0.009411	0.000738	0.010628
PCB028T	326	61	0.010	0.01	0.010000	0.000000	0.010000
PCB031T	326	61	0.010	0.01	0.010000	0.000000	0.010000
PCB189T	326	61	0.005	0.02	0.006681	0.000230	0.007061
PCB044T	326	69	0.005	0.03	0.007290	0.000464	0.008056
PCB037T	326	91	0.005	0.04	0.007697	0.000402	0.008359
PCB158T	326	92	0.005	0.07	0.009763	0.000618	0.010782
PCB049T	326	98	0.005	0.07	0.010318	0.000537	0.011204
PCB195T	326	98	0.005	0.05	0.007730	0.000623	0.008758
PCB201T	326	99	0.005	0.10	0.011694	0.000770	0.012965
PCB128T	326	111	0.005	0.08	0.010798	0.000704	0.011959
PCB052T	326	113	0.006	0.10	0.012096	0.000710	0.013266
PCB099T	326	113	0.009	0.45	0.030291	0.002820	0.034943
PCB146T	326	129	0.006	0.11	0.015337	0.000946	0.016898
PCB194T	326	129	0.005	0.06	0.009824	0.000444	0.010556
PCB151T	326	142	0.006	0.11	0.014018	0.000834	0.015394
PCB183T	326	148	0.007	0.11	0.014356	0.000871	0.015792
PCB170T	326	169	0.007	0.20	0.013644	0.001027	0.015339
PCB101T	326	170	0.005	0.32	0.021701	0.001646	0.024416
PCB196T	326	194	0.006	0.10	0.014977	0.000893	0.01645
PCB114T	326	195	0.005	0.12	0.016226	0.000869	0.017658
PCB118T	326	213	0.005	0.30	0.030539	0.002131	0.034054
PCB138T	326	224	0.007	0.58	0.040282	0.003832	0.046603
PCB105T	326	261	0.006	0.05	0.009742	0.000218	0.010101
PCB095T	326	264	0.005	0.14	0.013320	0.000720	0.014508
PCB180T	326	269	0.01	0.40	0.045491	0.003435	0.051156
PCB087T	326	279	0.005	0.21	0.011701	0.000777	0.012983
PCB153T	326	283	0.01	0.48	0.055433	0.004337	0.062586
PCB171T	326	287	0.005	0.13	0.012910	0.000635	0.013958
PCB077T	326	293	0.006	0.35	0.024301	0.001880	0.027402
PCB081T	326	300	0.005	0.20	0.013337	0.000846	0.014734
PCB156T	326	302	0.005	0.09	0.013332	0.000586	0.014298
PCB066T	326	304	0.005	0.04	0.010675	0.000237	0.011065
PCB149T	326	307	0.005	0.12	0.015331	0.000819	0.016682
PCB123T	326	308	0.005	0.20	0.018597	0.001241	0.020644
PCB110T	326	310	0.006	0.18	0.021557	0.001283	0.023672
PCB132T	326	313	0.006	0.10	0.010176	0.000283	0.010644

Table N30. Summary of PCB congener detection percentage for catfish from 11 site/year samples in Watts Bar Reservoir

Congener	Fall 1992				Spring 1993		Fall 1993				Spring 1994
	CRM 1	PCM 1	TRM 545	TRM 570	CRM 1	CRM 20	CRM 10	CRM 1	PCM 5.3	TRM 530	CRM 10
PCB018T	.	.	.	.	.	.	.	.	.	.	.
PCB028T	0	0	0	0	.	.	.	.	.	.	.
PCB031T	0	0	0	0	.	.	.	.	.	.	.
PCB037T	-	.	.	-	+	+	.	-	.	-	.
PCB044T	-	.	.	.	+	+	.	.	.	.	.
PCB049T	-	.	.	.	-	-	.	-	-	+	.
PCB052T	-	-	.	.	-	+	.	-	-	-	.
PCB066T	+	0	+	+	0	0	0	0	0	0	0
PCB070T	.	.	.	.	.	.	.	.	.	.	.
PCB076T	.	.	.	.	.	.	.	.	.	.	.
PCB077T	+	0	0	-	0	0	0	0	0	0	0
PCB081T	+	+	+	+	0	0	0	0	0	0	0
PCB087T	-	-	.	.	0	0	0	0	0	0	0
PCB095T	+	+	-	-	+	+	0	0	0	0	0
PCB099T	0	0	0	-	.	.	.	.	.	.	.
PCB101T	+	+	+	-	.	.	0	0	0	0	-
PCB105T	.	-	.	.	0	0	0	0	0	0	0
PCB110T	0	0	0	0	0	0	0	0	0	0	0
PCB114T	0	+	0	0	+	0	-	+	0	0	-
PCB118T	0	0	0	-	-	0	+	0	0	0	+
PCB123T	0	+	+	0	0	0	0	0	0	0	0
PCB126T	-	-	.	.	-	+	.	-	.	+	.
PCB128T	+	+	+	.	-	-	-	+	-	0	.
PCB132T	0	0	0	0	0	0	0	0	0	0	0
PCB138T	0	0	+	-	0	0	0	0	0	0	.
PCB146T	+	+	+	-	.	+	+	0	0	0	.
PCB149T	0	0	+	+	0	0	0	0	0	0	0
PCB151T	+	+	+	-	-	0	-	0	0	0	.
PCB153T	0	0	0	0	0	0	0	0	0	0	+
PCB156T	0	+	0	0	0	0	0	0	0	0	0
PCB157T	+	-	+	+	.	.	.	.	.	-	.
PCB158T	-	+	.	.	-	+	-	+	-	0	.
PCB166T	.	.	.	.	.	.	.	.	.	.	.
PCB167T	.	.	.	.	.	-	.	.	.	0	.
PCB169T	.	.	.	.	.	.	.	.	.	.	.
PCB170T	0	0	0	+	0	0	.	.	.	.	.
PCB171T	0	-	+	+	0	0	0	0	0	0	0
PCB180T	0	0	0	-	0	0	0	0	0	0	+

“0”= detected in >75% of samples

“+”= detected in 50-74% of samples

“-”= detected in 25-49% of samples

“.”= detected in 0-24% of samples

Table 30 (continued)

Congener	Fall 1992				Spring 1993		Fall 1993				Spring 1994
	CRM 1	PCM 1	TRM 545	TRM 570	CRM 1	CRM 20	CRM 10	CRM 1	PCM 5.3	TRM 530	CRM 10
PCB183T	+	+	+	-	+	o	+	+	o	o	-
PCB189T	-	.	+	-	-	+	.	.	.	o	.
PCB194T	o	o	o	+	.	-	.	-	-	o	.
PCB195T	o	o	o	-	.	.	-	-	.	+	.
PCB196T	o	o	o	-	+	o	-	+	o	o	-
PCB201T	-	+	-	-	-	+	-	+	+	o	.

“o”= detected in >75% of samples

“+”= detected in 50-74% of samples

“- ”= detected in 25-49% of samples

“.”= detected in 0-24% of samples